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electronic engineers master catalog

VOLUME B

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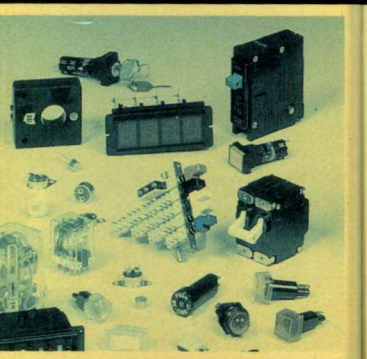
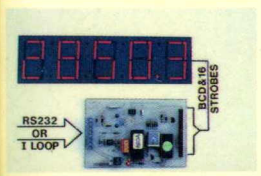
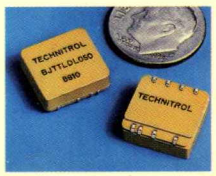
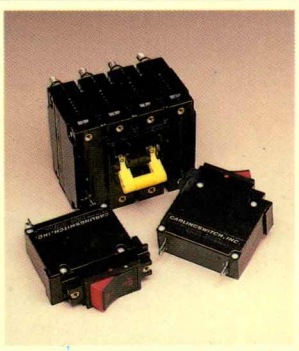
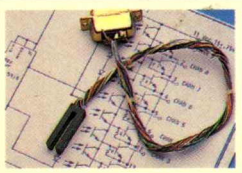
VOLUME B

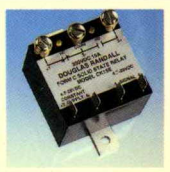


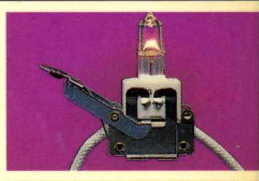












components

electromechanical
electro-optical

electromechanical, electro-optical, and military components

31st EDITION

2440 Military Components
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2460 Lamps, Lights, & Indicators
2475 Fiber Optic Equipment & Accessories
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3700 Electro-optical Equipment (Excl. Fiber Optics)
4300 Protective Components
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4500 Relays
4550 Solenoids
5100 Switches
5150 Keyboards & Keypads
5300 Thermal Components
5500 Transducers & Encoders

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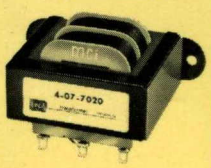
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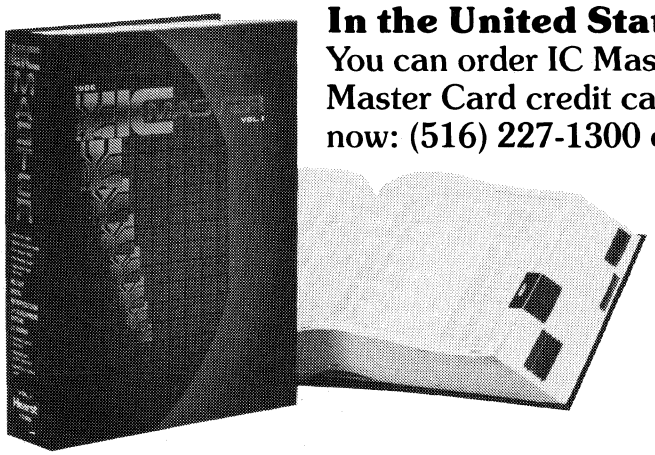

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how to use eem

The 31st edition of EEM is arranged in four volumes each composed of related Product Sections. For user convenience, each volume contains its own Product in-dex and Directory (green pages) and its own Manufac-turers and Sales Offices Directory (yellow pages). Every Product Heading and every manufacturer of electronic products is listed in each volume. Where, however, the Product Section is assigned to a volume other than that in use, a cross reference is made to the appropriate volume for further information.

To locate a specific product. Start by choosing the volume whose title describes the class of electronic product you are seeking. If you are not sure which volume is appropriate, pick up the first one at hand and look up the product heading in the green pages. There you will find either a list of that product's manufacturers or you will be referred to the proper volume. All products are identified by their generic terms. Please read the instructions on the first page of each section. Manufacturers with catalog data pages in this edition of EEM appear in bold face type and page numbers are shown. Manufacturers appearing in light face type have submitted verifying evidence that they supply the products shown. When you have located a product of interest, turn to the page(s) shown for further information. You will find these pages in each volume in the appropriate sections.

product selection guides

There are 33 Product Selection Guides included in this edition of EEM. They are located on the first pages of the Product Section to which they apply. Use these guides for basic selection parameters and then go to the EEM pages shown in the guide for more detailed information.

product selection index

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2450*	Displays, Readouts, & CRTs		B•1032		
2460*	Lamps, Lights, & Indicators		B•1104		
2475	Fiber Optic Equipment & Accessories		B•1166		
2500	Mechanical Components			C•1637	
2550	Environmental Test Equipment				D•1186
2600*	Fans, Blowers, Cooling Equipment, & Heat Exchangers			C•1642	
2700*	Filters	A•1633			
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*A Product Selection Guide precedes these Product Sections

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advertisers' index

To find a specific manufacturer's data pages, an alphabetical index of EEM participants appears in EEM starting on page **A**•4 of Volume A and on pages **B**•4, **C**•4 and **D**•4 of the other volumes.

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trademark and logofinder directories

A comprehensive trademark directory is included at the end of the EEM yellow pages in Volume **C**.The EEM logofinder shows the symbols and graphics used by manufacturers as identifiers on their products. Use these pages to locate manufacturers of specific trademarks and logos.

manufacturers' index

In the EEM yellow pages you will find pertinent details on all manufacturers listed in EEM including local sales offices and/or distributors. Please refer to the detailed instructions on the first page of the EEM yellow pages for additional information.

to order a product found in eem

When you have located the product that suits your needs, call the manufacturer or the local sales rep or distributor as shown in the EEM yellow pages. Give the EEM data page number and specs from that page. You and the supplier will be talking on the same wave length which should simplify your ordering and buying.

to file manufacturers' catalogs and data

The EEM File System is revised and updated to reflect changes in EEM itself. Each new EEM File System contains a complete Product Index. This index tells you where to file which catalog. It also contains a cross reference identifying what should be filed in each section.

In order to use the EEM File System all you need is a supply of standard letter size, third-cut manila file folders. You then use the pressure sensitive labels which are supplied with the system to go into as much detail as you want or need.

Each label fits the third-cut file folder exactly. There are over 300 of these labels in each system: 1 for the index, 1 each for the 61 EEM Product Sections, 24 for the alphabetical file of multiproduct catalogs, plus more than 200 additional labels for system expansion. The EEM File System also includes 61 Cross Reference Cards so you can quickly and easily find multiproduct catalogs. The EEM File System is complete and can save you countless hours of time and thousands of dollars. Send your check for $25.00 to: EEM File System, 645 Stewart Ave., Garden City, NY 11530 and we'll absorb postage and handling. Send a purchase order and add $2.00 for postage and handling. NY, CA and MA residents, please add sales tax.

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§ Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
† Edcliff Div., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016 818-358-4571
§ Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
† Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
† IMO Delaval Inc., 325 Halstead St., Pasadena, CA 91109-7087 818-351-4241
† Kelmet, Inc., 569 W. Covina Blvd., San Dimas, CA 91773 714-599-0954
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† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Metrix Instrument Co., 1711 Townhurst, Houston, TX 77043 713-461-2131
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St., Middletown, CT 06457 203-632-1000
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
† Sundstrand Data Control Inc., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701 206-885-3711
§† Systron-Donner Inertial Div., 2700 Systron Dr., Concord, CA 94518 415-671-6400
§ Terra Technlg. Corp., 3860 148th Ave. N.E., Redmond, WA 98052 206-883-7300
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
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U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† Vibration Instruments Co., 1614 Orangethorpe Way, Anaheim, CA 92801 714-879-6085
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
† Wilcoxon Research, 2096 Gaither Rd., Rockville, MD 20850 301-330-8811

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† EOTec Corporation, 3M Corporation, 420 Frontage Road, West Haven, CT 06516 203-934-7961
§ EXFO E.O. Engineering, 352 St.-Sacrement Ave., Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 201-239-3400
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
INTELCO, 8 Craig Road, Acton, MA 01720 617-264-4485
§ Jensen Tools, Inc., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044 602-968-6241
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
C. G. Soar, Inc., 434 Windsor Pk. Dr., Dayton, OH 45459 513-434-7643

Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§ Telebyte Technology, Inc., Remark Datacom Div., 270 East Pulaski Road, Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000

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§ Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708
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§† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
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§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
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§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
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§ Wiltron, 490 Jarvis Dr., Morgan Hill, CA 95037-2809 408-778-2000

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† Alarm Controls Corporation, P.O. Box 280, Deer Park, NY 11729 516-586-4220
† Electron-Machine Corp., Box M, Umatilla, FL 32784 904-669-3101
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§ Heath Co., Hilltop Road, St. Joseph, MI 49085 616-982-3200
§ Hughey & Phillips, Inc., 2162 Union Pl., Simi Valley, CA 93065 805-581-5591
§ WALTER KIDDE, Div. of Kidde, Inc., Fire Sys. Operations, P.O. Box 1147, Wake Forest, NC 27587 919-556-6811
Lark Electronics, Inc., Box 390, New York, NY 10040 212-569-0430
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§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
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† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946

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Antennas (MIL)-2440

† Adams-Russell Electronics Co., Inc., Haverhill Rd., Amesbury, MA 01913 617-388-5210
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† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
† Collins Avionics Divisions, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498 319-395-1000
† Electro-Magentic Processes, Inc., Subsidiary of ISC Group, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858 818-882-6333
§† Electro-Metrics, Penril Corp., 100 Church St., Amsterdam, NY 12010 518-843-2600
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000
† Microwave Applications Group, 3030 Industrial Pkwy., Santa Maria, CA 93455 805-928-5711
† Radio Research Instrument Co., Inc., 584 North Main Street, Waterbury, CT 06704-3506 203-753-5840
† Sabre Communications Corp., 3400 Hwy 75 N., P.O. Box 536, Sioux City, IA 51102 712-258-6690

† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
† Tecom Industries, Inc., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311 818-341-4010
† Teledyne Micronetics, 7155 Mission Gorge Rd., San Diego, CA 92120 .. 619-583-3525
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141

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Arresters, Electrical Surge/Lightning (MIL)-2440

§† MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729, 516-586-5125 ..... B•1327,1331-1339
§ PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1347
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
§ EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† EFI Corporation, 350 West 2700 South, Salt Lake City, UT 84115 ..... 801-486-5871; 800-221-1174
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ Joslyn Electronic Systems, P.O. Box 817, Goleta, CA 93116 805-968-3551
§ L.E.A. Dynatech, Inc., Dynatech Corporation, 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990 213-944-0916
§† Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
† RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ..... 212-892-6700;800-223-8312

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Attenuators, Fiber Optic-2475

§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1174
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Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
§ EXFO E.O. Engineering, 352 St.-Sacrement Ave., Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
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Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333

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Attenuators (MIL)-2440

† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1766
EG & G Almond Instruments, 1330 E. Cypress St., Covina, CA 91724, 818-967-9521 ..... D•1709
† Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701, 516-226-8900 ..... A•1770
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
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† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Merrimac Industries, 41 Fairfield Pl., West Caldwell, NJ 07006 201-575-1300
Solitron/Microwave, Solitron Devices, Inc., 1177 Blue Heron Blvd., Solitron Pk., Riviera Bch., FL 33404 305-848-4311
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

Attenuators (MIL), Inductive-2440

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† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761

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Batteries (MIL)-2440

Gates Energy Products, P.O. Box 114, Gainesville, FL 32602, 904-462-3911 ..... D•1463
§† **Power Conversion, Inc., Hawker Siddeley Group, Ltd.-London, England, 280 Midland Avenue, Saddle Brook, NJ 07662, 201-796-4800 ..... D•1480**
SAFT America, Inc., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, 912-247-2331 ..... D•1488-1490
Alexander Batteries, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92128 619-480-4445
† EDMAN Corp., Subsidiary of Rospatch, 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750 716-924-4000
Engineered Assemblies Corp., 429 Getty Ave., Clifton, NJ 07011 ..... 201-340-0600; 1-800-4-BATTERY
† Jam Power Systems, Inc., P. O. Box 710, Bronxville, NY 10708-0710 914-793-3344
Whittaker-Yardney Power Systems, Whittaker-Tech. Prods., Inc., 82 Mechanic St., Pawcatuck, CT 02891 203-599-1100

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Beam Splitters-3700

Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Optics for Research, Inc., P.O. Box 82, Caldwell, NJ 07006 201-228-4480
† Plumer Precision Optics, 601 Montgomery Ave., Pennsburg, PA 18073 .. 215-679-6272
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

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Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
American Etching & Mfg., 13730 Desmond St., Pacoima, CA 91331-2796 818-896-1187
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907 419-756-5911

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Applied Data Systems, 9811 Mallard Dr., Ste. 203, Laurel, MD 20708, 800-541-2003;301-953-9326 ..... B•1041
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Applied Micro Technlg., A Burr Brown Co., 3669 E. 44th Street, Tucson, AZ 85713 602-622-8605
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Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
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Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

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Brakes, Clutches, Electromechanical-3500

Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1898
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† Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272

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† **Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1240**
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§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
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§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Techno, A DSG Company, 2101 Jericho Turnpike, New Hyde Park, NY 11040 516-328-3970

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§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
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† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
† Techno, A DSG Company, 2101 Jericho Turnpike, New Hyde Park, NY 11040 516-328-3970
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

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§ **Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, 201-436-2230 ..... B•1188-1190**
† **Fabricast, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, 818-443-3247 ..... B•1207**
† **Graphite Metallizing Corp., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, 914-968-8400 ..... B•1212**
† **Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1221-1222,1224,1230**
† Danmar Inds., 9705 Lurline Ave., Chatsworth, CA 91311 ..... 818-882-7979/5280

† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
§† Eraser Co., Box 4961, Syracuse, NY 13221 315-454-3237
§† Facet Enterprises, Inc., Elmira, NY 14903 607-737-8011
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Jonard Industries Corp., 134 Marbledale Rd., Tuckahoe, NY 10707 914-793-0700
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
† Maurey Instrument Corp., 4555 W. 60th St, Chicago, IL 60629 312-581-4555
† Micro-Products Engineering Co., 230 Ridgewood Ave., Newark, NJ 07108 201-824-8467
Stackpole, Carbon Div., 201 Stackpole St., St. Marys, PA 15857 814-781-1234
§† Superior Carbon Products, Inc., Hwy. 35, Superior Place, Walnut Grove, MS 39189 601-253-2442
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Thermotech, Div. of FL Industries, Inc., 1203 S. 5th St., Hopkins, MN 55343 612-933-9400
† Unit Industries, 1140 E. Valencia Dr., Fullerton, CA 92631 714-871-4161

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Cable, Fiber Optic-2475

§ AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1273
§† Belden Wire and Cable, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, 317-983-5200;800-BELDEN-1 ..... C•1772,1813
§ Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167
Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... C•1456
§† Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Andrew Corp., 10500 W. 153rd St, Orland Pk, IL 60462 800-255-1479
§† AT&T, 555 Union Blvd, Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Banner Engineering Corp., 9714 - 10th Ave. N., Minneapolis, MN 55441 612-544-3164
§† Berk Tek, Inc., Box 888, RD 1, New Holland, PA 17557 717-354-6200
§† BIW Cable Systems, Inc., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764 617-822-6600
Breeze-Illinois, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584 309-693-3322
§ BRIntec Corp., Brand-Rex Cable Systems Division, 1600 W. Main St., Willimantic, CT 06226-1128 203-456-8000
§ Cablex, Inc., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112 303-792-5760
§ Canada Wire and Cable Limited, 250 Ferrand Dr., Don Mills, Ontario, CANADA M3C 3J4 416-424-5000
Canstar, Canada Wire & Cable, Ltd., 3900 Victoria Pk. Ave., North York, Ont., CANADA M2H 3H7 416-756-4100
§ Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
Computer System Products, 14305 21st Ave. N., Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537
Dolan-Jenner Inds., Box 1020, Woburn, MA 01801 617-935-7444
§ Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700
† Electro Weave, 425 Shrewsbury St., Worcester, MA 01604 617-752-8932
† EOTec Corporation, 3M Corporation, 420 Frontage Road, West Haven, CT 06516 203-934-7961
Fiberguide Industries Inc., 1 Bay St., Stirling, NJ 07980 201-647-6601
Fiberoptics Technology, Inc., Quassett Rd., Pomfret, CT 06258 203-928-0443
† Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
† Galite, 2 Tower Dr., Wallingford, CT 06492 203-265-7126
§† General Cable Co., Fiber Optics Div., 160 Fieldcrest Ave., P.O. Box 7810, Edison, NJ 08818-7810 201-225-4780
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
W. L. Gore & Assocs., Inc., 1505 N. Fourth St., P.O. Box 1389, Flagstaff, AZ 86002 602-526-1290
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
† Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014 413-592-9123
§† Manhattan Electric Cable Corporation, 1 Station Plaza, Rye, NY 10580 .. 914-967-8000
§ Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
Mechatronics/SAB Inc., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040 206-236-1000
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
§ Olympic Wire & Cable, 1 Madison Rd., Fairfield, NJ 07006 201-227-7996
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
§ Phalo Corp., Transitron Corp., 900 Holt Ave., Manchester, NH 03103 603-669-4347
Philadelphia Insulated Wire Co. Inc., 333 New Albany Rd., Moorestown, NJ 08057 609-235-6700
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
§† Remee Products Corp., 41 Bridge St., Florida, NY 10921 914-651-4431
Siecor Corp., 489 Siecor Park-CO, Hickory, NC 28603-0489 704-327-5000
§† SpecTran Corp., 50 Hall Road, Sturbridge, MA 01566 617-765-0851
§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276
§ Storm Products Co., 116 Shore Drive, Hinsdale, IL 60521 312-323-9121
Textro, P.O. Box 381, Greer, SC 29652-0381 803-879-0752
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
† United Wire & Cable Corp., 425 Shrewsbury St., Worcester, MA 01604 .. 617-757-3872
§ Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945
§† Western Electronic Products Co., 915-G Calle Amanecer, San Clemente, CA 92672 714-492-4677
§† Whitmor Wire & Cable, 27737 Ave. Hopkins, Valencia, CA 91355 805-257-2400
† Woven Electronics, Woven Electronics Corporation, Old Stage Road, Simpsonville, SC 29681 803-963-5131

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Cable & Assemblies (MIL)-2440

American Insulated Wire Corp., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, 401-726-0700 ..... C•1770

Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274

Belden Wire and Cable, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, 317-983-5200;800-BELDEN-1 ..... C•1772,1802-1806,1813

† Breeze-Illinois, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, 309-693-3322 ..... C•1814-1815

§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410, 201-796-2886 ..... C•1816-1817,1819-1820,1822-1825

† Cable Systems, Inc., 210 Broadway, Everett, MA 02149, 617-389-7080 ... C•1826

Caton Connector Corp., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, 617-585-4315 ..... C•1299-1300

Component Mfg. Svc., Inc., 1 Component Park, W. Bridgewater, MA 02379, 508-580-0111 ..... C•1304

Consolidated Electronic Wire & Cable, 11044 King St., Franklin Park, IL 60131-1412, 312-455-8830 ..... C•1835

§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838-1840

General Instrument, Network Cable Div., P. O. Box 1729, Hickory, NC 28603, 704-324-2200;800-438-3331 ..... C•1845

† GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093, 301-252-1768 ..... C•1850-1852

Hudson Industries, 36 Executive Drive, Hudson, NH 03051, 603-880-7712 ..... C•1855

† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936, 201-887-0571 ..... C•1406-1407

§† Judd Wire, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, 413-863-4357 ..... B•1012, C•1857

§† Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... B•1016, C•1456,1863

National Wire & Cable Corp., 136 San Fernando Rd., Los Angeles, CA 90031-1780, 213-225-5611 ..... C•1874,1877-1882

§ Pomona Electronics, 1500 E. 9th St., P.O. Box 2767, Pomona, CA 91766, 714-623-3463 ..... C•1489,1708

Precision Interconnect, 16640 SW 72nd Ave., Portland, OR 97224, 503-620-9400 ..... C•1902-1903

† Product Technology, Inc., 2811-B McGaw Avenue, Irvine, CA 92714, 714-474-8998 ..... C•1735

Ritz Electronics/Relco, 196 Queen St. N., New Dundee, Ont., CANADA N0B 2E0, 519-696-2616 ..... C•1089

Rowe Industries, Inc., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, 419-729-9761 ..... C•1532-1534

† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... C•1551,1907

† Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069, 818-707-2020 ..... C•1581

§† U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, 213-316-9984 ..... C•1089

ABL Electronics Supply, Inc., 1736 Front St, Yorktown Hgts., NY 10598 914-962-2253

† Accurate Electronics, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-366-6330

Adirondack Wire & Cable Co., Inc., 1451 New Britain Ave., Farmington, CT 06032 1-203-677-2657

Advanced Techn. Research Labs., 5645 K General Washington Dr., Alexandria, VA 22312 703-750-2920

Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304

Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000

Amphenol Corporation, LPL Investment Grp., 20 Valley St, Endicott, NY 13760 607-754-4444

Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500

† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272

Atlantic Research, 5390 Cherokee Ave., Alexandria, VA 22312 703-642-4000

Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202

§† BRIntec Corp., Brand-Rex Cable Systems Division, 1600 W. Main St, Willimantic, CT 06226-1128 203-456-8000

Burton Electrical Engineering, Wyle Laboratories, 111 Maryland Street, P.O. Box 217, El Segundo, CA 90245-0217 213-772-1406

† Cabletest Products Co., 81 W. Wyoming Ave., Melrose, MA 02176 617-665-2932

§ Cablex, Inc., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112 303-792-5760

† Capulum Cable Technology, Ltd., 106-195 Stafford Road, Nepean, Ontario, CANADA K2H 9C1 613-726-1966

† Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379

† Coaxitube Corp., 245 Naylor Mill Rd., Salisbury, MD 21801 301-546-3911

Computer System Products, 14305 21st Ave. N., Minneapolis, MN 55447 ..... 612-476-6866;800-422-2537

§ Control Cable, Inc., 7261 Ambassador Rd., Baltimore, MD 21207 301-298-4411

§ Cooner Wire Co., 9186 Independence Ave., Chatsworth, CA 91311 818-882-8311

§† Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198

† Dilwol, 3325 North Service Rd., Burlington, Ontario, CANADA L7N 3G2 416-335-2343

§† Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700

† Electroprep, Inc., Rt 28A, P.O. Box 437, Cataumet, MA 02534 617-563-5559

† E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473

† Excel Specialty Corp., 6335 N. Broadway, Chicago, IL 60660 312-262-4781

† Flexco Microwave, Inc., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865 201-689-3020

† FM&T Industries,Inc., 145 S. Church St, P.O. Box 204, Shrewsbury, PA 17361 717-235-3000

† Gavitt Wire & Cable, Brookfield, MA 01506 617-867-6476

† W. L. Gore & Assocs., Inc., 1505 N. Fourth St, P.O. Box 1389, Flagstaff, AZ 86002 602-526-1290

† W. L. Gore & Assocs., 555 Paper Mill Rd., Newark, DE 19714 302-738-4880

Judd Wire, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069 619-744-7720

† Lamtech Electronics, 620 Easy Street, Garland, TX 75042 214-272-3504

† Lance Wire & Cable, Inc., 1010 Sherman Ave., Hamden, CT 06514 203-288-5571

† Lynn Electronics, 915 Pennsylvania Blvd., Feasterville, PA 19047 ..... 215-677-6700; 800-523-6075

§ Markel Corp., P.O. Box 752, Norristown, PA 19404 215-272-8960

National Telephone & Electronics Inc., 2350 N.W. 96 Avenue, Miami, FL 33172 305-592-0551

† N.E.D. Cable Co., Div. of Electro-Prep, Inc., 16 Proctor St, Salem, MA 01970 617-745-9911

† Olympic Wire & Cable, 1 Madison Rd., Fairfield, NJ 07006 201-227-7996

† Parlex Corp., 145 Milk St., Methuen, MA 01844 ..... 617-685-4341, Ext. 265

† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920

§† Precision Tube, Church Rd. & Wissahickon, N. Wales, PA 19454 215-699-5801

Pulse Tronic Inc., P.O. Box 5196, Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028

† Reactel, Inc., 687-D Lofstrand La., Rockville, MD 20850 301-279-5535

Sealectro-BICC Electronics, 40 Linderman Dr., Trumbull, CT 06611 203-372-4118

SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222

Storm Products Co., 116 Shore Drive, Hinsdale, IL 60521 312-323-9121

§ Support Systems Intl. Corp., 150 South Second St., Richmond, CA 94804 415-234-9090

§ Symbex Corp., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077 .. 216-354-0925

† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221

† Tevelec, Ltd., 977 Pantera Drive, Mississauga, Ontario, CANADA L4W 2W6 416-624-5241

† Textro, P.O. Box 381, Greer, SC 29652-0381 803-879-0752

† Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610

† Victor Elec. Wire & Cable, 618 Main St, W. Warwick, RI 02893 .... 401-821-1700;SALES 401-821-7800

§† Western Electronic Products Co., 915-G Calle Amanecer, San Clemente, CA 92672 714-492-4677

† Western Reserve Electronics, 2150 Highland Rd., Twinsburg, OH 44087 216-425-4951

Whitmor Wire & Cable, 27737 Ave. Hopkins, Valencia, CA 91355 805-257-2400

§† Wilco Wire & Cable Co., Inc., 1921 Las Plumas Ave., San Jose, CA 95133 408-926-8880

† Wire-Pro, Inc., 23 Front Street, Salem, NJ 08079 ..... 609-935-7601;609-935-7651

† Zippertubing Co., Box 61129, Los Angeles, CA 90061 213-321-3901

Cable & Connectors, Satellite Antennas-1900 — *See Vol. D*

Cable Assemblies & Harnesses-6000 — *See Vol. C*

Cable Assemblies, Microwave-3450 — *See Vol. A*

Cable Fault Locators-2900 — *See Vol. D*

Cable (MIL), Flat-2440

Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274

§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838

† GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093, 301-252-1768 ..... C•1850-1852

† Advanced Circuit Technology, 118 Northeastern Blvd., Nashua, NH 03062 ..... 603-880-6000;800-234-FLEX

§† Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000

Amphenol Corporation, LPL Investment Grp., 20 Valley St, Endicott, NY 13760 607-754-4444
Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410 201-796-2886
§† BRIntec Corp., Brand-Rex Cable Systems Division, 1600 W. Main St, Willimantic, CT 06226-1128 203-456-8000
§ Cablex, Inc., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112 303-792-5760
Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198
† W. L. Gore & Assocs., Inc., 1505 N. Fourth St, P.O. Box 1389, Flagstaff, AZ 86002 602-526-1290
† W. L. Gore & Assocs., 555 Paper Mill Rd, Newark, DE 19714 302-738-4880
§† King Wire & Cable Corp., 179-45 110 Ave., Jamaica, NY 11433 718-657-4422
§ 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-1800
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
§ Support Systems Intl. Corp., 150 South Second St, Richmond, CA 94804 415-234-9090
Symbex Corp., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077 .. 216-354-0925
† Tech Labs., Inc., 500 10th St, Palisades Pk, NJ 07650 201-944-2221
† Temp-Flex Cable, Inc., 11 Depot Street, S. Grafton, MA 01560 617-839-5987
§† Textro, P.O. Box 381, Greer, SC 29652-0381 803-879-0752
§ Wilco Wire & Cable Co., Inc., 1921 Las Plumas Ave., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., 23 Front Street, Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Cable (MIL), RF-2440

ABL Electronics Supply, Inc., 1736 Front St., Yorktown Hgts., NY 10598, 914-962-2253 ..... C•1768
Breeze-Illinois, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, 309-693-3322 ..... C•1814
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410, 201-796-2886 ..... C•1817,1819
Carol Cable Co. Inc., 249 Roosevelt Ave., Pawtucket, RI 02862, 401-724-9605 ..... C•1827
Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1309,1704
§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
§† General Instrument, Network Cable Div., P. O. Box 1729, Hickory, NC 28603, 704-324-2200;800-438-3331 ..... C•1845
Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... B•1016, C•1456,1862-1863
Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500
Brady Co., 63 Middlesex Ave., Iselin, NJ 07083 201-283-0400
§† BRIntec Corp., Brand-Rex Cable Systems Division, 1600 W. Main St, Willimantic, CT 06226-1128 203-456-8000
Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
† Flexco Microwave, Inc., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865 201-689-3020
§† FL Surprenant Div., 172 Sterling St, Clinton, MA 01510 617-368-1401
† W. L. Gore & Assocs., Inc., 1505 N. Fourth St, P.O. Box 1389, Flagstaff, AZ 86002 602-526-1290
† W. L. Gore & Assocs., 555 Paper Mill Rd, Newark, DE 19714 302-738-4880
† Plastoid Corporation, 45 Gingerbread Castle Rd., Hamburg, NJ 07419 .. 201-827-7141
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
Remee Products Corp., 41 Bridge St, Florida, NY 10921 914-651-4431
§† Specialty Cable Corporation, P.O. Box 50, Wallingford, CT 06492 ..... 203-265-7126; 800-243-3959
† Storm Products Co., 116 Shore Drive, Hinsdale, IL 60521 312-323-9121
§ Support Systems Intl. Corp., 150 South Second St, Richmond, CA 94804 415-234-9090
§† Western Electronic Products Co., 915-G Calle Amanecer, San Clemente, CA 92672 714-492-4677
† Whittaker Corp., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063 805-584-4100
§ Wilco Wire & Cable Co., Inc., 1921 Las Plumas Ave., San Jose, CA 95133 408-926-8880
† Wire-Pro, Inc., 23 Front Street, Salem, NJ 08079 ..... 609-935-7601;609-935-7651

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American Shizuki Corporation, 21541 Blythe St., Canoga Pk., CA 91304, 818-710-8555 ..... A•1008
American Technical Ceramics Corporation, 1 Norden La., Huntington Sta., NY 11746, 516-271-9600 ..... A•1009-1013
† AVX Corporation, Box 867, Myrtle Bch., SC 29577, 803-448-9411 ..... A•1023,1025, B•1009
§† Component Research Co. Inc., 1655-26 St., Santa Monica, CA 90404, 213-829-3615 ..... A•1031-1045,1048-1064,1066,1068-1069
§† Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, 617-996-8561 ..... A•1070
CSI Capacitors, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, 619-747-4000 ..... A•1071
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, 914-699-2000 ..... A•1072
Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
§† Electronic Concepts, Inc., Box 1278, Eatontown, NJ 07724, 201-542-7880 ..... A•1076-1077,1079,1081
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
Johanson Dielectrics, 2220 Screenland Dr., Burbank, CA 91505, 818-848-4465 ..... A•1098
§† Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
† Kemet Electronics Corporation, Box 5928, Greenville, SC 29606, 803-963-6621 ..... A•1100-1101
† Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1108-1111
† Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... B•1015
† Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... B•1015
† Mepco/Centralab, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, 803-772-2500 ..... A•1122
† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... B•1015
† Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1126-1133
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1145,1147-1148,1151,1153-1157
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1013
Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... D•1863,1874-1875
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
U S Microtek Components Corp., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, 818-767-6770 ..... A•1184
Wesco Electrical Co., 201 Munson St., Greenfield, MA 01301, 413-774-4358 ..... A•1186-1191
† Cera-Mite Corp., 1327 Sixth Ave., Grafton, WI 53024 414-377-3500
† Chicago Condenser Corp., 2900 West Chicago Ave., Chicago, IL 60622 312-227-7070
† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
§† Electron Products, 2084 Central Ave., Duarte, CA 91010 818-359-8281
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
† Kahgan Electronics Corp., 605 Peninsula Blvd., Hempstead, NY 11550 .. 516-538-2300
† KD Components, Inc., 2710 S. Main St, Santa Ana, CA 92707 714-545-7108
Maida Development Co., 20 Libby St., Hampton, VA 23663 804-723-0785
† Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
Microcap, Inc., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025 619-480-1906
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
§† Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390
§† Republic Elctrns. Corp., 176 E. 7th St., Paterson, NJ 07524 201-279-0300
† Rogers Corp., One Technology Dr., Rogers, CT 06263 203-774-9605
SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Southern Electronics, F-Dyne, 726 So. Flower St., Burbank, CA 91502 ... 818-845-2458
† Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
§† Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Sprague Electric Company, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051 603-881-7200
† Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
† TRW Capacitor Div., 301 West "O" St., Ogallala, NE 69153 308-284-3611

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Johanson Manufacturing Corporation, 400 Rockaway Valley Rd., Boonton, NJ 07005, 201-334-2676 ..... A•1099
† Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... B•1015
† Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... B•1015
† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... B•1015
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1156
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1013
Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... D•1863,1874-1875
Sprague-Goodman Elctrns., Inc., 134 Fulton Ave., Garden City Pk., NY 11040, 516-746-1385 ..... A•1174-1175
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1181
† Voltronics Corporation, West St.,, P.O. Box 476, E. Hanover, NJ 07936, 201-887-1517 ..... A•1185
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
† Mepco/Centralab, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915 915-779-3961
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208

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§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1108
§† Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1122-1123

§ **Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989** ..... **B•1130**
§ **Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330** ..... **B•1153**
§ **ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040** ..... **B•1734,1736-1737**
Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... **B•1125**
§† **Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188** ..... **B•1137**
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... **B•1142**
§ **Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123** ..... **B•1155-1156,1160**
† **Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240** ..... **B•1161**
§ **Sylvania Miniature Lighting, GTE Corporation, W. Main St., Hillsboro, NH 03244, 603-464-5533** ..... **B•1163-1165**
§ **Visual Communications Co., Inc., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, 619-549-6900** ..... **B•1099-1100**
† Atlantic Optical Moulding, Ellis St, P.O. Box 309, Dudley, MA 01570 617-943-1746
§ Augat Alcoswitch, 1551 Osgood St, N. Andover, MA 01845 617-685-4371
Control Inds. Inc., 530 Burnside Ave., Inwood, NY 11696 212-471-9800
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
§† Electrical Industries, North American Philips Corp., 691 Central Ave., Murray Hill, NJ 07974 201-464-3200
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689 818-442-7180
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§† Genisco Technology Corp., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
NOBEX Div., Griffith Plastics Corp., 1027 California Dr., Box 4365, Burlingame, CA 94010 415-342-8170
§† Oak Switch Systems, 100 S. Main St, Crystal Lake, IL 60014 815-459-5000
Risk, George, Inds., 802 S. Elm St, Kimball, NE 69145 308-235-4645
Schott Electronics, 42 Silvermine Road, Seymour, CT 06483 203-881-0102
§ Schurter, Inc., 1016 Clegg Ct, Petaluma, CA 94952 707-778-6311
§† Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400

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Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... **A•1215**
§† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
† Presidio Components, Inc., 7185 Construction Ct., San Diego, CA 92121 619-578-9390

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§ **Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720, 617-264-9550** ..... **B•1884**
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... **B•1919-1920**
† A. L. Design, Inc., 4232 Ridge Lea Rd., Amherst, NY 14226 716-833-6272
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
BLH Elctrns., 75 Shawmut Road, Canton, MA 02021 617-821-2000
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§† Dillon, W. C., & Co., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031 507-238-4461
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
§ GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024 313-476-7875
§ Helm Instrument Co., Inc., 1387 Dussel Drive, Maumee, OH 43537 419-893-4356
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
§† Interface, Inc., 7401 E. Butherus Dr., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
§† Revere Corporation of America, 845 N. Colony Rd., Wallingford, CT 06492 203-269-7701
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Tedea Inc., 8606 Wilbur Ave., Northridge, CA 91324 818-349-6116
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721

Cells, Photoconductive-3700

§ **Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602** ..... **B•1270**
§ **EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900** ... **B•1271**
† **Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160** ..... **B•1295**
Advanced Detector Corp., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746 818-369-6886
A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
† Centronic, Inc., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702 805-499-5902
EG&G, Inc., Photon Devices, 35 Congress St., Salem, MA 01970 617-745-3200
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Infrared Industries, Inc., 12151 Research Parkway, Orlando, FL 32826 ... 305-282-7700
Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 201-974-0090
Optoelectronics/Textron, 1309 Dynamic St., Petaluma, CA 94975-0039 707-763-4181
§ Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
† Santa Barbara Resch. Ctr., 75 Coromar Dr., Goleta, CA 93117 805-968-3511
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
§ Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946
United Detector Technology, 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516

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Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... **B•1270**
EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... **B•1271**
§ **Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461** ..... **B•1278**
A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141

Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 201-974-0090
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586

Cells, Photovoltaic-3700

§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
Energy, Ltd., 4714 Upshur Street, Bladensburg, MD 20710, 301-699-1144 ..... D•2099
Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1275-1277
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160 ..... B•1295
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
† Atlantic Solar Products, P.O. Box 70060, Baltimore, MD 21237 ..... 301-686-2500; 800-237-6527
† Centronic, Inc., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702 805-499-5902
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
EG&G, Inc., Photon Devices, 35 Congress St., Salem, MA 01970 617-745-3200
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ GNB Incorporated, 2010 Cabot Blvd. W., Langhorne, PA 19047 215-750-2600
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§ Johnson Controls, Battery Grp.-Indl. Prods. Div., Janet A. Korol, Milwaukee, WI 53212 414-961-6500
§ Panasonic Industrial Co., Battery Sls. Div., Box 1511, Secaucus, NJ 07096-1511 201-348-5266
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Santa Barbara Resch. Ctr., 75 Coromar Dr., Goleta, CA 93117 805-968-3511
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Solarex Corp., 1335 Piccard Dr., Rockville, MD 20850 301-948-0202
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
United Detector Technology, 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516

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Ango Electronics Corp., 16 North Third St., Harrison, NJ 07029, 201-484-1115 ..... C•1015
† Optima Enclosures, 2166 Mountain Indl. Blvd., Tucker, GA 30084, 404-496-4000 ..... C•1063
† General Technology Corp., 6816 Washington Avenue, NE, Albuquerque, NM 87109 505-345-5591
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703 714-973-1800
Prototek, Inc., 25 Standen Dr., Hamilton, OH 45015 513-874-5094
† STRONGBOX, P.O. Box 84508, Los Angeles, CA 90073 213-305-8288
† Trilobyte Computer Corporation, 14477 Catalina St., San Leandro, CA 94577 415-895-1100

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† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157
§† Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1199-1202,1204
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1212,1216,1219-1221
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•1233,1236-1237,1239
§† Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600 ..... A•1241
§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•1246,2280-2281
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270-1272, D•1863
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282,1285,2367
† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•1300
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
† Atlas Engineering Corp., 10 Cheney St., Dorchester, MA 02121 617-445-7100
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147 305-696-6660
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
§† Capcon, Inc., 147 West 25th Street, New York, NY 10001 212-243-6275
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
§† Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† PTC Transformers, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505 609-298-8200
† Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518 213-638-1790
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763 516-654-1880
† Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291 ... 209-739-1077
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

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† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
† Duplicon, Inc., 516 E. Second St, S. Boston, MA 02127 617-269-5484
† Solid State Electronics Corp., 18646 Parthenia St, Northridge, CA 91324 818-993-8257

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Circuit Breakers-4300

† Airpax Corp., Woods Rd., Cambridge, MD 21613, 301-228-4600 ..... B•1298
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1306-1308
§ Curtis Industries, 7400 W. Douglas Ave., P.O. Box 18699, Milwaukee, WI 53218-0699, 414-535-1500 ..... A•1642-1643
† E-T-A Circuit Breakers, 7400 N. Croname Rd., Chicago, IL 60648, 312-647-8303 ..... B•1311-1313
§† Heinemann Electric Co., Brunswick Pike, Alt. Rte. #1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1315-1318
§† Mechanical Products Inc., 1824 River St. P. O. Box 729E, Jackson, MI 49204, 517-782-0391 ..... B•1342
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1348
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025, 415-361-3860 ..... B•1349
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
§ USD Products, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656, 312-867-4600 ..... B•1352-1353
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§ Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
Brown Boveri Elec., Norristown Rd., Spring House, PA 19477 215-628-7400
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211 408-747-0550
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
§ Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Nedco Electronics, Inc., 6216 Oakton St., Morton Grove, IL 60053 312-966-6000
Pyle-National Division, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651 312-342-6300
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ SL Waber, Inc., 300 Harvard Ave., Westville, NJ 08093 ... 609-456-5400;800-257-8384
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
§ Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
§ Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St, Covington, KY 41012 606-431-0900
§ Weber, Inmark Corporation-Importer, 147 W. Cedar St., Norwalk, CT 06854 203-866-8474
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Airpax Corp., Woods Rd., Cambridge, MD 21613, 301-228-4600 ..... B•1298
Heinemann Electric Co., Brunswick Pike, Alt. Rte. #1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1315,1317
§ Mechanical Products Inc., 1824 River St. P. O. Box 729E, Jackson, MI 49204, 517-782-0391 ..... B•1342
† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St, Covington, KY 41012 606-431-0900

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§† All-States, Inc., 1801 W. Foster Ave., Chicago, IL 60640, 312-728-0525 .. C•1160
Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274
§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
§† Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, 312-532-1800 ..... C•1892-1893
§ Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410 201-796-2886
§ Control Cable, Inc., 7261 Ambassador Rd., Baltimore, MD 21207 301-298-4411
§† Heyco Molded Products, Inc., Box 160, Kenilworth, NJ 07033 ..... 201-245-0033; 800-526-4182
† Micro Plastics Inc., Hwy 178 North, P.O. Box 149, Flippin, AR 72634 501-453-2261
§ Richco Plastic Co., P.O. Box 804238, Chicago, IL 60680 312-539-4060
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
§† Tyton Corp., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223 ... 414-355-1130

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§ Atlee Inc., 10 Bayfield Dr., North Andover, MA 01845, 617-681-1003 ..... B•1300, C•1745
Augat/RDI, 525 Randy Rd., Carol Stream, IL 60188, 312-682-4100 ..... C•1285
§ Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 ..... B•1304
§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
§ Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1309,1704
Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646, 312-539-3108 ..... C•1310-1311
§ Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
† Doran Manufacturing Co., 2834 Sidney Ave., Cincinnati, OH 45225, 513-681-5424 ..... C•1325
§† FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
§† Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1319,1323-1326
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 ..... B•1344, C•1481
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, 201-736-5722 ..... A•1679
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. C•1547-1548
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... C•1550,1552,1906
§† Zierick Manufacturing Corp., 56 Radio Circle, Mt. Kisco, NY 10549, 914-666-2911;800-882-8020 ..... C•1601

§ Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
Accurate Electronics, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-366-6330
§ Acme Model Engineering Co., 654 Bergen Blvd., Ridgefield, NJ 07657 .. 201-943-7650
Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403 617-583-0160
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401
§† Beswick, Dubilier International Plc., Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Blackburn, Division of FL Industries, 1525 Woodson Rd., St. Louis, MO 63144 314-993-9430
§ Carbone-Ferraz, Inc., 14 Eastmans Rd., Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Components Corp., 6 Kinsey Pl., Denville, NJ 07834 201-627-0290
EG & G Birtcher, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268 818-442-2572
§† Electronic Essentials, 60-20 34th Avenue, Woodside, NY 11377 718-898-8300
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Gould Inc., Circuit Protection Div., 374 Merrimac St., Newburyport, MA 01950 ..... 617-462-6662/3131
§ Heyco Molded Products, Inc., Box 160, Kenilworth, NJ 07033 ..... 201-245-0033; 800-526-4182
§ Ideal Industries, 4450 Becker Pl., Sycamore, IL 60178 815-895-5181
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
§† Keystone Electronics Corp., 31-07 20th Rd., Astoria, NY 11105-2017 ... 718-956-8900
§ LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879 ... 301-921-9440
§ Marathon Special Prods., 13300 Van Camp Rd., Bowling Green, OH 43402 419-352-8441
Miniature Metal Forming Div., 4819 Emerald St., P.O. Box 2962, Torrance, CA 90509 213-370-3679
§ National Tel-Tronics, State Road Hill, Meadville, PA 16335 814-724-6440
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Richco Plastic Co., P.O. Box 804238, Chicago, IL 60680 312-539-4060
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
Schaffner EMC, Inc., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083 ..... 201-851-0644; 800-367-5566
Seastrom Manufacturing Co., Inc., 701 Sonora Ave., Glendale, CA 91201 213-245-9121
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
† Tech-Etch, Inc., 45 Aldrin Rd., Plymouth, MA 02360 617-747-0300
§ USD Products, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656 312-867-4600
§ Weidmuller, Inc., 821 Southlake Blvd., Richmond, VA 23236 804-794-2877

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Atlee Inc., 10 Bayfield Dr., North Andover, MA 01845, 617-681-1003 ..... B•1300, C•1745
§ Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1308-1309,1704
EG & G Birtcher, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, 818-442-2572 ..... C•1028-1029
§† FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
† Mueller Elec. Co., 1583 E. 31st St., Cleveland, OH 44114, 216-771-5225 ..... C•1468-1469,1472
Autosplice, Inc., 59-12, 37th Ave, Woodside, NY 11377 718-429-0500
† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
Philips Circuit Assemblies, 1515 Sixth St. South, Hopkins, MN 55343 ... 612-933-4600

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Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607,1624,1632
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1240
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... B•1252
§† Berg, W. M., Inc., 499 Ocean Ave., East Rockaway, NY 11518 516-599-5010
Dial Products Co., 19-21 Cottage St., Bayonne, NJ 07002 ..... 201-HE7-0720
§† Facet Enterprises, Inc., Elmira, NY 14903 607-737-8011
† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
† Perfect Gear & Instrument, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040 516-328-3300
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040 516-328-3970
§ Vemaline Prods. Div., 333 Strawberry Field Rd., P.O. Box 6979, Warwick, RI 02887 401-739-7600
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

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† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1240
§ Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513, 312-485-5152 ..... B•1634
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ... B•1030,1267
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Dial Products Co., 19-21 Cottage St., Bayonne, NJ 07002 ..... 201-HE7-0720
§† Facet Enterprises, Inc., Elmira, NY 14903 607-737-8011
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
† Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
† Perfect Gear & Instrument, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040 516-328-3300
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040 516-328-3970

Clutches, Positive-3500

Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1240
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
§† Berg, W. M., Inc., 499 Ocean Ave., East Rockaway, NY 11518 516-599-5010
§† Facet Enterprises, Inc., Elmira, NY 14903 607-737-8011
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
† Perfect Gear & Instrument, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040 516-328-3300
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

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§† **Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200** ..... A•1205
Caddell-Burns Mfg., 258 E. 2nd St., Mineola, NY 11501-3508, 516-746-2310 ..... A•1208-1209,1219-1220
§ **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... A•1234,1238
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•1244
Gowanda Electronics Corp., 1 Industrial Pl., Gowanda, NY 14070, 716-532-2234 ..... A•1245
§† **Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050** ..... A•1246,2280-2281,2288
Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1248,1255-1256,1263,1269, B•1019
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•1271-1275,2323
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... A•1277-1278
† **Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700** ..... A•2352-2353
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054** ..... A•2011
Renco Electronics, Inc., 60 Jefryn Blvd., East, Deer Pk., NY 11729, 516-586-5566;1-800-645-5828 ..... A•1282
† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... A•1287
† **Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790** ..... A•1291,1695,2398
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... A•1300
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... A•2426
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... A•2428
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
† Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
† E-Tron Corporation, 30 Ethel Rd, Edison, NJ 08817 201-287-9039
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061 913-782-0012
§† Inductive Prods., Inc., 11733 Markon Dr., Garden Grove, CA 92641 714-891-2572
§† Jeffers Electronics, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621 ... 602-287-5851
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† North Hills Electronics, 1 Alexander Pl, Glen Cove, NY 11542 516-671-5700
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Perkin-Elmer Corp., Elctrn. Prods. Dept, 761 Main Ave., Norwalk, CT 06859-0132 203-762-4786
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
Vanguard Electronics Co., 1480 W. 178th St, Gardena, CA 90248 213-323-4100
Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856
§ Zambre Co., Inc., 2134 Old Middlefield Way, Mountain View, CA 94043 .. 415-968-9176

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Amecon, Inc., 1900 S. Chris La., Anaheim, CA 92805, 714-634-2220;800-392-2292 ..... A•2174
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§† **Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301** ..... A•1233-1234,1236-1238
§† **Delevan Div., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, 716-652-3600** ..... A•1241-1243
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† **Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012** ..... A•2239
† **North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700** ..... A•1247
§ **Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421** ..... A•1248-1266, B•1019
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† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064** ..... A•1271-1275,2323
† **Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501** ..... A•1277-1278
§† **RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054** ..... A•2011
† **Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777** ..... A•1287
§† **Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, 312-297-0070** ..... A•1296
† **Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314** ..... A•1300-1305
† **Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880** ..... A•2426
§† **United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600** ..... A•2428
† Associated Spring, Barnes Grp., 10 Main St, Bristol, CT 06010 203-583-1331
§ Atlantic Magnetics, Inc., 1441 S.W. 30th Ave., Pompano Beach, FL 33069 305-979-7920
† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660
Bey Electric, Inc., 362 Main St, Box 548, Lincoln Park, NJ 07035 201-694-5000
† Electro Assemblies Corp., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062 312-498-6520
† E-Tron Corporation, 30 Ethel Rd, Edison, NJ 08817 201-287-9039
Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Lenox-Fugle Electronics, 100 Sylvania Pl, S. Plainfield, NJ 07080 201-756-1164

† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
SFE Technologies, 1501 1st St, San Fernando, CA 91340 818-365-9411
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Vanguard Electronics Co., 1480 W. 178th St, Gardena, CA 90248 213-323-4100
§† West-Cap Arizona, Sub. of SFE Technologies, 2201 East Elvira Road, Tucson, AZ 85706 602-294-2646
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

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MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1233
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† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Danmar Inds., 9705 Lurline Ave., Chatsworth, CA 91311 ..... 818-882-7979/5280
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
† Omnitek, Inc., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-4443
POWR-UPS Corp., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967 ..... 516-345-5700;1-800-333-POWR
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
Tech Labs., Inc., 500 10th St, Palisades Pk, NJ 07650 201-944-2221

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§ **AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673** ..... **C•1165,1269-1273**
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§ **Belden Wire and Cable, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, 317-983-5200;800-BELDEN-1** ..... **C•1772,1813**
Component Mfg. Svc., Inc., 1 Component Park, W. Bridgewater, MA 02379, 508-580-0111 ..... **C•1304**
§† **Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727** ..... **B•1169**
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† **MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496** ..... **B•1172**
Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... **C•1456**
§† **NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000** ..... **B•1175**
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... **B•1179**
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703, 508-699-3800;508-699-3450 ..... **B•1028, C•1572**
Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807, 201-685-1600 ..... **C•1575**
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§ Amphenol, Bendix Connector Operations, 40-60 Delaware St., Sidney, NY 13838 607-563-5011
§ Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
§ Assmann Components, Div. of ebm Industries, Inc., 525 New Britain Ave., Unionville, CT 06085 203-674-1515
§† AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
Braxton Mfg., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795 203-274-6781
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Deutsch Co., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045 213-649-1400
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
§ Dynacast, Div. Coats & Clark Inc., 1401 Front Street, Yorktown Heights, NY 10598 914-245-0060
† EOTec Corporation, 3M Corporation, 420 Frontage Road, West Haven, CT 06516 203-934-7961
§ Ercona, 101 Main/Patchogue Rd., Port Jefferson Sta., NY 11776 516-331-5500
Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
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General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
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† Hughes Aircraft Co., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714 714-660-5701
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
Light Control Systems Inc., 2 Bridgeview Circle, Tyngsboro, MA 01879 .. 617-649-9870
§ Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
§ Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 312-867-9600
Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532 312-969-4550
Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
§ Philadelphia Insulated Wire Co. Inc., 333 New Albany Rd., Moorestown, NJ 08057 609-235-6700
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
Sabritec, 1733 Kaiser Ave., Irvine, CA 92714 714-660-1970
Security Plastics, Inc., 14427 N.W. 60th Ave., Miami Lakes, FL 33014 305-823-5440
Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505 213-517-7770
Siecor Corp., 489 Siecor Park-CO, Hickory, NC 28603-0489 704-327-5000
§ Souriau, Inc., 28309 N. Avenue Crocker, Valencia, CA 91355 805-257-4830
§† SpecTran Corp., 50 Hall Road, Sturbridge, MA 01566 617-765-0851
§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276
§ Stanley/AC Interface, 17911 Sampson Lane, Costa Mesa, CA 92647 ... 714-841-6090
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Swiss Jewel Company, 406 Lafayette Building, Philadelphia, PA 19106 215-925-2867
§ Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
TRW Fiber Optic Prods., Connector Div., TRW Elctrn. Comps. Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900
§ U.S. Components, Inc., Unitech PLC, 35 Carlough Rd., Bohemia, NY 11716 516-589-8080

Connectors, Filtered-2100 – *See Vol. C*

Connectors, Flat Cable (Incl. Flexible)-2100 – *See Vol. C*

Connectors, Fused-2100 – *See Vol. C*

Connectors, Heavy Duty, Power-2100 – *See Vol. C*

Connectors, Hermetically Sealed, Pressurized, or Waterproof-2100 – *See Vol. C*

Connectors, High Density, Multipin-2100 – *See Vol. C*

Connectors, High Voltage (1,000 Volts & Over)-2100 – *See Vol. C*

Connectors, IDC (Insulation Displacement Contact)-2100 – *See Vol. C*

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Connectors, Magnetron-2100 – *See Vol. C*

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Connectors (MIL), Flat Cable-2440

AirBorn, Inc., 4321 AirBorn Dr., Addison, TX 75001-0519, 214-931-3200 ..... C•1132,1137,1139,1142
† AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1172
Beau Products Div., Vernitron Corp., Box 10, Laconia, NH 03247, 603-524-5101 ..... C•1289
Carrot Components Corporation, 750 West Ventura Blvd., Camarillo, CA 93010, 805-484-0540 ..... C•1293-1295
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... C•1316-1317
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... C•1331,1357-1359
§† Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, 312-532-1800 ..... C•1476-1478
Robinson Nugent, Inc., 800 East 8th St., New Albany, IN 47150, 812-945-0211 ..... C•1530
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807, 201-685-1600 ..... C•1575
Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§† Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000
† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
Autosplice, Inc., 59-12, 37th Ave, Woodside, NY 11377 718-429-0500
Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401
§ Eby Company, Pullman Co., 2751 Southampton Rd., Philadelphia, PA 19154 215-969-4200
Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
Fuji Electric Corp. of America, 727 W. 7 St., Ste. 235, Los Angeles, CA 90017 213-622-4490
§† H & T Components Inc., Unitech Plc., 35 Carlough Road, Bohemia, NY 11716 516-567-2282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
§† 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-1800
Pulse Tronic Inc., P.O. Box 5196, Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
Souriau, Inc., 28309 N. Avenue Crocker, Valencia, CA 91355 805-257-4830
§ Support Systems Intl. Corp., 150 South Second St., Richmond, CA 94804 415-234-9090
Symbex Corp., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077 .. 216-354-0925
Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
Urban Electronics, P. O. Box 456, Dover, MA 02030 617-329-4068
§ Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610

Connectors (MIL), Power-2440

Amphenol Canada Corporation, An LPL Company, 20 Melford Dr., Scarborough, Ontario, CANADA M1B 2X6, 416-291-4401 ..... C•1276
Caton Connector Corp., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, 617-585-4315 ..... C•1296,1300
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... C•1324
H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1553
† Alden Products Co., P.O. Box 860, 117 N. Main St., Brockton, MA 02403 617-583-0160
§† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
§ Anderson Power Products, Div. of High Voltage Engineering, 145 Newton St., Boston, MA 02135 617-787-5880
† Burndy Corporation, Richards Ave., Norwalk, CT 06852 203-838-4444
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428 612-537-1010
Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
† Hypertronics Corp., 16 Brent Dr., Hudson, MA 01749 ..... 617-568-0451;800-225-9228
§ Ideal Industries, 4450 Becker Pl., Sycamore, IL 60178 815-895-5181
§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
§† 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-1800
Pyle-National Division, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651 312-342-6300
Sabritec, 1733 Kaiser Ave., Irvine, CA 92714 714-660-1970
Souriau, Inc., 28309 N. Avenue Crocker, Valencia, CA 91355 805-257-4830
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
Urban Electronics, P. O. Box 456, Dover, MA 02030 617-329-4068
§† U.S. Components, Inc., Unitech PLC, 35 Carlough Rd., Bohemia, NY 11716 516-589-8080
§† Wire-Pro, Inc., 23 Front Street, Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), Printed Circuit-2440

† AirBorn, Inc., 4321 AirBorn Dr., Addison, TX 75001-0519, 214-931-3200 ..... C•1132-1146,1148-1157
† AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165
Atlee Inc., 10 Bayfield Dr., North Andover, MA 01845, 617-681-1003 ..... C•1720
Components Corp., 6 Kinsey Pl., Denville, NJ 07834, 201-627-0290 ..... C•1306
Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646, 312-539-3108 ..... C•1310-1311
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... C•1316-1317
§† Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... C•1323
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680, 714-669-9473 ..... C•1726
Holmberg Elctrns., Asheville Hwy., Inman, SC 29349, 803-472-4141 ..... C•1385
† Hypertronics Corp., 16 Brent Dr., Hudson, MA 01749, 617-568-0451;800-225-9228 ..... C•1392
Industrial Electronic Hardware Corp., 109 Prince St., New York, NY 10012, 212-677-1881 ..... C•1397-1399
Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... B•1016-1017, C•1456-1457,1730-1731
§† Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, 312-532-1800 ..... C•1476,1478
§† Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703, 508-699-3800;508-699-3450 ..... B•1027-1029, C•1571-1573
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807, 201-685-1600 ..... C•1575
† Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069, 818-707-2020 ..... C•1579,1581
§† Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000
† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
Autosplice, Inc., 59-12, 37th Ave, Woodside, NY 11377 718-429-0500
Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
† CTS Corporation, Connector Division, 9210 Science Center Dr., New Hope, MN 55428 612-533-3533
† CTS Corporation, Systems & Datacomm Division, 6900 Shady Oak Rd., Eden Prairie, MN 55344 612-941-9100
DuPont Electronics, (Interconnect & Packaging Grp.), 515 Fishing Creek Rd., New Cumberland, PA 17070 800-237-2374
† Dynatech Corp., 1225 E. Wakeham Ave., P.O. Box 1019, Dept. E, Santa Ana, CA 92702 714-558-8755
Eby Company, Pullman Co., 2751 Southampton Rd., Philadelphia, PA 19154 215-969-4200
Edac Inc., 20 Railside Rd., Toronto, ON, CANADA M3A 1A4 416-445-2292
Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
§† H & T Components Inc., Unitech Plc., 35 Carlough Road, Bohemia, NY 11716 516-567-2282
§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§† 3M-Electronic Products Division, Bldg. 502, P.O. Box 2963, Austin, TX 78769-2963 512-834-1800
§† Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 312-867-9600
† Milross Controls, Inc., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405 203-488-1033
† PCD, 5 Lowell Avenue, Winchester, MA 01890 617-721-1280
Pulse Tronic Inc., P.O. Box 5196, Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
Pyle-National Division, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651 312-342-6300
Souriau, Inc., 28309 N. Avenue Crocker, Valencia, CA 91355 805-257-4830
§ Sullins Electronics Corp., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92069 619-744-0125
Symbex Corp., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077 .. 216-354-0925
Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
§† Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
Urban Electronics, P. O. Box 456, Dover, MA 02030 617-329-4068
§† U.S. Components, Inc., Unitech PLC, 35 Carlough Rd., Bohemia, NY 11716 516-589-8080
§† Wire-Pro, Inc., 23 Front Street, Salem, NJ 08079 ..... 609-935-7601;609-935-7651

Connectors (MIL), RF-2440

AirBorn, Inc., 4321 AirBorn Dr., Addison, TX 75001-0519, 214-931-3200 ..... C•1132,1136,1153,1156
§† AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1242-1246
Amphenol Corporation, Corporate Headquarters, 358 Fail Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1275
Breeze-lilinois, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, 309-693-3322 ..... C•1814-1815
Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1308-1309,1704

Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... **C•1321**
Jettron Products, P.O. Box 337, E. Hanover, NJ 07936, 201-887-0571 ..... **C•1406-1407**
Lear Siegler, Inc., Telecommunications Div., 714 N. Brookhurst St., Anaheim, CA 92801, 714-774-1010 ..... **C•1416**
Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... **C•1452**
Microdot, Interconnect Systems Division, 201 Progress Dr., Montgomeryville, PA 18936, 215-699-5373 ..... **B•1016, C•1456-1458**
Rowe Industries, Inc., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, 419-729-9761 ..... **C•1532-1534**
† **Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069, 818-707-2020** ..... **C•1579,1581**
§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333
§† Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§† Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500
§† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
§† Applied Engineering Products, P.O. Box A-D, Amity Sta., New Haven, CT 06525 203-387-5282
C. E. Precision Assemblies, 1031 W. Fremont Dr., Tempe, AZ 85282 602-820-5596
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428 612-537-1010
† Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400
§ Compar, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, CANADA L3R 4Z4 416-475-8500
Delta Electronics Mfg. Corp., 416 Cabot St, Beverly, MA 01915 617-927-1060
§ Electronic Resources Inc., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089 408-745-1420
Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
§ Penstock Engineering Labs., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018 408-730-0300
Pyle-National Division, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651 312-342-6300
† Sabritec, 1733 Kaiser Ave., Irvine, CA 92714 714-660-1970
§† Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
§† Specialty Connector Co., 2100 Earlywood Dr., Franklin, IN 46131 317-738-2800
§ Support Systems Intl. Corp., 150 South Second St., Richmond, CA 94804 415-234-9090
† Whittaker Corp., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063 805-584-4100

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Contactors (MIL)-2440

† **FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025** ..... **B•1425**
ICC, Inc., 1144 W. Grove Ave., Orange, CA 92665, 714-998-8310 ... **C•1395-1396**
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
† PCD, 5 Lowell Avenue, Winchester, MA 01890 617-721-1280
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
§† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

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Contacts (MIL), Assemblies & Holders-2440

† **AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673** ..... **C•1165,1260-1268**
Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... **C•1274**
Delbert Blinn Co., Box 2007, Pomona, CA 91769, 714-629-3900 ..... **A•2130**
Hiram Jones Electronics, 11607 Vanowen St., No. Hollywood, CA 91605, 213-875-0213 ..... **C•1377**
ICC, Inc., 1144 W. Grove Ave., Orange, CA 92665, 714-998-8310 ... **C•1395-1396**
§† Amphenol, Bendix Connector Operations, 40-60 Delaware St, Sidney, NY 13838 607-563-5011
† Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500
† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
Autosplice, Inc., 59-12, 37th Ave, Woodside, NY 11377 718-429-0500
§† CINCH Cylindrical Division, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428 612-537-1010
§ Compar, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, CANADA L3R 4Z4 416-475-8500
† Danmar Inds., 9705 Lurline Ave., Chatsworth, CA 91311 ..... 818-882-7979/5280
§† Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
Pulse Tronic Inc., P.O. Box 5196, Ville St. Laurnet, Que., CANADA H4L 4Z8 514-747-6028
United Foam Plastics, 172-Q E. Main St., Georgetown, MA 01833 617-352-2200
§ U.S. Components, Inc., Unitech PLC., 35 Carlough Rd., Bohemia, NY 11716 516-589-8080

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Controls, Fluid Flow-2200 — *See Vol. D*
Controls, Fluorescent Light Power-2200 — *See Vol. D*
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† **Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727** ..... **B•1169**

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Croven Crystals, 500 Beech St., Whitby, ON, CANADA L1N 5S5, 416-668-3324 ..... A•1365
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1366,1368-1370
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1399
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† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Digital Radio Corp., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277 213-316-9114
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† **Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, 305-696-6660 ..... A•1498-1500**
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Control Electronics, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, 516-694-0125 ..... A•1534
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Spiricon, Inc., 2600 North Main, Logan, UT 84321 801-753-3729

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Detector Arrays, Infrared-3700

§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275,1277
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Detectors, Ground Fault-4300

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Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1269

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§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
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§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
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§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
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§ SC Technology, Inc., 2450 Armstrong St., Livermore, CA 94550 415-373-9230
§ Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
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§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
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§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Spiricon, Inc., 2600 North Main, Logan, UT 84321 801-753-3729
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
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§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... C•1605
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1128-1129
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... B•1272-1273
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130-1131,1133
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093, 516-937-3475 ..... A•1094
§ JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ..... B•1135
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1079,1125
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1137
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275-1276
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1173,1175,1280-1281
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461 ..... B•1278
§ Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1146-1147
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1013,1142
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2142, B•1148-1151,1291-1292
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092

† **Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155-1156,1158-1160**
§† **Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161**
Visual Communications Co., Inc., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, 619-549-6900 ..... B•1099-1101
§† A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
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§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
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Ei North America, 435 E. 79th St, New York, NY 10021 212-517-5622
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† Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
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§† Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
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§ Schroff UK Ltd., Maylands Ave., Hemel Hempstead, Herts, ENGLAND HP2 4SG 0442-40471/6
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† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
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Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
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† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1128
Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1275,1277
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§ Advanced Detector Corp., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746 818-369-6886
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Micronetics, 36 Oak St., Norwood, NJ 07648, 201-767-1320 ..... D•1300
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§† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
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Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000

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AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1039,1107
Applied Data Systems, 9811 Mallard Dr., Ste. 203, Laurel, MD 20708, 800-541-2003;301-953-9326 ..... B•1041
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
Canyon Elctrns., 2001 W. North Lane, Phoenix, AZ 85021, 602-944-4421 ..... B•1044
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107, 818-791-5600 ..... B•1055
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Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052-1053
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Dic-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1057,1062
Electro-Numerics, Inc., 1811 Reynolds, Irvine, CA 92714, 714-250-1501 ..... D•1369
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
Excel Technology Intl. Corp., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, 201-874-4747 ..... B•1069
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076, D•1132
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143-1145
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083, D•1137,1382-1384,1386-1387
Setra Systems, Inc., 45 Nagog Park, Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1922-1923
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1097
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
† Data Check Corporation, 9918 Via Pasar, San Diego, CA 92126 619-578-0101
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
§ Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
† K-Systems, Inc., 3902 Lilac, Las Cruces, NM 88005 505-526-3209
† Quantum Electronics, Inc., R.D. 4, Box 6AAA, Lewistown, PA 17044 717-242-1132
Telegenix, Inc., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034 609-424-5220

Display Power Supplies — See Converters, DC to DC (Vol. D), Power Supplies, AC Output (Vol. D)

Displays, CRT-2450

Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107, 818-791-5600 ..... B•1055
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047
Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1055
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1257
§ Leader Instruments Corp., 380 Oser Ave., Hauppauge, NY 11788-3694, 516-231-6900 ..... D•1288
§ Ann Arbor Terminals, 6175 Jackson Rd., Ann Arbor, MI 48103 313-663-8000
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
Aspect Electronics Inc., 725 San Aleso, Sunnyvale, CA 94086 408-737-2290
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., #200, Santa Clara, CA 95051 408-748-1200
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Controls, 414 Commerce Dr., Ft. Washington, PA 19034 215-542-7800
† CELCO, 70 Constantine Dr., Mahwah, NJ 07430 201-327-1123
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000

† Collins Avionics Divisions, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498 319-395-1000
Colorgraphic Communications Corp., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366 404-455-3921
§ Computerware, Inc., 8480-I Tyco Rd., Vienna, VA 22180 703-821-8200
§ Conrac Display Products Group, A Mark IV Industries Co., 1724 S. Mountain Ave., Duarte, CA 91010 818-303-0095
† Data Check Corporation, 9918 Via Pasar, San Diego, CA 92126 619-578-0101
Data Ray Corp., 452 Burbank Street, Broomfield, CO 80020 303-469-5173
§ Data Rentals/Sls., Inc, 4209 Van Owen Place, Burbank, CA 91505 818-843-1221
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Digital Equip., One Iron Way, Marlborough, MA 01752
§ Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
† ISC Cardion Electronics, Inc., Long Island Expwy., Woodbury, NY 11797 516-921-7300
† Kaiser Electronics, Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134 408-432-3000
Kikusui International Corp., 19601 Mariner Ave., Torrance, CA 90503 ..... 213-371-4662; 800-545-8784
Lee Data Corporation, 7075 Flying Cloud Drive, Minneapolis, MN 55344 612-828-0300
Matrix Corp., 1203 New Hope Rd., Raleigh, NC 27610 919-833-2000
§ Matrox Electronic Systems, 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Metra Instruments, 2056 Bering Dr., San Jose, CA 95131 408-436-8530
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
§ Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
† Systems Research Laborotories, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440 513-426-6000
TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Texscan Instruments, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226 317-545-4196
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271
XKD Corporation, 101 Cooper Court, Los Gatos, CA 95030 408-395-3700
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733
Zenith Components Group, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Displays, Dot Matrix-2450

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1035
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1037
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1038,1107
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042-1043
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
Citizen Business Machines, 2999 Overland Ave., Ste. 203, Los Angeles, CA 90064, 213-558-0961;800-421-6516 ..... D•1080-1081
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1049
§ Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1062
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1070
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1071
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1079
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1749, B•1081,1281
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... B•1085
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086,1088-1091
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1151
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1094,1096-1097
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
§ A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
Astec USA, Ltd., A BSR Intl. Co., 2880 San Tomas Expwy., #200, Santa Clara, CA 95051 408-748-1200
§ Chrono-log Corp., 2 W. Park Rd., Havertown, PA 19083 215-853-1130
Colorgraphic Communications Corp., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366 404-455-3921
Computerwise, 302 N. Winchester, Olathe, KS 66062 913-829-0600
Crystaloid Electronics, Box 628, Hudson, OH 44236 216-655-2429
§† Digital Electronics, 31047 Genstar Road, Hayward, CA 94544-7831 415-471-4700
Digital Equip., One Iron Way, Marlborough, MA 01752
Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
Noritake Co., Inc., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505 213-373-6704
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630 714-527-0561
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§ Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611
Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Edge Lighted & Back Lighted-2450

† Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1062
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086,1088-1091
Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
Crystaloid Electronics, Box 628, Hudson, OH 44236 216-655-2429
Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
† Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Electroluminescent-2450

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086-1087
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
§† Digital Electronics, 31047 Genstar Road, Hayward, CA 94544-7831 415-471-4700
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760 607-754-9187

Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630 714-527-0561
Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§ Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Electromagnetic-2450

§ Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143,1145
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093,1097

Displays, Electromechanical-2450

§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
Electrodynamics, Inc., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, 312-259-0740 ..... D•1129
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
† Mineico Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459, 203-283-8261 ..... B•1140-1141
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093
† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6 519-271-3880
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
Schroff Incorporated, Schroff GMBH, 170 Commerce Dr., Warwick, RI 02886 401-732-3770

Displays, Fiber Optic-2450

§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Galileo Electro-Optics Corp., Galileo Pk., Sturbridge, MA 01518 617-347-9191
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Displays, Graphic-2450

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1035
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1037
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1038,1107
Applied Data Systems, 9811 Mallard Dr., Ste. 203, Laurel, MD 20708, 800-541-2003;301-953-9326 ..... B•1041
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
Bergquist, 5300 Edina Ind'l., Minneapolis, MN 55435, 800-328-3882 ..... B•1809
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
Citizen Business Machines, 2999 Overland Ave., Ste. 203, Los Angeles, CA 90064, 213-558-0961;800-421-6516 ..... D•1080-1081
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1048
† DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... B•1054
§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052-1053
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1062
Dixson, Inc., Box 1449, Grand Junction, CO 81502, 303-242-8863 (ext 223) ..... D•1366
§† Excel Technology Intl. Corp., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, 201-874-4747 ..... B•1068-1069
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1070
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1257
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1071
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1825
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... B•1085
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1151
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093,1096
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
† Alden Electronics, Inc., 40 Washington Street, Westboro, MA 01581 617-366-8851
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 .. 313-779-8700
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§† Aydin Controls, 414 Commerce Dr., Ft. Washington, PA 19034 215-542-7800
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
Colorgraphic Communications Corp., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366 404-455-3921
Crystaloid Electronics, Box 628, Hudson, OH 44236 216-655-2429
Data Ray Corp., 452 Burbank Street, Broomfield, CO 80020 303-469-5173
§† Digital Electronics, 31047 Genstar Road, Hayward, CA 94544-7831 415-471-4700
Digital Equip., One Iron Way, Marlborough, MA 01752
Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Evans & Sutherland Computer Corp., P.O. Box 8700, 580 Arapeen Dr., Salt Lake City, UT 84108 801-582-5847
† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† Image Technology Methods Corp., 103 Moody St., Waltham, MA 02154 617-894-1720
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
Keltron Corp., Miniprinters Div., 225 Crescent St., Waltham, MA 02154 ... 617-894-8700
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
† Lexidata, Division of Adage, Inc., One Fortune Dr., Billerica, MA 01821 ... 617-667-7070
Matrox Electronic Systems, 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Mauell Corp., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019 717-432-8686
Metra Instruments, 2056 Bering Dr., San Jose, CA 95131 408-436-8530
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
Noritake Co., Inc., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505 213-373-6704
Raster Graphics, Inc., P. O. Box 5157, Bend, OR 97701 503-388-2584
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
† Systems Research Laborotories, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440 513-426-6000
† Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
† Telpar, Inc., 4137 Billy Mitchell Rd., Box 796, Addison, TX 75001 214-233-6631

Displays, Graphic Systems-2000 — *See Vol. D*

Displays, Head Up (HUD)-2450

Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Kaiser Electronics, Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134 408-432-3000

Displays, Indicator Lights-2450

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1678
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1062
† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1079
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 716-694-5076
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
§ JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331 ... 818-896-0019
† Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800

† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
§† Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Displays, Intelligent-2450

Applied Data Systems, 9811 Mallard Dr., Ste. 203, Laurel, MD 20708, 800-541-2003;301-953-9326 ..... B•1041
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1048
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
American Control Technology, Microdot Graphics, Inc., 825 Village Quarter Rd., West Dundee, IL 60118 312-426-6780
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Colorgraphic Communications Corp., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366 404-455-3921
§ Corman Technologies Inc., 75 Bathurst Dr., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† ISC Cardion Electronics, Inc., Long Island Expwy., Woodbury, NY 11797 516-921-7300
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
Keltron Corp., Miniprinters Div., 225 Crescent St., Waltham, MA 02154 ... 617-894-8700
Nu-Media, 1075 Featherstone, Pontiac, MI 48057 313-373-1165
Pacific Communications, 2041 S. Grand Ave., Santa Ana, CA 92705 714-546-0147
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§† Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Laser-2450

† Laser Concepts, Omega Organization Intl., P.O. Box 33623, Seattle, WA 98133 206-364-7881

Displays, Light-emitting Diode (LED)-2450

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034-1035
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1038,1107
Canyon Elctrns., 2001 W. North Lane, Phoenix, AZ 85021, 602-944-4421 ..... B•1044
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
§ C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880, 617-246-1720 ..... D•1126
DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... D•1356
Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1124
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1058,1060-1062
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1073
§† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076, D•1133
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1079
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1173,1281
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083, D•1137,1382-1383
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388
Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
Setra Systems, Inc., 45 Nagog Park, Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1922-1923
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1148-1150
§ A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
Artisan Controls Corp., P.O. Box 233, 5 Eastmans Rd., Ste. 100, Parsippany, NJ 07054 201-428-1770
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Chrono-log Corp., 2 W. Park Rd., Havertown, PA 19083 215-853-1130
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
§ Corman Technologies Inc., 75 Bathurst Dr., Waterloo, Ontario, CANADA N2V 1N2 519-884-4430
Digitec Corp., 959 Cheney Ave., Marion, OH 43302 614-387-3444
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
§ Electro Industries, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590 516-334-0870
§ Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801 617-935-4442
§ Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670 714-993-6970
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714 602-748-7900
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
Keltron Corp., Miniprinters Div., 225 Crescent St., Waltham, MA 02154 ... 617-894-8700
† Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
Ledco Div., 346 Chester St., St. Paul, MN 55107 612-222-2791
Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-676-7996
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
Matrix Corp., 1203 New Hope Rd., Raleigh, NC 27610 919-833-2000
Nu-Media, 1075 Featherstone, Pontiac, MI 48057 313-373-1165
§ Paccom, 3928 148th NE, Redmond, WA 98052 ..... 206-883-9200;800-426-6254
† Pho-Tronics Div., E. R. Wagner Mfg. Co., 8701 W. Bradley Rd., Milwaukee, WI 53224 414-355-6704
§ Quantum Electronics, Inc., R.D. 4, Box 6AAA, Lewistown, PA 17044 717-242-1132
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
Schroff Incorporated, Schroff GMBH, 170 Commerce Dr., Warwick, RI 02886 401-732-3770
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§ Stanley/AC Interface, 17911 Sampson Lane, Costa Mesa, CA 92647 ... 714-841-6090
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Telegenix, Inc., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034 609-424-5220
§ Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§ Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
Track Equipment, Div. of Entec Corp., 32 Daniel Webster Hwy., Merrimack, NH 03054 603-882-7743
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
§ Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Displays, Lighted Segment-2450

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1035
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1039,1107

Canyon Elctrns., 2001 W. North Lane, Phoenix, AZ 85021, 602-944-4421 ..... B•1044
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047,1049
Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1124
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1058,1062
† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1071
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143-1145
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1294
Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1095
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St, Anaheim, CA 92805 714-491-5121
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
§† Digital Electronics, 31047 Genstar Road, Hayward, CA 94544-7831 415-471-4700
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
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§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
§ Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560

Displays, Liquid Crystal (LCD)-2450

A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1037
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1038-1039
Citizen Business Machines, 2999 Overland Ave., Ste. 203, Los Angeles, CA 90064, 213-558-0961;800-421-6516 ..... D•1081
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880, 617-246-1720 ..... D•1126
† DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... B•1054
§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
§† Excel Technology Intl. Corp., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, 201-874-4747 ..... B•1068-1069
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1071
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083, D•1137
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388
§ Seiko Instruments U.S.A., Inc., 2990 W. Lomita Blvd., Torrance, CA 90505, 213-517-7770 ..... B•1085
Setra Systems, Inc., 45 Nagog Park, Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1922-1923
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086,1088-1091
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1294
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103
§ A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
Computerwise, 302 N. Winchester, Olathe, KS 66062 913-829-0600
Crystaloid Electronics, Box 628, Hudson, OH 44236 216-655-2429
Displaytech, Inc., 2200 Central Ave., Boulder, CO 80301 303-449-8933
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Elform, Inc., P.O. Box 7362, Reno, NV 89510 702-356-1734
§ Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505 213-534-4500
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440
† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
International Instrumentation, Inc., 2282 Townsgate Rd., Westlake Vlg., CA 91361 805-495-7673
§ LXD, Inc., 24500 Highpoint Road, Beachwood, OH 44122 216-292-3300
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879 ... 301-921-9440
Polaroid Corp., Powercard Div., 391 Totten Pond Rd., Waltham, MA 02159 617-890-6789
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Stanley/AC Interface, 17911 Sampson Lane, Costa Mesa, CA 92647 ... 714-841-6090
§ Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177
§ Thor Electronics, 321 Pennsylvania Ave., Linden, NJ 07036 201-486-3300
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Message-2450

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1038,1107
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1049
† DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... B•1054
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1060,1062
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1070
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1825
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1145
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1137,1382-1386
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1151
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093,1096-1097
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
Nu-Media, 1075 Featherstone, Pontiac, MI 48057 313-373-1165
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
† Quantum Electronics, Inc., R.D. 4, Box 6AAA, Lewistown, PA 17044 717-242-1132
Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Telegenix, Inc., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034 609-424-5220
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Multifunction-2450

Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1070
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
† Kaiser Electronics, Kaiser Aerospace & Elctrns., 2701 Orchard Pkwy., San Jose, CA 95134 408-432-3000

Displays, Planar Gas Discharge-2450

Canyon Elctrns., 2001 W. North Lane, Phoenix, AZ 85021, 602-944-4421 ..... B•1044
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047
§ Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1053
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805 714-491-5121
† Displays, Inc., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044 717-242-2541
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§† Interstate Electronics Corp., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803 714-635-7210
† Quantum Electronics, Inc., R.D. 4, Box 6AAA, Lewistown, PA 17044 717-242-1132
Telegenix, Inc., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034 609-424-5220

Displays, Plasma-2450

§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1049
§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1053
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1070
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Miltope Corp., 1770 Walt Whitman Rd., Melville, NY 11747 516-420-0200
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630 714-527-0561
† Singer Co., Librascope Div., 833 Sonora Ave., Glendale, CA 91201 818-244-6541
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Telegenix, Inc., Div. of Inductotherm Industries, P.O. Box 5550, Cherry Hill, NJ 08034 609-424-5220

Displays, Programmable-2450

§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1043
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047-1049
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1057,1062
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
American Control Technology, Microdot Graphics, Inc., 825 Village Quarter Rd., West Dundee, IL 60118 312-426-6780
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
§ ITT Gilfillan, ITT Corp., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409 818-988-2600
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
Matrox Electronic Systems, 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630
Nu-Media, 1075 Featherstone, Pontiac, MI 48057 313-373-1165
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§† Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910

Displays, Projection Type (CRT; Electromechanical; Film; Light Valve)-2450

† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
Sharp, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1086
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
§ Data General, 4400 Computer Dr., Westboro, MA 01581 617-366-8911
† Devco Engineering, 36 Pier Lane West, Fairfield, NJ 07006 ..... 201-CA8-0321
Dotronix, 160 First St. SE, New Brighton, MN 55112 612-633-1742
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
Hughes Aircraft Co., Industrial Products Division, 6155 El Camino Real, Carlsbad, CA 92009 619-931-3000
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630 714-527-0561
§† Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
† Singer Co., Librascope Div., 833 Sonora Ave., Glendale, CA 91201 818-244-6541
† Systems Research Laborotories, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440 513-426-6000
† Terminal Data Corp., 15733 Crabbs Branch Way, Rockville, MD 20855 301-921-8282
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Displays, Remote-2450

Applied Data Systems, 9811 Mallard Dr., Ste. 203, Laurel, MD 20708, 800-541-2003;301-953-9326 ..... B•1041
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042-1043
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... B•1047,1049
† DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... B•1054, D•1356
§ Electro-Numerics, Inc., 1811 Reynolds, Irvine, CA 92714, 714-250-1501 ..... D•1369
Excel Technology Intl. Corp., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, 201-874-4747 ..... B•1068-1069
Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076, D•1133
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083, D•1137,1382-1387
Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388-1389
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1097
Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766 512-251-2341
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Chrono-log Corp., 2 W. Park Rd., Havertown, PA 19083 215-853-1130
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Colorgraphic Communications Corp., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366 404-455-3921
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Datachron Inc., 1150 E. Stanford Court, Anaheim, CA 92805 714-385-1705
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
The IVYnet Company, One Gale Rd., Brick, NJ 08723 201-920-6807
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
Kode, Odetics, 1515 S. Manchester Ave., Anaheim, CA 92802 714-758-0400
§ LFE, Instruments Div., 55 Green St., Clinton, MA 01510 617-835-1000
Nu-Media, 1075 Featherstone, Pontiac, MI 48057 313-373-1165
Systems Data, Inc., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321 216-666-0085
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509
§ Vidco, 8029 S.W. Cirrus Dr., Beaverton, OR 97005 503-641-1804

Displays, Status-2450

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1037
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042
Canyon Elctrns., 2001 W. North Lane, Phoenix, AZ 85021, 602-944-4421 ..... B•1044
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1045
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880, 617-246-1720 ... D•1126-1127
† DCI Inc., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, 913-782-5672 ..... B•1054
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1124
† Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1062
Electro-Numerics, Inc., 1811 Reynolds, Irvine, CA 92714, 714-250-1501 ..... D•1369
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074
IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076
† Minelco Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459, 203-283-8261 ..... B•1140-1141
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143-1145
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1137,1382-1387

Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1148-1150,1294
§† **Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092**
§† **Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161**
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1097
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 .. 313-779-8700
Automation Displays Inc., 3533 N. White Ave., Eau Claire, WI 54703 715-834-9595
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790 714-533-6333
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
Elec-tek, Inc., 10280 Alliance Rd., Cincinnati, OH 45242 513-793-7937
ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
† ISC Cardion Electronics, Inc., Long Island Expwy., Woodbury, NY 11797 516-921-7300
§ JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331 ... 818-896-0019
Keltron Corp., Miniprinters Div., 225 Crescent St., Waltham, MA 02154 ... 617-894-8700
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
Kode, Odetics, 1515 S. Manchester Ave., Anaheim, CA 92802 714-758-0400
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
† Quantum Electronics, Inc., R.D. 4, Box 6AAA, Lewistown, PA 17044 717-242-1132
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Track Equipment, Div. of Entec Corp., 32 Daniel Webster Hwy., Merrimack, NH 03054 603-882-7743
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509
§ Vidco, 8029 S.W. Cirrus Dr., Beaverton, OR 97005 503-641-1804

Displays, Storage Tube — See Displays, CRT (Vol. A)

Displays, Surface Mount-2450

NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143-1144
§† **NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083**
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
† Data Check Corporation, 9918 Via Pasar, San Diego, CA 92126 619-578-0101
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
† Metron Optics Inc., P.O. Box 690, Solana Beach, CA 92075-0690 619-755-4477

Displays, Touch Sensitive (Infrared & Mechanical) — See Touch Monitors (Vol. D), Touch Panels (Vol. D), Touch Terminals (Vol. D)

Displays, Tube — See Tubes, Readout (Vol. A)

Displays, Vacuum Fluorescent-2450

§ **Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1042-1043**
Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505, 213-530-3530 ..... B•1052
§† **Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074**
§† **NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1080-1081**
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
Comark Corp., 93 W St., P. O. Box 474, Medfield, MA 02052 617-359-8161
§† Digital Electronics, 31047 Genstar Road, Hayward, CA 94544-7831 415-471-4700
Futaba Corporation of America, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173 312-884-1444
Noritake Co., Inc., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505 213-373-6704
Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129

Display Sets (MIL), Computer-3475 — See Vol. D

Dissipators, Heat — See Heat Sinks, Semiconductor (Vol. C), Heat Sinks, Soldering (Vol. C)

Distortion Analyzers, Indicators — See Analyzers, AF (Vol. D)

Distributed Control Systems & Components-2200 — See Vol. D

Dividers, Analog-3130 — See Vol. A

Dividers, Frequency-3450 — See Vol. A

Dividers, Power (LF, HF, VHF, UHF)-3450 — See Vol. A

Dividers, Power, Microwave-3450 — See Vol. A

Dividers, Voltage-Also See Networks, Resistance; Transformers, Voltage Dividing-2900 — See Vol. D

Doublers, Frequency — See Multipliers, Frequency (Vol. A)

Doublers, Voltage-Also See Rectifiers, Bridges & Assemblies-4800 — See Vol. A

Down Converters-3400 — See Vol. D

Drafting Machines-4200 — See Vol. C

Drafting Symbols, Dry Transfer, Pressure Sensitive, etc. (Incl. Lettering)-4200 — See Vol. C

Drawers, Sliding-1400 — See Vol. C

Drills & Accessories, Manual & Power-5400 — See Vol. C

Drivers & Decoders For Readouts-2450

Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805, 714-491-5121 ..... B•1043
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... A•1733
§ **Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1124**
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1058-1062
§† **ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067**
† **Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074**
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1279,1281
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1145
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
Automation Displays Inc., 3533 N. White Ave., Eau Claire, WI 54703 715-834-9595
§ C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
† Exar Corp., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007 408-732-7970
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§ LSI Computer Systems, Inc., 1235 Walt Whitman Rd., Melville, NY 11747 516-271-0400
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
§† RCA Solid State Div., CMOS IC Mktg., Rte. 202, Somerville, NJ 08876 ... 201-685-6000
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 201-685-6000
Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§† Teledyne Semiconductor, 1300 Terra Bella Ave., PO Box 7267, Mountain View, CA 94039-7267 415-968-9241
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509
Wilson, H. F., Engineering Co., 475 Taft Ave., Glen Ellyn, IL 60137 312-469-8473

Drivers, Chopper-1100 — See Vol. D

Drivers, Hardware & Software-2000 — See Vol. D

Drivers, Nut-5400 — See Vol. C

Drivers, Solenoid-4550

Linear Motions Co., 17025 Dubesor St., Valinda, CA 91744, 818-918-7806 ..... B•1627
† **Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577**
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ MKC Electronics Corp., 9205 Quivira Road, Overland Park, KS 66215 ... 913-894-9711
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§ Sanken Electric Co., Ltd., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, JAPAN 171 03-986-6164
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121

Voltex, 3460 Great Neck Rd, Amityville, NY 11701 516-842-2772

Drivers, Speaker-1300 — *See Vol. D*

Drivers, Surface Mount-1100 — *See Vol. D*

Drivers, Switch-3450 — *See Vol. A*

Drivers, Tube — See Drivers & Decoders for Readouts (Vol. B)

Drives & Drive Mechanisms (Dial)-2400 — *See Vol. C*

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Dummy Loads, Power-2900 — *See Vol. D*

Dummy Loads, Programmable-2900 — *See Vol. D*

Dummy Loads, Resistive-2900 — *See Vol. D*

Dummy Loads (MIL), RF-2440

† **NH Research, Incorporated, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714, 714-474-3900** ..... **D•1302**
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
Amphenol Products, 4300 Commerce Ct, Lisle, IL 60532 312-983-3500
† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
Applied Research, Inc., 111 New South Rd, Hicksville, NY 11802 516-938-9700
† Bird Electronic Corp., 30303 Aurora Rd, Cleveland, OH 44139-2794 216-248-1200
† Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400
Continental Electronics, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227 214-381-7161
† KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
† Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069 818-707-2020

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EW Sets (MIL), Ground Multitarget-3475 — *See Vol. D*

EW Sets (MIL), Portable-3475 — *See Vol. D*

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Electrostatic Discharge (MIL)-2440

§† **NRD Inc., Mark IV Ind., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, 716-773-7634** ..... **D•2170**
Schaffner EMC, Inc., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083, 201-851-0644;800-367-5566 ..... **D•1319**
§† ACL Inc., 1960 E. Devon Ave., Elk Grove, IL 60007 ..... 312-981-9212;800-STATIC-0
Brady Co., 63 Middlesex Ave., Iselin, NJ 07083 201-283-0400
§† Electro-Metrics, Penril Corp., 100 Church St, Amsterdam, NY 12010 518-843-2600
Greenwich Instruments USA, 3401 Monroe Rd., Charlotte, NC 28205 ... 704-376-7805

† KeyTek Instrument Corp., 260 Fordham Rd., Wilmington, MA 01887 617-658-0880
Plastic Capacitors, Inc., 2623 N. Pulaski Rd., Chicago, IL 60639 312-489-2229
§ Semtronics Corp., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269 404-487-6681
Simco Co., 2257 North Penn Rd., Hatfield, PA 19440 215-822-2171
§† Stackbin Corp., Albion Road, P.O. Box 397, Lincoln, RI 02865 ..... 401-333-1600; 800-346-1018
§ Voyager Technologies, Inc., 2250 Cabot Blvd. W. Bldg. 40M, Langhorne, PA 19047 215-750-0270

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Emitter Location & Identification System (MIL), Automatic Ground Transportable-3475 — *See Vol. D*

Emitters/Detectors, Infrared-3700

A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1293-1294
Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750 ..... 305-339-4356/4355
§ Banner Engineering Corp., 9714 - 10th Ave. N., Minneapolis, MN 55441 612-544-3164
† DBA Systems, Inc., P.O. Drawer 550, Melbourne, FL 32902-0550 305-727-0660
§ General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-676-7996
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 214-323-2200
Zexco, 7661 Densmore, #8, Van Nuys, CA 91406 818-997-7895

Emitters, Fiber Optic-Also See Diodes, Laser-2475

§† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
§ A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Banner Engineering Corp., 9714 - 10th Ave. N., Minneapolis, MN 55441 612-544-3164
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
Deutsch Co., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045 213-649-1400
Dolan-Jenner Inds., Box 1020, Woburn, MA 01801 617-935-7444
§ EXFO E.O. Engineering, 352 St.-Sacrement Ave., Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 201-239-3400
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
† Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
Thomson Electron Tubes & Devices Corp., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801 201-328-1400
Zexco, 7661 Densmore, #8, Van Nuys, CA 91406 818-997-7895

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Enclosures, (MIL)-2440

Amco Engineering, 3801 N. Rose St., Schiller Pk., IL 60176, 312-671-6670;800-833-3156 ..... C•1010,1012-1013
Cabtron Systems, Inc., 200 N. Anets Dr., Northbrook, IL 60062, 312-498-6090 ..... C•1020
Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741, 516-585-3400 ..... C•1022-1023
ECS Composites, 3560 Rogue River Hwy., Box 188, Grants Pass, OR 97526, 503-476-8871 ..... C•1027
EG & G Birtcher, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, 818-442-2572 ..... C•1028
† Electronic Enclosures, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, 213-643-8181 ..... C•1030
† Equipto Electronics Corp., 351 Woodlawn Ave., Aurora, IL 60506, 312-897-4691 ..... C•1042
† Gemini, 103 Mensing Way, Cannon Falls, MN 55009, 507-263-3957;800-533-3631 ..... C•1055
† Hudson Industries, 36 Executive Drive, Hudson, NH 03051, 603-880-7712 ..... C•1060
† Optima Enclosures, 2166 Mountain Indl. Blvd., Tucker, GA 30084, 404-496-4000 ..... C•1063
Par Metal Products, Inc., 1260 Atlantic Ave., Brooklyn, NY 11216, 718-774-5900 ..... C•1072
Skydyne Inc., 21 River Rd., Port Jervis, NY 12771, 914-856-6655;800-428-CASE ..... C•1096-1097
TDJ Co., Inc., 1154 Morena Blvd., San Diego, CA 92110, 619-276-5920 ..... C•1104-1105
Zero Corp., 777 Front St., Burbank, CA 90503, 818-846-4191 ..... C•1120
ADE, Inc., 1430 E. 130th St., Chicago, IL 60633 312-646-3400
A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
Anvil Cases, Inc., 4128 Temple City Blvd., Rosemead, CA 91770 ..... 818-575-8614; 800-242-4466;800-423-4279(outside CA)
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 215-322-6510
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
General Devices Co., Inc., Box 39100, Indianapolis, IN 46239-9632 317-897-7000
† Hoffman Engineering, Federal-Hoffman, Inc., 900 Ehlen Dr., Anoka, MN 55303 612-421-2240
† Instrument Enclosures, 9767 Glenoaks Blvd., Sun Valley, CA 91352 818-768-4622
† Langley, P.O. Box 2911, San Diego, CA 92112 619-264-3181
Rose Enclosures Sys., Inc., 12140 Parklawn Dr., Rockville, MD 20852 301-984-1783
† STRONGBOX, P.O. Box 84508, Los Angeles, CA 90073 213-305-8288
† Trilobyte Computer Corporation, 14477 Catalina St., San Leandro, CA 94577 415-895-1100

Encoders, Digital — See Encoders, Shaft Angle (Vol. B)

Encoders, Displacement, Linear-5500

† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883
Eltrol Corporation, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, 818-709-0131 ..... B•1203
† Itek Encoder, 27 Christina St., Newton, MA 02164-1515, 617-969-7300 ..... B•1892-1893
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1030
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600

Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Dynamics Research Corp., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193 617-658-6100
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
§ Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
§ JMR Electronics, 1525 Blondell Ave., Bronx, NY 10461 212-597-6050
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
Perfect Gear & Instrument, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040 516-328-3300
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
† Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Encoders, Fiber Optic-2475

† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883
Eltrol Corporation, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, 818-709-0131 ..... B•1203
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167
§† Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
§ JMR Electronics, 1525 Blondell Ave., Bronx, NY 10461 212-597-6050
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

Encoders, Magnetic Strip-5500

Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1898
§ Xico, Inc., 9737 Eton Ave., Chatsworth, CA 91311, 818-709-4403 ..... D•1109
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Elcom Industries, Inc., 10268 Bach Blvd., St. Louis, MO 63132 314-429-3100
§ Identatronics, Inc., 425 Lively Blvd., Elk Grove, IL 60007 ..... 312-437-2654; 1-800-323-5403
§ Mag-Tek, 20725 S. Annalee Ave., Carson, CA 90746 213-631-8602
† Vertex Industries, Inc., P. O. Box 996, 23 Carol St., Clifton, NJ 07014 201-472-1331

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Encoders, Shaft Angle, Contacting-5500

Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, 201-436-2230 ..... B•1191
BEI Motion Systems Co., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, 619-471-2600 ..... B•1880
BEI Motion Systems Co., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, 805-968-0782 ..... B•1880
BEI Motion Systems Co., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, 619-931-0200 ..... B•1880
§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•2065
Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1145
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164
§† Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 .. B•1932-1933
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ... B•1030,1929
§† Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
BEI Motion Systems Co., Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009 619-931-1500
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141 .. 703-639-2495
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Motor-Tronics, Inc., 2142 Industrial Ct., Bldg. "F", Vista, CA 92083 619-727-7430
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201

Encoders, Shaft Angle, Magnetic-5500

Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1164
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1898
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
Hitachi America, Ltd., 50 Prospect Ave., Tarrytown, NY 10591 914-332-5800
Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724 201-542-5151
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 215-675-6500
Real Time Systems, 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550 .. 914-667-0425
† Singer Co., Librascope Div., 833 Sonora Ave., Glendale, CA 91201 818-244-6541
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§† Vega Precision Labs., 800 Follin La., Vienna, VA 22180 703-938-6300
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

Encoders, Shaft Angle, Optical-5500

BEI Motion Systems Co., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, 619-471-2600 ..... B•1880
BEI Motion Systems Co., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, 501-851-4000 ..... B•1880
BEI Motion Systems Co., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, 805-968-0782 ..... B•1880
BEI Motion Systems Co., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, 619-931-0200 ..... B•1880
§† Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000 ..... B•1200
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883
Disc Instruments, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, 714-433-0343 ..... B•1885-1887
† Itek Encoder, 27 Christina St., Newton, MA 02164-1515, 617-969-7300 ..... B•1892-1893
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1894
§† Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1896-1897
Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1275
† Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... B•1232
† Measurement Systems, Inc., 121 Water St., Norwalk, CT 06854, 203-838-5561 ..... D•1135
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1898
Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne, NJ 07506, 201-427-3100 ..... B•1254
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1925
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
U. S. Digital Corp., 12371 Kensington Rd., Los Alamitos, CA 90720, 213-594-0094 ..... B•1928
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ... B•1030,1929
§† Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807

§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St, Dover, NH 03820 603-742-1120
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
§ C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Datametrics Inc., 340 Fordham Road, Wilmington, MA 01887 617-658-5410
§ Data Technology, Inc., 4 Gill St, Woburn, MA 01811 617-935-8820
Dynamics Research Corp., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193 617-658-6100
§ Dynapar, 1675 Delany Rd., Gurnee, IL 60031 312-662-2666
Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
Elm Systems, 1101 Brown St., Wauconda, IL 60084 312-526-5003
§ Encoder Products, 1601B Dover Rd., Sandpoint, ID 83864 208-263-8541
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505 213-534-4500
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063 805-583-2088
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757 501-636-5000
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116 918-438-7800
† HH Controls Co., Inc., 16 Frost St., Arlington, MA 02174 617-646-2626
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
IMC Magnetics Corp., Universal Magnetics Corp., 12627 Hidden Creek Way, Cerritos, CA 90702 213-926-0927
Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141 .. 703-639-2495
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
§ Motion Control Devices, An EG & G Torque Systems Co., 80 Stedman St., Lowell, MA 01851 617-454-3407
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
Oriel Corp., 250 Long Beach Blvd., Stratford, CT 06497-0872 203-377-8282
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ Renco, Robbins & Myers, 26 Coromar Dr., Goleta, CA 93117-3094 805-968-1525
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
† Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
§† Wide Range Elctrns. Corp., 140 Sun Valley Cir., St. Louis, MO 63026 314-343-9191
ZI-TECH Instrument Corp., P.O. Box 391567, Mountain View, CA 94039 415-966-8484

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BEI Motion Systems Co., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, 501-851-4000 ..... B•1880
BEI Motion Systems Co., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, 619-931-0200 ..... B•1880
Itek Encoder, 27 Christina St., Newton, MA 02164-1515, 617-969-7300 ..... B•1892-1893
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Digital Radio Corp., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277 213-316-9114
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000

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American Photonics Inc., 71 Commerce Dr., Brookfield Center, CT 06805 203-775-8950
§† Canoga-Perkins Corp., 21012 Lassen St., Chatsworth, CA 91311 818-718-6300

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Fans, Tubeaxial-2600 — *See Vol. C*

Fans, Vaneaxial-2600 — *See Vol. C*

Fans/Blowers (MIL)-2440

† Hi-Tech, Inc., 3600 16th St., Zion, IL 60099, 312-746-2447 ..... C•1669
McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550, 609-799-0100 ..... C•1682-1683
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... C•1691
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
§ Interfan, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-1203
† Kooltronic, Inc., Hamilton Ave., Hopewell, NJ 08525 609-466-3400
† Kooltronic, Inc., 1700 Morse Avenue, Ventura, CA 93003 805-642-8521
Mechatronics/SAB Inc., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040 206-236-1000
† Merrill, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437 .. 215-643-2116
† MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779 516-467-5151
§ Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
§ PFT, Inc., State Road 16 W., Monon, IN 47959 ..... 1-800-558-7297;219-253-6666
§ Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300

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Fiber Optic Splices & Splicing Equipment-2475

AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1269-1272
† Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1175
Power Technology, Inc., P.O. Box 9769, Little Rock, AR 72219, 501-568-1995 ..... D•1937
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
INTELCO, 8 Craig Road, Acton, MA 01720 617-264-4485
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Siecor Corp., 489 Siecor Park-CO, Hickory, NC 28603-0489 704-327-5000
§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276
Teleterminal Corp., Greenland, NH 03840 603-431-1200
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
† York Technology, Inc., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502 818-955-8927

Fiber Optics (MIL)-2440

† Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1170,1221,1230
§† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
§† A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
Ametek Controls Div., Orionics Products, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Berk Tek, Inc., Box 888, RD 1, New Holland, PA 17557 717-354-6200
† Circuit Technology Inc., 160 Smith St., Farmingdale, NY 11735 516-293-8686
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
Corning Glass Works, Telecommunications Products Division, MP-RO-03, Corning, NY 14831 607-974-7741
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063 805-583-2088
† Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† Galileo Electro-Optics Corp., Galileo Pk., Sturbridge, MA 01518 617-347-9191
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
LeCroy Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
§† Mikron Instr., 445 W. Main St., Wyckoff, NJ 07481 201-891-7330
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 .. 415-960-6000
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Pasternack Enterprises, P.O. Box 16759, Irvine, CA 92713 714-261-1920
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945

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Filters, Coaxial-2700 — *See Vol. A*

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† AME Corporation, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1641
† Homalite, Inc., 11 Brookside Dr., Wilmington, DE 19804, 302-652-3686 .. B•1072
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607,1621
† JMJ Technical Prods., 50 Wheeler Point Rd., Newark, NJ 07105, 201-589-4257 ..... C•1633
Polaroid Corporation, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, 800-225-2770 ..... B•1084
RMF Products, Inc., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, 312-879-0020 ..... C•1635
Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155,1160
APM-Hexseal, 44 Honeck St., Englewood, NJ 07631 201-569-5700
† Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010
§ Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689 818-442-7180
GraphTec Services, Inc., 1600 N.W. Madrid Way, P.O. Box 1380, Boca Raton, FL 33432 305-392-3373
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706 516-231-6400
Rolyn Optics Co., 706 Arrowgrand Circle, Covina, CA 91722-2199 ..... 818-915-5707/5717
Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
Schott Glass Technologies, Inc., 400 York Ave., Duryea, PA 18642 717-457-7485

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Filters, Display-2450

† Homalite, Inc., 11 Brookside Dr., Wilmington, DE 19804, 302-652-3686 .. B•1072
Polaroid Corporation, Polarizer Div., 1 Upland Rd., Norwood, MA 02062, 800-225-2770 ..... B•1084
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
† Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
International Polarizer, Inc., 320 Elm Street, Marlborough, MA 01752 617-481-7495
§ Screen Data Corp., 80 S. Jefferson Rd., Whippany, NJ 07981 ..... 201-887-7713; 800-248-1212
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221

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§ Alan Gordon Entprs., Inc., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601 818-985-5500
§ Babcock Display Products, Inc., A Subsidiary of Babcock, Inc., 1051 S. East St., Anaheim, CA 92805 714-491-5121
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
† Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., 2365 Maryland Rd., Willow Grove, PA 19090 215-659-3080
† Hartman Systems, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746 516-427-7500
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
† Homalite, Inc., 11 Brookside Dr., Wilmington, DE 19804 302-652-3686
† Infrared Industries, Inc., 12151 Research Parkway, Orlando, FL 32826 ... 305-282-7700
International Polarizer, Inc., 320 Elm Street, Marlborough, MA 01752 617-481-7495
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† JMJ Technical Prods., 50 Wheeler Point Rd., Newark, NJ 07105 201-589-4257
† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
† Melles Griot, Optics, 1770 Kettering St., Irvine, CA 92714 714-261-5600
† Optical & Conductive Coatings, Meridian Inds., Inc., 428 N. Buchanan Cir., # 8, Pacheco, CA 94553 415-798-6066
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Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405 203-488-1033
† Plumer Precision Optics, 601 Montgomery Ave., Pennsburg, PA 18073 .. 215-679-6272
† Pomfret Research Optics, P. O. Box 1265, Orange, VA 22960 703-854-4350
Rolyn Optics Co., 706 Arrowgrand Circle, Covina, CA 91722-2199 ..... 818-915-5707/5717
Schott Glass Technologies, Inc., 400 York Ave., Duryea, PA 18642 717-457-7485
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§ Sun-Flex Co., Inc., 20 Pimentel Ct., Novato, CA 94947 415-883-1221

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Filters, RF-2700 — *See Vol. A*

Filters, Single Sideband-2700 — *See Vol. A*

Filters, Synchronous Tracking-2700 — *See Vol. A*

Filters, Telemetering-1900 — *See Vol. D*

Filters, Tone, Telegraph-2700 — *See Vol. A*

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Filters (MIL), Electrical & Networks-2440

Chesterfield Products, 37 Midland Ave., Elmwood Park, NJ 07407, 201-797-9655 ..... A•1638
Comstron Corp., 10 Hub Dr., Melville, NY 11747, 516-756-1100 ..... A•1639
† Eagle, P.O. Box 911, Fallbrook, CA 92028, 619-728-6000 ..... A•1647
† Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, 914-664-2333 ..... A•1652
Elpac Components, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, 714-979-4440 ..... A•1082-1083
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,1653
Filter Concepts Inc., 2624 S. Rousselle, Santa Ana, CA 92707, 714-545-7003 ..... A•1656-1657
† Filtron Co., Inc., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, 516-752-1144 ..... A•1659
Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031, ;;;603-886-4115 ..... A•1663
† KR Electronics, Inc., 91 Avenel St., Avenel, NJ 07001, 201-636-1900 ..... A•1666-1668
Metuchen Capacitors, Inc., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, 201-679-3366 ..... A•1672-1673
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
§† Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1430,1675
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... A•1677, B•1013
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•1678
RFI Corporation, 100 E. Pine Aire Dr., Bay Shore, NY 11706, 516-231-6400 ..... A•1687
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•1694
TTE, Incorporated, 11652 W. Olympic Blvd., Los Angeles, CA 90064, 213-478-8224 ..... A•1706
§† Tusonix, Inc., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, 602-744-0400 ..... A•1714
§† United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•1479
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 215-322-6510
Cir-Q-Tel, Inc., 6600-04 Virginia Manor Rd., Beltsville, MD 20805 301-946-1800
† Cirtech, EG & G, 15237 Cherry St., Shawnee Mission, KS 66223 913-681-2801
Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
† Elmag Division, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104 201-481-1600
Engineered Components Co., P. O. Box 8121, San Luis Obispo, CA 93403-8121 805-544-3800
† Ferretec Inc., 544 Gibralter Dr., Milpitas, CA 95035-6315 408-263-1216
Fil-Coil Company, Inc., 800 Axinn Ave., Garden City, NY 11530 516-228-9445
Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Frequency Selective Networks, 69-20 Garfield Ave., Woodside, NY 11377 718-424-7500
† Hertz Filter, 3 Aerial Way, Syosset, NY 11791 516-822-4770
§† Hi-Q Crystals, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062 913-764-4544
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
† Integrated Microwave, 3422 Tripp Ct., San Diego, CA 92121 619-259-2600
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703 714-973-1800
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552 ..... 914-699-5514;800-431-1064
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034 ... 215-643-6950
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013 717-243-5929
† SFE Technologies, 1501 1st St., San Fernando, CA 91340 818-365-9411
Sokol Crystal Products, Inc., 121 Water St., Mineral Point, WI 53565 608-987-3363
Spectrum Control, Inc., 2185 W. 8th St., Erie, PA 16505 814-455-0966
† Stanford Applied Engrg. Inc., 3520 De La Cruz Blvd., Santa Clara, CA 95054 408-988-0700
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478 .. 216-232-8600

Flanges, Waveguide-3450 — *See Vol. A*

Flanges (MIL), Waveguide-2440

Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
§ Micro-Coax Components, Inc., a UTI Company, Box E, Collegeville, PA 19426 215-489-3700
Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666

Flashers-2200 — *See Vol. D*

Flashers (MIL)-2440

† Logitek, Inc., 101 Christopher St, Ronkonkoma, NY 11779 516-467-4200
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967 516-345-3100
† Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd, Hayward, CA 94544 415-471-9717

Flat Packages, Integrated Circuit — See Packages, Integrated Circuit (Vol. A)

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Furnaces, Gas (Production)-4100 — *See Vol. D*

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Furnaces, Vacuum-4100 — *See Vol. D*

Furniture, Electronic Lab. — See Benches, Consoles, Stools, Tables (Lab & Shop) (Vol. C)

Fuse Clips — See Clips & Holders, Fuse (Vol. B)

Fuse Elements-4300

§ Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1323-1326
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 ..... B•1344
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. A•1692-1693
Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
§† Fusecom, 14864 NE 95th St, Redmond, WA 98052 206-881-2442
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308

Fuseholders — See Clips & Holders, Fuse (Vol. B)

Fuses-4300

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. B•1302-1305
§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
Elcom Systems, Inc., 932 Clint Moore Rd., Boca Raton, FL 33487, 305-994-1774 ..... A•1768
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
§† Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1319-1323
Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1117
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 ..... B•1345
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
Alden Products Co., P.O. Box 860, 117 N. Main St, Brockton, MA 02403 617-583-0160
§† Beswick, Dubilier International Plc, Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§† Brush Fuses Inc., 2070 Maple St, Des Plaines, IL 60018 312-299-2211
§† Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
§ Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
§ Ercona, 101 Main/Patchogue Rd, Port Jefferson Sta., NY 11776 516-331-5500
§† Fusecom, 14864 NE 95th St, Redmond, WA 98052 206-881-2442
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Gould Inc., Circuit Protection Div., 374 Merrimac St, Newburyport, MA 01950 ..... 617-462-6662/3131
International Components Corp., 105 Maxess Rd, Melville, NY 11747 ... 516-293-1500
† KRL/Bantry Components, Inc., 160 Bouchard St, Manchester, NH 03103 603-668-3210
† Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
§ LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879 ... 301-921-9440
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Mepcopal Company, 11468 Sorrento Valley Rd, San Diego, CA 92121 .. 619-453-0332
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St, Middletown, CT 06457 203-632-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
† Rush/Houston, Inc., 600 Kealrick, Ste C-40, Houston, TX 77060 713-682-5151
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
§ Schurter, Inc., 1016 Clegg Ct, Petaluma, CA 94952 707-778-6311
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
† Shogyo International Corp., 287 Northern Blvd, Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Fuses, Failure Indicating-4300

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. B•1302-1305
§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1319-1323
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 ..... B•1345
Alden Products Co., P.O. Box 860, 117 N. Main St, Brockton, MA 02403 617-583-0160
§† Beswick, Dubilier International Plc, Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brush Fuses Inc., 2070 Maple St, Des Plaines, IL 60018 312-299-2211
§† Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
§† Fusecom, 14864 NE 95th St, Redmond, WA 98052 206-881-2442
§ Gould Inc., Circuit Protection Div., 374 Merrimac St, Newburyport, MA 01950 ..... 617-462-6662/3131
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St, Middletown, CT 06457 203-632-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
§ Schurter, Inc., 1016 Clegg Ct, Petaluma, CA 94952 707-778-6311

Fuses, Fuseholders, Boxes & Panels (MIL)-2440

§ Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646, 312-539-3108 ..... C•1311
§ Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
† Doran Manufacturing Co., 2834 Sidney Ave., Cincinnati, OH 45225, 513-681-5424 ..... C•1325
§† FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
§† Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1319
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
§† Beswick, Dubilier International Plc, Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067

Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
§† Fusecom, 14864 NE 95th St, Redmond, WA 98052 206-881-2442
International Components Corp., 105 Maxess Rd, Melville, NY 11747 ... 516-293-1500
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§† Keystone Electronics Corp., 31-07 20th Rd, Astoria, NY 11105-2017 ... 718-956-8900
† LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879 ... 301-921-9440
§ National Tel-Tronics, State Road Hill, Meadville, PA 16335 814-724-6440
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
§ Schurter, Inc., 1016 Clegg Ct, Petaluma, CA 94952 707-778-6311
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St, Covington, KY 41012 606-431-0900

Fuses, International, 5x20 mm-4300

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ Bel Fuse, 198 Van Vorst St., Jersey City, NJ 07302, 201-432-0463 .. B•1303-1304
§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
Panel Components Corp., P.O. Box 6626M, Santa Rosa, CA 95406, 707-523-0600 ..... B•1345, C•1894
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, 201-736-5722 ..... C•1900
§† Beswick, Dubilier International Plc., Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brush Fuses Inc., 2070 Maple St, Des Plaines, IL 60018 312-299-2211
Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
§ Ercona, 101 Main/Patchogue Rd., Port Jefferson Sta., NY 11776 516-331-5500
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
§ Schurter, Inc., 1016 Clegg Ct, Petaluma, CA 94952 707-778-6311

Fuses, Thermal-4300

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1837-1838
§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861, 401-727-1300 ..... B•1843
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1849
Matsuo Electronics, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, 714-969-2491 ..... A•1117
Micro Devices Product Group, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, 419-756-5911 ..... B•1343,1873
§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1857
Accurate Electronics, 169 S. Abbe Rd, P.O. Box 1287, Elyria, OH 44036 216-366-6330
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
Bel Fuse, 198 Van Vorst St, Jersey City, NJ 07302 201-432-0463
§ Beswick, Dubilier International Plc., Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
Carbone-Ferraz, Inc., 14 Eastmans Rd, Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
§ Chatham Controls, 33 River Rd, Chatham, NJ 07928 201-635-8892
Concord Electronics Corporation, 30 Great Jones St, New York, NY 10012 1-212-777-6571
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
§ Inmark Corp., 147 West Cedar St, Norwalk, CT 06854 203-866-8474
KRL/Bantry Components, Inc., 160 Bouchard St, Manchester, NH 03103 603-668-3210
§ LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879 ... 301-921-9440
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St, Middletown, CT 06457 203-632-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St, P. O. Box 3538, Mansfield, OH 44907 419-756-5911

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Gaskets, Shielding, RF-Also See Shields, RF-4525 — *See Vol. C*

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Gauges, Humidity-2900 — *See Vol. D*

Gauges, Ionization-2900 — *See Vol. D*

Gauges, Pressure-Also See Transducers, Pressure-2900 — *See Vol. D*

Gauges, Strain-5500

§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1384
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... B•1779,1860-1861,1932-1933, C•1891, D•1312,1392-1393,1420
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1919
BLH Elctrns., 75 Shawmut Road, Canton, MA 02021 617-821-2000
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650
Flotek Corporation, 1300 E. Floriza St, Ste. 101, Tucson, AZ 85714 602-294-9222
§ Hottinger Baldwin Measurements, 139 Newbury St, Framingham, MA 01701 617-875-8282
§† Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Measurements Group, Inc., Box 27777, Raleigh, NC 27611 919-365-3800
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800

Gauges, Temperature-2900 — *See Vol. D*

Gearheads & Speed Reducers - Also see gears and gear mechanisms-3500

Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
§ Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607-1609,1612
† Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... B•1232
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1234,1236,1898
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
§† Berg, W. M., Inc., 499 Ocean Ave., East Rockaway, NY 11518 516-599-5010
§† Berger-Lahr Corp., Fitzgerald Dr., Jaffrey, NH 03452 603-532-7701
† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§† Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042 516-488-6700
§ Dolan-Jenner Inds., Box 1020, Woburn, MA 01801 617-935-7444
† Dresser Inds., 1505 Elm St, Dallas, TX 75201 214-746-6000
§ Electrol Co., 321 Dewey St, P.O. Box 29, York, PA 17405 717-848-1722
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
† IMC Magnetics Corp., Eastern Div., 570 Main St, Westbury, NY 11590 .. 516-334-7070
† PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
Robbins & Myers, Motion Control Group, 1600 Second St South, Hopkins, MN 55343 612-931-2700
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514 219-262-4418
§ SPS Inc. (Muirhead Vactric), 51 Commerce St, Springfield, NJ 07081 ... 201-376-1222
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040 516-328-3970
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100

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Generators, Hall-5500

Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 407-678-6900 ..... B•1881, D•1122-1123

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700

† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735 .. 516-694-5100

Cryomagnetics, Inc., 739 Emory Valley Rd., Oak Ridge, TN 37830 615-482-9551

Dpwty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100

Lake Shore Cryotronics, Inc., 64 E. Walnut St., Westerville, OH 43081 ... 614-891-2243

LDJ Incorporated, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219 313-528-2202

Magnetic Instrumentation, 8350 E. 48TH ST., Indianapolis, IN 46226 317-545-2102

Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212 ... 614-486-9561

Walker Scientific, Rockdale St., Worcester, MA 01606 .... 617-852-3674;617-853-3232

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Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274-1275

† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936, 201-887-0571 ..... C•1406-1407

† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500

† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272

Autosplice, Inc., 59-12, 37th Ave, Woodside, NY 11377 718-429-0500

Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401

† Fema Elctrns. Corp., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816 201-238-1223

§† ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700

§† Lyn-Tron, Inc., 3150 Damon Way, Burbank, CA 91505 .... 213-849-6211;800-423-2734

† Micro Plastics Inc., Hwy 178 North, P.O. Box 149, Flippin, AR 72634 501-453-2261

§ National Tel-Tronics, State Road Hill, Meadville, PA 16335 814-724-6440

§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000

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Headphones-1300 — *See Vol. D*

Heads, Magnetic Recording-1300 — *See Vol. D*

Heads, Reflective-3700

Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080

Headsets (MIL)-2440

§† Rye Industries, Inc., 125 Spencer Pl, P.O. Box M, Mamaroneck, NY 10543 914-698-0080

† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911

Trimm, Inc., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048 312-362-3700

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§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1838

§ Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1849

§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852,1859

§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1977

Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... D•1392

Acme Elec. Heating Corp., 4685 E. 11th Ave., Hialeah, FL 33013 305-685-8326

Ajax Magnethermic Corp., 1745 Overland Ave., N.E., Warren, OH 44482 216-372-8511

Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200

† Armstrong World Inds., W. Liberty St., Lancaster, PA 17604 717-397-0611

† Blue M, A Unit of General Signal, 138th & Chatham Sts., Blue Island, IL 60406 312-385-9000

§† Casso-Solar, P.O. Box 163, U.S. Route 202, Pomona, NY 10970 914-354-2500

† DELTA M Corporation, 525 Warehouse Rd., Oak Ridge, TN 37830 615-483-1569

§† Despatch Industries, 619 S.E. 8th St., P.O. Box 1320, Minneapolis, MN 55440-1320 612-331-1873

† Electrofilm, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355 805-257-2240

Eraser Co., Box 4961, Syracuse, NY 13221 315-454-3237

§ GTE Corp., Sylvania Emissive Prods./Process Heat, Portsmouth Ave., Exeter, NH 03833 603-772-4331

§ Hoffman Engineering, Federal-Hoffman, Inc., 900 Ehlen Dr., Anoka, MN 55303 612-421-2240

§ Law, R. E. Instrument, Inc., 7735 W. 112th Pl., Palos Hills, IL 60465 312-974-4000

† Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121

† Molecu-Wire, P.O. Box 495, Farmingdale, NJ 07727 201-938-9473

Multi-Amp Corp., TBG, 4271 Bronze Way, Dallas, TX 75237 214-333-3201

† NANMAC Corp., 9 Mayhew St., Framingham, MA 01701 617-872-4811

† OAL Associates, P.O. Box J, Escondido, CA 92025 619-743-7143

§ Pamran Inc., 1900 Williams St., Young Ind. Pk., Racine, WI 53404 414-637-7999

§† Philips Elmet, 1560 Lisbon Rd., Lewiston, ME 04240 207-784-3591

Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860

§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700

† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000

† Thermolab, 14713 Keswick St., N. Hollywood, CA 91605 818-787-4084

Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277

† Trent, Inc., 201 Leverington Ave., Philadelphia, PA 19127 215-482-5000

§ Wellman Thermal Systems, 1 Progress Rd, Shelbyville, IN 46176 317-398-4411

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Heating Elements, Infrared-5300

§† Remtek Corporation, 46107 Landing Parkway, Fremont, CA 94538, 415-490-3999 ..... C•1717

Acme Elec. Heating Corp., 4685 E. 11th Ave., Hialeah, FL 33013 305-685-8326

§† Casso-Solar, P.O. Box 163, U.S. Route 202, Pomona, NY 10970 914-354-2500

† Glenro, Inc., 39 McBride Ave. Extension, Paterson, NJ 07501 ..... 201-279-5900; 800-922-0106

Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660

§ S. F. Products Corporation, P. O. Box 369, Southport, CT 06490 203-929-6180

§ Wellman Thermal Systems, 1 Progress Rd, Shelbyville, IN 46176 317-398-4411

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Bergquist, 5300 Edina Ind'l., Minneapolis, MN 55435, 800-328-3882 ..... C•1714

Delbert Blinn Co., Box 2007, Pomona, CA 91769, 714-629-3900 ..... A•2130

§† IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, 213-849-2481 ..... C•1671

† Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093

§† Thermalloy, Inc., 2021 W. Valley View, P. O. Box 810839, Dallas, TX 75381-0839, 214-243-4321 ..... C•1699

Unitrack Industries, Inc., 1372 Enterprise Dr., Goshen Corp. Pk., P.O. Box 1927, West Chester, PA 19380, 215-692-0800 ..... C•1117

§† AAVID Engineering, Inc., One Kool Path, P.O. Box 400, Laconia, NH 03247-0400 603-528-3400

§† Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751

§† Calmark Corp., 4915 Walnut Grove Ave., San Gabriel, CA 91776 818-287-0451

Dow Corning Corp., Box 0994, Midland, MI 48686-0994 517-496-4000

† IMC Magnetics Corp., Thermal Products Group., 100 Jericho Quad., Ste. 221, Jericho, NY 11753 516-938-0800

§ Mann, Henry, Inc., 3983 Mann Road, Huntingdon Valley, PA 19006 215-355-7200

† Noren Products Inc., 1010 O'Brien Blvd., Menlo Pk., CA 94025 415-322-9500

Precision Extrusions, Inc., Box 120, Bensenville, IL 60106 312-766-0340

† Thermacore Inc., 780 Eden Road, Lancaster, PA 17601 717-569-6551

§† WEI Corp., 1405 S. Village Way, Santa Ana, CA 92705 714-834-9333

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Imagers, Charge-Coupled Devices-3700

Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200

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§ Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 .. B•1260-1261
Design Components, Inc., 1 Kenwood Circle, Franklin, MA 02038 ..... 617-528-7300; 800-341-4811
PKS - Digiplan Ltd., 1859 Charter Lane, Lancaster, PA 17601 717-299-2706

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BEI Motion Systems Co., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, 619-471-2600 ..... B•1880
† BEI Motion Systems Co., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, 501-851-4000 ..... B•1880
BEI Motion Systems Co., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, 805-968-0782 ..... B•1880
BEI Motion Systems Co., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, 619-931-0200 ..... B•1880
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1144-1145
† Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... D•1149,1151
† Control Technology Co., Inc., 41-16 29th St., Long Island City, NY 11101, 718-361-2133 ..... D•2173
Disc Instruments, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, 714-433-0343 ..... B•1885-1886
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343, 617-986-2600 ..... D•1170-1171
Itek Encoder, 27 Christina St., Newton, MA 02164-1515, 617-969-7300 ..... B•1892-1893
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
† North Atlantic Industries, 60 Plant Ave., Hauppauge, NY 11788, 516-582-6060 ..... D•1305
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... B•1927
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1184-1185
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1030
Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002 201-436-2230
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
BEI Motion Systems Co., Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009 619-931-1500
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
† Electric Tachometer, 68th & Upland Sts., Philadelphia, PA 19142 ..... 215-SA6-7723
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† HH Controls Co., Inc., 16 Frost St., Arlington, MA 02174 617-646-2626
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
§† Mechanical Engraving, 4500 Bullard Ave, Bronx, NY 10470 212-324-4455
† Metric Systems, 645 Anchors St., Ft. Walton Beach, FL 32548-9990 904-244-9600
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
† Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
† Precision Level Vial Co., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925 ..... 215-794-0800;800-345-7517
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
§† Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581
† Warren-Knight Instrument Co., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116 215-464-9300
Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Indicators, Azimuth-5500

† Control Technology Co., Inc., 41-16 29th St., Long Island City, NY 11101, 718-361-2133 ..... D•2173
† Interface Engineering Inc., 275/300 Centre St., Unit 7, Holbrook, MA 02343, 617-986-2600 ..... D•1170-1171
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
† GAP Instrument Corp., 40 Oser Ave., Hauppauge, NY 11787 516-273-0909
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
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† Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
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† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
North Atlantic Industries, 60 Plant Ave., Hauppauge, NY 11788 516-582-6060
Precision Specialties, Inc., 19414 Londelius St., Northridge, CA 91324 ... 818-349-9774
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100
§† Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581
† Warren-Knight Instrument Co., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116 215-464-9300

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Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115-1117,1120-1124
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1702
§† FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
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§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772
† Mineico Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459, 203-283-8261 ..... B•1140-1141
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† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
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§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
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† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, 619-428-5581 ..... B•1268
Applied Controls Co., Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006-2828 201-227-5454
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§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
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EMICO Inc., Box 368, Dublin, PA 18917 215-249-9330
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
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Information Technolgoy A.D.S.C., P.O. Box 470, College Park, MD 20740 301-779-5110
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§ Modutec, 18 Marshall St., Norwalk, CT 06854 203-853-3636
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
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§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
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§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630 312-792-2700
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§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
Xycom, 750 N. Maple Rd., Saline, MI 48176 313-429-4971

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† **Minelco Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459, 203-283-8261 ..... B•1140-1141**
NEI Ferranti-Packard Electronics Ltd., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., CANADA L4W 2P1, 416-624-3020 ..... B•1143-1144
† **Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243**
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1013
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1148-1150
Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
Staver Co., Inc., 41-51 Saxon Ave., Bay Shore, NY 11706, 516-666-8000 ..... B•1093-1094
† **STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590**
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Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
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§ Westberg Manufacturing Inc. (WESTACH), 3400 Westach Way, Sonoma, CA 95476 707-938-2121
Westronics Inc. of Texas, 2441 Northeast Pkwy, Box 961003, Ft. Worth, TX 76161 817-625-2311

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† Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855, 203-866-2573 ..... D•1130
§ International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714, 602-748-7900 ..... D•1377
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§ National Controls Corp., 1725 Western Dr., W. Chicago, IL 60185 312-231-5900
§ Pacific Transducer Corp., 2301 Federal, Los Angeles, CA 90064 213-478-1134
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§ TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310 305-739-4300
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
§ West Instrument, A Mark IV Company, 3860 N. River Rd., Schiller Park, IL 60176 312-678-6400

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Dubbledee Diamond Corporation, D. Drukker & Zn., N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856 201-770-1420
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† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000

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EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
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† Galileo Electro-Optics Corp., Galileo Pk., Sturbridge, MA 01518 617-347-9191
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Intensifiers, Image-2450

A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
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†EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
†Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
Microscience, Inc., 182 Forbes Rd., Braintree, MA 02184 617-849-1952
§Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§†Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

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Interrupters, Ground Fault-4300

Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
Perma Power Elctrns., 5601 W. Howard Ave., Chicago, IL 60648, 312-647-9414 ..... C•1706-1707
§Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
†Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211

Interrupters, Optoelectronic-3700

Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1281
§Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1287-1290
†Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
§General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
†Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611

Interrupters, Photo-3700

NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1281
§Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1287-1290
†Atlantic Solar Products, P.O. Box 70060, Baltimore, MD 21237 ..... 301-686-2500; 800-237-6527
†Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
†Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707

Interrupters, Power-4300

§Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
†FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703 714-973-1800
†Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
Schaffner EMC, Inc., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083 ..... 201-851-0644; 800-367-5566

Interrupters, Vacuum-4300

†Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
†FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

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Isolators, Optoelectronic-3700

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1269
§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, 213-404-1770 ..... B•1166
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
§† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1174
Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 ..... B•1556-1557
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915, 617-922-5961 .. B•1274
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1282
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160 ..... B•1295
SSAC Incorporated, P.O. Box 1000, Baldwinsville, NY 13027, 315-638-1300 ..... B•1589
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1604-1605,1607
Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
Actek, Inc., 12740 28th N.E., Seattle, WA 98125 206-363-0217
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Atlantic Solar Products, P.O. Box 70060, Baltimore, MD 21237 ..... 301-686-2500; 800-237-6527
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
§ General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
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§ Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
§† Raytheon Co., 465 Centre St., Quincy, MA 02169 617-479-5300
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§† Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
§ Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

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AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1242-1245
§ Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1308
† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
Jolo Industries, 13921 Nautilus Dr., Garden Grove, CA 92643, 714-554-6840 ..... C•1409
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... C•1550,1906
H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1553
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... C•1562-1563
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703, 508-699-3800;508-699-3450 ..... B•1029, C•1573
† Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069, 818-707-2020 ..... C•1579,1581
§† Accessories for Elctrns., Inc., 800 Merrick Rd., Baldwin, NY 11510-3593 516-546-1751
† Accurate Electronics, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036 216-366-6330
† ADC Telecommunications, Inc., 4900 W. 78th St., Minneapolis, MN 55435 612-835-6800
Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401
† Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111

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† Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1170,1221,1230
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683

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Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1813
Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... B•1819
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1820-1821
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824-1825
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1827
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1807
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Arkay Engravers, Inc., 10-3 Drew Court, Ronkonkoma, NY 11779 516-467-7795
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
Plasticorp, 24105 S. Frampton Ave., Harbor City, CA 90710 213-539-9530

Keyboards, Address Encoded-5150

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767,1826
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
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† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
† SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960

Keyboards, Capacitive-5150

§† Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Datametrics Corp., 8966 Comanche Ave., Chatsworth, CA 91311 818-341-2901
Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
RAM Technologies, Div. of WISCO Intl., 690 W. 28th St., Hialeah, FL 33010 ..... 305-888-1676/1677/1682
§ Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Conductive Rubber-5150

† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01960, 617-281-2040 ..... B•1817
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824
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Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Moxness Products, Inc., Versa Technologies, 1914 Indiana St., Racine, WI 53405 ..... 414-554-5050;800-558-5706
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Ferrite Core-5150

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§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Full Travel-5150

§† Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
† Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1821
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1826-1827
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
† Datametrics Corp., 8966 Comanche Ave., Chatsworth, CA 91311 818-341-2901
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491

§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
RAM Technologies, Div. of WISCO Intl., 690 W. 28th St., Hialeah, FL 33010 ..... 305-888-1676/1677/1682
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Hard Contact-5150

§ Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1821
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767,1826
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035 315-655-8050
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
RAM Technologies, Div. of WISCO Intl., 690 W. 28th St., Hialeah, FL 33010 ..... 305-888-1676/1677/1682
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Lighted-5150

† Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1820-1821
Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
† Datametrics Corp., 8966 Comanche Ave., Chatsworth, CA 91311 818-341-2901
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734 .... 517-652-2656; 800-234-7525
OMNI Switch USA, Inc., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027 602-582-0629
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
† Stacoswitch, 1139 Baker St., Costa Mesa, CA 92626 714-549-3041
§ Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386

Keyboards, Low Profile-5150

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1820-1821
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... B•1829
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
† Datametrics Corp., 8966 Comanche Ave., Chatsworth, CA 91311 818-341-2901
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
† Jay-El Prods., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247 213-323-7130
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734 .... 517-652-2656; 800-234-7525
Moxness Products, Inc., Versa Technologies, 1914 Indiana St., Racine, WI 53405 ..... 414-554-5050;800-558-5706
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
† Stacoswitch, 1139 Baker St., Costa Mesa, CA 92626 714-549-3041
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§ Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
§ Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Keyboards, Membrane-5150

Bergquist, 5300 Edina Ind'l., Minneapolis, MN 55435, 800-328-3882 ..... B•1809
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... B•1819
The Hall Company, 420 East Water St., Urbana, OH 43078, 513-652-1376 ..... B•1822
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824

Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1828
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... B•1829
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct, P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., 15 Ranick Dr. W., Amityville, NY 11701 516-842-3400
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
GTI/Circuits Div., Box 217, Leesburg, IN 46538 219-453-3261
† Hallmark Nameplate, Inc., 1855 New Highway, Farmingdale, NY 11735 800-645-9502
HMW Enterprises, Inc., 604 Salem Road, Etters, PA 17319 717-938-4691
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 312-867-9600
§† Miller Dial Corp., 4400 N. Temple City Blvd., El Monte, CA 91731 818-444-4555
Moxness Products, Inc., Versa Technologies, 1914 Indiana St., Racine, WI 53405 ..... 414-554-5050;800-558-5706
OMNI Switch USA, Inc., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027 602-582-0629
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
† Sheldahl, Inc., P.O. Box 170, Hwy 3 North, Northfield, MN 55057 507-663-8000
Shin-Etsu Polymer, 34135 7th St, Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
§ Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386
Valmark Industries Inc., 1376 Borregas Ave., Sunnyvale, CA 94089 408-734-4253

Keyboards, Modular-5150

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
MOLEX, Inc., 2222 Wellington Ct, Lisle, IL 60532 312-969-4550
Rath Microtech Corp., Rath Affiliated Cos., 2505 Foster Ave., Janesville, WI 53545 ..... 608-754-2222;800-356-9464
Secoinsa/Digi Power, 686 E. Gish Rd., San Jose, CA 95112 408-288-5600

Keyboards, Pad-5150

§ Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
† Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813
§ Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1820-1821
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767,1826
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
† Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734 ..... 517-652-2656; 800-234-7525
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070

Keyboards, Programmable-5150

§ Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087 312-360-3500
† Da-Tech Corp., 141 Railroad Drive, Ivyland, PA 18974 215-322-9410
§ Digital Communications Associates, Inc., 1000 Alderman Dr., Alpharetta, GA 30201 404-442-4000
HMW Enterprises, Inc., 604 Salem Road, Etters, PA 17319 717-938-4691
§ Keytek Keyboards Canada Inc., 16 Mary St., Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
§ LC Bloc Inc., LC Bloc Technology, Inc., 1977 O'Toole Ave., Ste. B-109, San Jose, CA 95131 408-922-0322
Mors Technologies Inc., Mors Group-France, 3430 Griffith, St. Laurent, Quebec, CANADA H4T 1A7 514-735-4411

Keyboards, Reed-5150

EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
† Datametrics Corp., 8966 Comanche Ave., Chatsworth, CA 91311 818-341-2901
† Da-Tech Corp., 141 Railroad Drive, Ivyland, PA 18974 215-322-9410
† Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660

Keyboards, Solid State-5150

Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110

§ Keytek Keyboards Canada Inc., 16 Mary St, Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Key Tronic, P.O. Box 14687, Spokane, WA 99214 509-928-8000
Rath Microtech Corp., Rath Affiliated Cos., 2505 Foster Ave., Janesville, WI 53545 ..... 608-754-2222;800-356-9464
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards, Wireless-5150

Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812
Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Keyboards & Keypads (MIL)-2440

Amkey, 55 Chase St., Methuen, MA 01844, 617-975-5445 ..... B•1810-1811
† **Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813**
§† **Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814**
ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† **Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817**
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... B•1819
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1825
Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561 ..... B•1831
† **Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833**
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
† Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§† Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

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Keypads-5150

† **Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1812**
† **Control Displays, Inc., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, 215-822-3383 ..... B•1010,1046,1813**
§ **Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1814**
§ **EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1815**
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1816
† **Flex-Key Corp., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, 617-281-2040 ..... B•1817**
§ **Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1820-1821**
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824
§ **Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1826-1827**
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... B•1828
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
§ **Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1830**
§ **Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1832**
† **Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833**
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1807
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
AME Corporation, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195 201-263-1700
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
Bowmar Instrument Corp., Aerospace Div., 8000 Bluffton Rd., Ft. Wayne, IN 46809 219-747-3121
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
Conductive Rubber Technlg., 121 Gray Avenue, Santa Barbara, CA 93101 805-965-6511
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
Enterprise Sys. Corp., P.O. Box 698, Dover, NH 03820 603-742-7363
Frederick Components Intl., 20806 Plummer St., Chatsworth, CA 91311 ..... 818-882-0868;800-354-0660
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621 714-671-3931
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Keytek Keyboards Canada Inc., 16 Mary St, Units 3 & 4, Aurora, Ontario, CANADA L4G 3W8 416-727-9491
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
Moxness Products, Inc., Versa Technologies, 1914 Indiana St., Racine, WI 53405 ..... 414-554-5050;800-558-5706
OMNI Switch USA, Inc., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027 602-582-0629
Plasticorp, 24105 S. Frampton Ave., Harbor City, CA 90710 213-539-9530
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§ Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
§ Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 312-964-2330

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Kits, Connector-2100 — *See Vol. C*

Kits, Enclosure Prototyping-1400 — *See Vol. C*

Kits, Fiber Optic-2475

AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1270-1272
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1175
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
Contact East, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845 ... 617-682-2000
† Daniels Manufacturing Corp., 6103 Anno Ave., Orlando, FL 32809 407-855-6161
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
† EOTec Corporation, 3M Corporation, 420 Frontage Road, West Haven, CT 06516 203-934-7961
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
INTELCO, 8 Craig Road, Acton, MA 01720 617-264-4485
† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
§† TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000

Kits, Marking (Dial, Instrument, Equipment, etc.)-2400 — *See Vol. C*

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§ Everest Interscience, Inc., P. O. Box 3640, Fullerton, CA 92634-3640 714-992-4461
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660

§† Solder Absorbing Technology (SAT), A Spirig Co., 144 Oakland St, Springfield, MA 01108 800-628-8862
§ Tempil Div., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080 201-757-8300
§ Wahl Instruments, Inc., 5750 Hannum Ave., Culver City, CA 90231 800-421-2853

Labels, Pressure Sensitive, Adhesive-2400 — *See Vol. C*

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Laminates, Plastic Impregnated (Unclad)-2500 — *See Vol. C*

Laminates, Plastic (With Integral Heating Elements)-5300

Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ Identatronics, Inc., 425 Lively Blvd., Elk Grove, IL 60007 ..... 312-437-2654; 1-800-323-5403
Keene Laminates, Keene Corp., 199 Amaral St, E. Providence, RI 02914 800-556-7683

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Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630 312-792-2700

Lamp Assembly Color Filters, Lens Mountable-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
† AME Corporation, 33 Jacksonville Rd., P.O. Box 195, Towaco, NJ 07082-0195, 201-263-1700 ..... B•1641
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1058,1062
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130
† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
§† Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
† APM-Hexseal, 44 Honeck St, Englewood, NJ 07631 201-569-5700
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, 101 Main/Patchogue Rd., Port Jefferson Sta., NY 11776 516-331-5500
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701

Lamp Drivers-2460

Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1057,1062
Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130
Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Automation Displays Inc., 3533 N. White Ave., Eau Claire, WI 54703 715-834-9595
† Circuit Technology Inc., 160 Smith St, Farmingdale, NY 11735 516-293-8686
§ Data Display Products, Box 91072, Los Angeles, CA 90009 213-640-0442
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
KMC Systems, Inc., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432 201-447-0007
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
§† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§ SSAC Incorporated, P.O. Box 1000, Baldwinsville, NY 13027 315-638-1300
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670

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Lamps, Arc-2460

Christie Electric Corp., 18120 S. Broadway, Gardenia, CA 90248 213-320-0808
§† Control Laser Corp., 7503 Chancellor Dr., Orlando, FL 32809 305-438-2500
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
§ GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St, Danvers, MA 01923 617-777-1900
† Hanovia, 100 Chestnut St., Newark, NJ 07105 201-589-4300
ILC Technology, Inc., 399 Java Dr., Sunnyvale, CA 94089 408-745-7900
§† Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 201-575-0870
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 203-255-2633
Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Lamps, Deutenium-2460

Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141

Lamps, Edge Lighting, Panel-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1126
§† JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ..... B•1135
§† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
EG&G, Inc., Electro-Optics Div., 35 Congress St, Salem, MA 01970 617-745-3200
§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 716-694-5076
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Hoffman Engineering Corp., 20 Acosta St, Stamford, CT 06902 203-325-8933
Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 201-575-0870
Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 707-792-0333
† Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560

Lamps, Electroluminescent-2460

Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... B•1819
Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136
Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
E-L Products Corp., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052 716-655-0800
† Hoffman Engineering Corp., 20 Acosta St, Stamford, CT 06902 203-325-8933
§ Lucas Duralith Corporation, 525 Orange St., Millville, NJ 08332 609-825-6900
† Rogers Corporation, Special Products Div., 645 W. 24th St., Tempe, AZ 85282 602-967-0624
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Lamps, Exciter, Photographic-2460

† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1126
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
§ GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 609-448-4000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Lamps, Flashtube-2460

† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 312-671-4321
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640
EG&G, Inc., Electro-Optics Div., 35 Congress St, Salem, MA 01970 617-745-3200
Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
General Electric Co., Specialty Mktg. Oper., Nela Park, Cleviand, OH 44112 216-266-3494
ILC Technology, Inc., 399 Java Dr., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010

§† Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 312-829-6050
† Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 203-255-2633
§ Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Lamps, Fluorescent-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... B•1114
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1129
§ JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ..... B•1135
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
§† Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§† Luxo Lamp Corp., P.O. Box 951, Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., 3983 Mann Road, Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 203-255-2633

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Lamps, Hollow Cathode-2460

Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Lamps, Incandescent-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1106
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1108-1111,1653
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... B•1114
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1122-1123
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1056-1059,1062
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1127
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130,1132-1133
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153
§† JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ..... B•1135
† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1137
Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1146-1147
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1142
§† Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155,1157-1160
Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590
§† Sylvania Miniature Lighting, GTE Corporation, W. Main St., Hillsboro, NH 03244, 603-464-5533 ..... B•1163
Visual Communications Co., Inc., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, 619-549-6900 ..... B•1100
Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211 408-747-0550
§ Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Jensen Tools, Inc., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044 602-968-6241
§ Ledco Div., 346 Chester St., St. Paul, MN 55107 612-222-2791
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-676-7996
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§† Lohuis U.S.A. Inc., 949 Piner Place, Santa Rosa, CA 95401 ..... 707-579-1703; 800-922-5267;800-345-5267
† Lumitron, P.O. Box 12, Summit, NJ 07901 201-273-8998
§† Luxo Lamp Corp., P.O. Box 951, Port Chester, NY 10573 914-937-4433
§ Mann, Henry, Inc., 3983 Mann Road, Huntingdon Valley, PA 19006 215-355-7200
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
Micro Lamps Inc., 1055 Paramount Pkwy., Batavia, IL 60510 312-879-0900
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
§† Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 707-792-0333
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
§† Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 714-545-5560
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

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Lamps, Infrared-2460

A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, 201-231-8300 ..... B•1105
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1280-1281
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1142
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
§† Casso-Solar, P.O. Box 163, U.S. Route 202, Pomona, NY 10970 914-354-2500
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
Eraser Co., Box 4961, Syracuse, NY 13221 315-454-3237
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
§ General Electric Co., Specialty Mktg. Oper., Nela Park, Cleveland, OH 44112 216-266-3494
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 415-493-0400
§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900
† Hanovia, 100 Chestnut St., Newark, NJ 07105 201-589-4300
ILC Technology, Inc., 399 Java Dr., Sunnyvale, CA 94089 408-745-7900
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 213-676-7996
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 609-448-4000
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
† OAL Associates, P.O. Box J, Escondido, CA 92025 619-743-7143
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 201-575-0870
Scanning Devices, Inc., 108 Elm St., Waltham, MA 02154 617-891-8991
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200

Lamps, Krypton-2460

Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 707-792-0333
§ Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Lamps, LED & LCD — See Diodes, Light Emitting (Vol. B), Diodes, Liquid Crystal (Vol. B)

Lamps, Magnifying, Inspection-4100 — *See Vol. D*

Lamps, Mercury Vapor-2460

† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
§ American Ultraviolet, 562 Central Avenue, Murray Hill, NJ 07974 201-665-2211
Aristo Grid Lamp Prods., 65 Harbor Rd., Port Washington, NY 11050 516-944-3030
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
§ General Electric Co., Specialty Mktg. Oper., Nela Park, Cleveland, OH 44112 216-266-3494
§ GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900

Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN ... 0534-52-2141
† Hanovia, 100 Chestnut St., Newark, NJ 07105 ... 201-589-4300
Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 ... 201-974-0090
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 ... 312-829-6050
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 ... 516-567-1800
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 ... 609-448-4000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
§† Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 ... 516-333-4840
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 ... 818-285-3123
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 ... 203-255-2633

Lamps, Nanopulse-2460

Xenon Corp., 20 Commerce Way, Woburn, MA 01801 ... 617-938-3594

Lamps, Neon-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ... B•1034
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ... B•1108-1110,1653
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ... B•1114
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ... B•1115,1122-1123
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ... B•1129
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ... B•1130,1133
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ... B•1153
§† JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ... B•1135
† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ... B•1136
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ... B•1137
Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ... B•1147
§† Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ... B•1092
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ... B•1154
Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ... B•1155,1157-1158,1160
§† Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ... B•1161
§ Sylvania Miniature Lighting, GTE Corporation, W. Main St., Hillsboro, NH 03244, 603-464-5533 ... B•1163
Aristo Grid Lamp Prods., 65 Harbor Rd., Port Washington, NY 11050 ... 516-944-3030
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 ... 617-685-4371
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ... 516-249-2272; 1-800-654-8542
§ Data Display Products, Box 91072, Los Angeles, CA 90009 ... 213-640-0442
Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 ... 414-449-7487
§ Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689 ... 818-442-7180
§† Genisco Technology Corp., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 ... 813-572-9010
§† Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 ... 312-829-6050
§† Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 ... 516-567-1800
§ Ledco Div., 346 Chester St., St. Paul, MN 55107 ... 612-222-2791
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 ... 213-676-7996
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 ... 718-392-8800
§† Lohuis U.S.A. Inc., 949 Piner Place, Santa Rosa, CA 95401 ... 707-579-1703; 800-922-5267;800-345-5267
Micro Lamps Inc., 1055 Paramount Pkwy., Batavia, IL 60510 ... 312-879-0900
Miyakawa America Corp., 408 E. Devon Ave., Elk Grove Village, IL 60007 ... 312-640-0515
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 ... 815-459-5000
Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 ... 707-792-0333
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 ... 707-778-6311
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 ... 602-792-2230
§ UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 ... 818-285-3123
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 ... 312-459-3400
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 ... 203-255-2633
Wamco, Inc., 11555-A Coley River Cir., Fountain Valley, CA 92708 ... 714-545-5560
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 ... 612-222-2791
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Lamps, Oil Tight-2460

§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ... B•1115,1123
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 ... 216-951-8000
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505 ... 213-676-7996
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 ... 815-459-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 ... 312-397-2600
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 ... 312-459-3400

Lamps, Press-to-Test-2460

§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 ... 716-694-5076
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 ... 815-459-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 ... 312-397-2600

Lamps, Projection-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ... B•1034
† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ... B•1136
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ... B•1154
§ Alan Gordon Entprs., Inc., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601 ... 818-985-5500
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ... 516-249-2272; 1-800-654-8542
Christie Electric Corp., 18120 S. Broadway, Gardenia, CA 90248 ... 213-320-0808
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ... 617-429-8370;1-800-343-4912
§ Ercona, 101 Main/Patchogue Rd., Port Jefferson Sta., NY 11776 ... 516-331-5500
§ General Electric Co., Specialty Mktg. Oper., Nela Park, Clevland, OH 44112 ... 216-266-3494
§ Genisco Technology Corp., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
§ GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 ... 617-777-1900
† Hanovia, 100 Chestnut St., Newark, NJ 07105 ... 201-589-4300
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 ... 516-567-1800
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 ... 609-448-4000
§† Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 ... 707-792-0333
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 ... 714-669-9850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 ... 818-285-3123

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Lamps, Stroboscopic Source-2460

Alpha-M Corp., 913 Highland Dr., Euless, TX 76040 ... 817-267-7022
† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 ... 312-671-4321
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ... 516-249-2272; 1-800-654-8542
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 ... 617-745-3200
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 ... 503-641-4141
Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 ... 312-829-6050
Xenon Corp., 20 Commerce Way, Woburn, MA 01801 ... 617-938-3594

Lamps, Tritium (Hydrogen 3) Powered-2460

† NRD Inc., Mark IV Ind., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, 716-773-7634 ... D•2170

Lamps, Tungsten Halogen-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ... B•1034
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ... B•1126
§ JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ... B•1135
† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ... B•1136
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ... B•1154
American Ultraviolet, 562 Central Avenue, Murray Hill, NJ 07974 ... 201-665-2211
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ... 516-249-2272; 1-800-654-8542
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 ... 619-279-8034
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 ... 619-279-8034
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 ... 516-352-2904
§ General Electric Co., Specialty Mktg. Oper., Nela Park, Clevland, OH 44112 ... 216-266-3494
§ GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 ... 617-777-1900
§† Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 ... 516-567-1800
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 ... 718-392-8800
§† Lohuis U.S.A. Inc., 949 Piner Place, Santa Rosa, CA 95401 ... 707-579-1703; 800-922-5267;800-345-5267
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 ... 609-448-4000
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 ... 201-575-0870
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 ... 617-443-7333
Precision Lamp, Inc., 480 Aaron Dr., Cotati, CA 94928 ... 707-792-0333
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 ... 714-669-9850
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 ... 914-681-0700
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 ... 315-685-8945

Lamps, Ultraviolet-2460

§ American Ultraviolet, 562 Central Avenue, Murray Hill, NJ 07974 ... 201-665-2211
Aristo Grid Lamp Prods., 65 Harbor Rd., Port Washington, NY 11050 ... 516-944-3030

§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
† Clean Room Prods., 1800 Ocean Ave., Ronkonkoma, NY 11779-6528 .. 516-588-7000
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., 35 Congress St, Salem, MA 01970 617-745-3200
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
§ General Electric Co., Specialty Mktg. Oper., Nela Park, Cleveland, OH 44112 216-266-3494
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St, Danvers, MA 01923 617-777-1900
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Hanovia, 100 Chestnut St., Newark, NJ 07105 201-589-4300
Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 201-974-0090
§† Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 312-829-6050
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
§ Luxo Lamp Corp., P.O. Box 951, Port Chester, NY 10573 914-937-4433
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 516-333-4840
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
Vactronic Lab. Equip. Inc., 160 Wilbur Place, Bohemia, NY 11716 516-567-0520
Voltarc Tubes, 176 Linwood Ave., Fairfield, CT 06430 203-255-2633
§ Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Lamps, Xenon-2460

Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
JKL Components Corporation, 13343 Paxton St., Pacoima, CA 91331, 818-896-0019 ..... B•1135
§ Alan Gordon Entprs., Inc., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601 818-985-5500
† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 312-671-4321
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
Christie Electric Corp., 18120 S. Broadway, Gardenia, CA 90248 213-320-0808
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G, Inc., Electro-Optics Div., 35 Congress St, Salem, MA 01970 617-745-3200
Electro Scientific Inds., 13900 N.W. Science Pk. Dr., Portland, OR 97229 503-641-4141
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St, Danvers, MA 01923 617-777-1900
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
† Hanovia, 100 Chestnut St., Newark, NJ 07105 201-589-4300
ILC Technology, Inc., 399 Java Dr., Sunnyvale, CA 94089 408-745-7900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
§† Kemlite Labs., Inc., 1819 W. Grand Ave., Chicago, IL 60622 312-829-6050
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
§ North American Philips Lighting, Bank St., Hightstown, NJ 08520 609-448-4000
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
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§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

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Laser Components & Laser Accessories-3700

† Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ..... D•1006
§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
Power Technology, Inc., P.O. Box 9769, Little Rock, AR 72219, 501-568-1995 ..... D•1937
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... A•2144
Advanced Kinetics, 1239 Victoria St, Costa Mesa, CA 92627 714-646-7165
§ Aerotech, Inc., 101 Zeta Dr., Pittsburgh, PA 15238 412-963-7470
§ Apollo Lasers, Inc., 20977 Knapp St., Chatsworth, CA 91311 818-407-3000
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
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§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
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† Cleveland Crystals, Box 17157, Euclid, OH 44117 216-486-6100
† Coherent General, Inc., Picker Rd., Sturbridge, MA 01566 617-347-2681
Coherent, Inc., 3210 Porter Dr., Palo Alto, CA 94304 415-493-2111
† Control Laser Corp., 7503 Chancellor Dr., Orlando, FL 32809 305-438-2500
† D. O. Industries, 317 E. Chestnut St., E. Rochester, NY 14445 716-385-4920
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
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† Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
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§† International Laser Sys., 3404 N. Orange Blossom Trail, Orlando, FL 32804 305-295-4010
† KLC/Karl Lambrecht Corp., 4204 N. Lincoln Ave., Chicago, IL 60618 312-472-5442
† Kontes, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360 609-692-8500
§† Laakmann Electro-Optics, Inc., 33052 Calle Aviador, San Juan Capistrano, CA 92675 714-493-6624
§† Laser Concepts, Omega Organization Intl., P.O. Box 33623, Seattle, WA 98133 206-364-7881
Lincoln Laser Co., 234 East Mohave, Phoenix, AZ 85004 602-257-0407
Lumonics Material Processing Corp., 12163 Globe Rd., Livonia, MI 48150 313-591-0101
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Photon, Inc., 970 University Ave., Los Gatos, CA 95030 408-354-5600
Quantronix, 49 Wireless Blvd., P.O. Box 9014, Smithtown, NY 11788 516-273-6900
Raytheon Co., Laser Products, 465 Centre St., Quincy, MA 02169 617-479-5300
RMF Products, Inc., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510 312-879-0020
Spiricon, Inc., 2600 North Main, Logan, UT 84321 801-753-3729
Staffall Inc., 7 Woodland St., Providence, RI 02908 401-351-8282
§ Sun Research, Inc., Box 210, Old Bay Rd., New Durham, NH 03855 603-859-7110
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Hybrid Components Operation, P.O. Box 500, Beaverton, OR 97077 503-627-4220
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Laser Diodes — See Diodes, Laser (Vol. A)

Latches, Panels & Cabinets-2400 — *See Vol. C*

LCDs — See Diodes, Liquid Crystal (Vol. B)

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Leads, Test & Adapters-2900 — *See Vol. D*

LEDs — See Diodes, Light Emitting (LEDs) (Vol. B)

Light Emitting Diodes (LEDs), Surface/Mount-3700

Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130-1131
Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1079
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1151
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§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
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§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Rohm Corporation, 8 Whatney, Irvine, CA 92718 714-855-2131
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680 714-669-9850

Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386

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† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1125

Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1142

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† Applied Optics Center Corp., Varo, Inc., 2005 Whitfield Industrial Way, Sarasota, FL 34243 813-756-0636

† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860

Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355

Ceramaseal, Box 260, New Lebanon, NY 12125 518-794-7800

† Cleveland Crystals, Box 17157, Euclid, OH 44117 216-486-6100

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† D. O. Industries, 317 E. Chestnut St., E. Rochester, NY 14445 716-385-4920

† Dontech, Inc., 700 Airport Blvd., Doylestown, PA 18901 215-348-5010

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§ IR Scientific, Box 110, Carlisle, MA 01741 617-667-7110

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Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405, 818-787-0311 ..... B•1074

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§ Lucas Duralith Corporation, 525 Orange St., Millville, NJ 08332 609-825-6900

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† Moldtronics, Inc., 703 Rogers St., Downers Grove, IL 60515 312-968-7000

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Lids, Hybrid Package-3130 — *See Vol. A*

Light Choppers-3700

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† Electro-Optical Industries, Box 3770, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)

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Light Sources, Fiber Optic - Also see Generators, Light Pulse-2475

† Advantest America, Inc., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, 312-634-2552 ..... D•1196,1204

AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1271-1272

Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804, 415-234-1100 ..... D•1219

Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167

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Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700

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§† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014 815-455-0400

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§ Laser Precision Corp., 1231 Hart St., Utica, NY 13502 315-797-4449

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Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
Rehlander Assocs., 118A Bridge St, Beverly, MA 01915 617-922-5961
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† York Technology, Inc., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502 818-955-8927

Light Sources, Infrared - Also see Generators, Light Pulse-3700

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High Technology Sensors, Inc., 262 E. Hornbeam Dr., Longwood, FL 32779 305-423-1755
§ IR Scientific, Box 110, Carlisle, MA 01741 617-667-7110
§† Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
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† Radiometrics, Inc., 12021 South Memorial Pkwy., Huntsville, AL 35803 .. 205-881-1272
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† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
Zexco, 7661 Densmore, #8, Van Nuys, CA 91406 818-997-7895

Light Sources, Photoelectric-3700

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Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
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§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
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† Photo Research, Kollmorgen Corp., 9330 DeSoto Avenue, Chatsworth, CA 91311 818-341-5151
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Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Scanning Devices, Inc., 108 Elm St., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

Light Sources, Stroboscopic-3700

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Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Video Logic Corp., 1294 Lawrence Station Rd., Sunnyvale, CA 94086 ... 408-745-0933

Light Sources, Ultraviolet-3700

† American Ultraviolet, 562 Central Avenue, Murray Hill, NJ 07974 201-665-2211
Contact East, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845 ... 617-682-2000
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EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
§ Gates, Geo. W., & Co., Inc., 1209 Hempstead Tpke., Franklin Sq., NY 11010 516-352-2904
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900
Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 201-974-0090
† Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
§† Powertron Corporation, Rte. 15, Box 932, Sparta, NJ 07871 201-579-5599
§† Spectronics Corp., 956 Brush Hollow Rd., Westbury, NY 11590 516-333-4840
† Stenning Instrments, Inc., 671 Enchanted Way, Pacific Palisades, CA 90272 213-459-2930
† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

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Altair Exchange Corporation, 19205 Parthenia St., Ste. F, Northridge, CA 91324, 818-701-6977;800-824-5620 ..... B•1034
§ AND, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-9916 ..... B•1039,1107
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1108-1109,1111-1112,1653-1654
§† Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115-1123
Dio-Rey, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1062
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098, 203-379-2731 ..... B•1067
§† FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852, 301-881-8124;800-638-6594 ..... B•1314
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1127-1128
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1073
§ Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130-1134
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§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153
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§† Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136
† Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1125
§† Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1137
§ Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1146-1147
§ Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1142
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§† Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1154
§ Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155
§† Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
§† Sylvania Miniature Lighting, GTE Corporation, W. Main St., Hillsboro, NH 03244, 603-464-5533 ..... B•1163-1165
§ Visual Communications Co., Inc., 7920 Arjons Dr., Ste. G, San Diego, CA 92126, 619-549-6900 ..... B•1099-1100
APM-Hexseal, 44 Honeck St., Englewood, NJ 07631 201-569-5700
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ..... 203-268-4372/6703
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022 201-941-4455
§ Data Display Products, Box 91072, Los Angeles, CA 90009 213-640-0442
† Devco Engineering, 36 Pier Lane West, Fairfield, NJ 07006 ..... 201-CA8-0321
Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689 818-442-7180
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† Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661

§† Genisco Technology Corp., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
§† Glar-Ban, A Mark IV Company, 199 Wales Ave., Tonawanda, NY 14150 716-694-5076
GTE Sylvania Lighting, Sylvania Lighting Center, 100 Endicott St., Danvers, MA 01923 617-777-1900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§ Lamp Technology, Inc., 1645 Sycamore Ave., Bohemia, NY 11716 516-567-1800
§† Ledco Div., 346 Chester St., St. Paul, MN 55107 612-222-2791
§† Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§ Merix Chemical Co., 2234 East 75th St., Chicago, IL 60649 312-221-8242
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
Micro Lamps Inc., 1055 Paramount Pkwy., Batavia, IL 60510 312-879-0900
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241 415-960-6000
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260 602-991-0942
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 201-575-0870
Pyle-National Division, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651 312-342-6300
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630 312-792-2700
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
TIW Systems, Inc., 1284 Geneva Drive, Sunnyvale, CA 94089 408-734-3900
§† VCH Incorporated, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089 312-459-3400
§ Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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§† Bussmann:Cooper Industries, P.O. Box 14460, St. Louis, MO 63178, 314-394-2877 ..... C•1291
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§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1853-1854,1858
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, 609-298-7300 ..... D•1857
§ PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1347
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Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... B•1350-1351
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ..... B•1870

§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Burndy Corporation, Richards Ave., Norwalk, CT 06852 203-838-4444
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301 201-782-5525
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857 814-781-1591
NWL Capacitors, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404 305-848-9009
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
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MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729 516-586-5125
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211

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VL Electronics, Inc, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, 213-661-8883 ..... B•1103

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† Arnold Engineering Company, Sub. SPS Technologies, 300 West Street, Marengo, IL 60152 815-568-2000
Jobmaster Corp., 9008 Liberty Rd., Randallstown, MD 21133 ..... 301-655-1400; 800-642-1400
† Magnet Sales & Mfg. Co. Inc., 11250 Playa Court, Culver City, CA 90230-6127 ..... 213-391-7213;800-421-6692
† Ogallala Elctrns., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153 308-284-4093
† The Permanent Magnet Co., Inc., 4437 Bragdon St, P. O. Box 26226, Indianapolis, IN 46226 317-547-1336
Steward, D. M., Mfg. Co., P.O. Box 510, Chattanooga, TN 37401 615-867-4100
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000

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† Photo Research, Kollmorgen Corp, 9330 DeSoto Avenue, Chatsworth, CA 91311 818-341-5151
Simpson Electric Co, 853 Dundee Ave, Elgin, IL 60120 312-697-2260
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Triplett Corporation, One Triplett Dr, Bluffton, OH 45817-9987 419-358-5015

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Microcircuits (MIL)-2440

† **Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803, 516-694-6700** ..... **A•1716**
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906, 317-463-2565 ..... **A•1732-1733**
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... **A•1928-1931**
§† **Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253** ..... **A•1916-1917**
Integrated Circuits, Inc., 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, 206-882-3100 ..... **A•1740-1741**
† **Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770** ..... **A•1744-1745, B•1516-1523**
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, 414-785-6506 ..... **A•1747**
Mini-Systems, Inc., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, 508-695-2000 ..... **A•1748**
† Allied Corp. Aerospace Sector, Bendix Communications Div., East Joppa Rd, Towson, MD 21204 301-583-4000
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Datel, Inc., 11 Cabot Blvd, Mansfield, MA 02048 617-339-3000
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Hycomp, Inc., 165 Cedar Hill St, Marlborough, MA 01752 617-485-6300
Hytek Microsystems, 980 University Ave., Los Gatos, CA 95030 408-395-2300
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508

† NCR Microelectronics, NCR Corporation, 1635 Aeroplaza Dr., Colorado Springs, CO 80916 ..... 303-596-5795;800-543-5618
Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304 716-283-4025
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Linear-2440

§† Advanced Linear Devices, Inc., 1030 West Maude Ave., Bldg. 501, Sunnyvale, CA 94086-2810 408-720-8737
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 617-339-3000
§† Fairchild Camera & Instr. Corp., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139 415-962-4011
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
§† Precision Monolithics, Inc., 1500 Space Park Dr., Santa Clara, CA 95054-3499 408-727-9222
§† Raytheon Semiconductor, 350 Ellis St., Mountain View, CA 94043 415-968-9211
§† Silicon General, 11861 Western Ave., Garden Grove, CA 92641 714-898-8121
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
† Third Domain, Inc., P.O. Box 17568, Tucson, AZ 85731-7568 602-290-1820

Microcircuits (MIL), Low Power Schottky-2440

Alpha Industries, Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500

Microcircuits (MIL), Memories, CMOS, Hybrids-2440

† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
Memory X, 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, 619-292-1151 ..... A•1746
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1429
Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1451
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740, 818-914-1926 ..... A•1758
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
† Cincinnati Elctrns., 2630 Glendale Milford Rd., Cincinnati, OH 45241 513-733-6100
† EMC Technology Inc, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034 609-429-7800
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
† Holt Inc., 9351 Jeronimo Rd., Irvine, CA 92718 714-859-8800
§† Integrated Device Technology, Inc., 3236 Scott Blvd., Santa Clara, CA 95054-3090 408-727-6116
† Mel Tec, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090 .. 617-329-1508
† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† VLSI Technology, Inc., 1109 McKay Dr., San Jose, CA 95131 408-434-3000

Microcircuits (MIL), TTL, Schottky, Microprocessor-2440

† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742-1743
Sunrise Electronics, Inc., 524 S. Vermont Ave., Glendora, CA 91740, 818-914-1926 ..... A•1758
Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† A.S.I. Microsystems, Inc., (Formerly Andrich Systems, Inc.), 1699 Roosevelt Ave., Bohemia, NY 11716 516-589-5656
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500

Microcomputer Boards-3130 — *See Vol. A*

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Microphones, Dynamic-1300 — *See Vol. D*

Microphones, Lavalier-1300 — *See Vol. D*

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Microphones, Omnidirectional-1300 — *See Vol. D*

Microphones, Subminiature-1300 — *See Vol. D*

Microphones, Wireless-1300 — *See Vol. D*

Microphones (MIL)-2440

§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ..... 203-268-4372/6703
§† Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683

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Microprocessor Development Systems-2900 — *See Vol. D*

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Microscopes-3700

§ BEA electro-optics, inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
§ Cambridge Instruments, Inc., Optical Systems Division, P.O. Box 123, Buffalo, NY 14240 716-891-3000
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
§† Excel Technology Intl. Corp., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502 201-874-4747
§ Hacker Instruments, Box 657, Fairfield, NJ 07007 201-226-8450
Jonard Industries Corp., 134 Marbledale Rd., Tuckahoe, NY 10707 914-793-0700
† Melles Griot, Optics, 1770 Kettering St., Irvine, CA 92714 714-261-5600
† Metron Optics Inc., P.O. Box 690, Solana Beach, CA 92075-0690 619-755-4477
§ Pacific Transducer Corp., 2301 Federal, Los Angeles, CA 90064 213-478-1134
§ Solder Absorbing Technology (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108 800-628-8862
Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
§ Vision Engineering, Inc., 570 Danbury Rd., New Milford, CT 06776 203-355-3776
Walker Scientific, Rockdale St., Worcester, MA 01606 .... 617-852-3674;617-853-3232
§ Carl Zeiss, Inc., One Zeiss Drive, Thornwood, NY 10594 914-747-1800

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Microwave Comb Generator — See Generators, Microwave (Vol. D)

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Miriplex Communication Systems-1900 — *See Vol. D*

Mirrors, Front Surface-3700

Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., 2365 Maryland Rd., Willow Grove, PA 19090 215-659-3080
† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
Metron Optics Inc., P.O. Box 690, Solana Beach, CA 92075-0690 619-755-4477
§ Optics for Research, Inc., P.O. Box 82, Caldwell, NJ 07006 201-228-4480
Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
† Plumer Precision Optics, 601 Montgomery Ave., Pennsburg, PA 18073 .. 215-679-6272
Rolyn Optics Co., 706 Arrowgrand Circle, Covina, CA 91722-2199 ..... 818-915-5707/5717
§ WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Mirrors, Rear Surface-3700

Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Evaporated Coatings, Inc., 2365 Maryland Rd., Willow Grove, PA 19090 215-659-3080

† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800
Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
Rolyn Optics Co., 706 Arrowgrand Circle, Covina, CA 91722-2199 ..... 818-915-5707/5717

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Modulator/Demodulators, Laser-3700

Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497
§ Artel Communications Corp., 22 Kane Industrial Dr., Hudson, MA 01749 617-562-2100
† CATEL Telecommunications, 4050 Technology Pl., Fremont, CA 94537 415-659-8988
Coherent, Inc., 3210 Porter Dr., Palo Alto, CA 94304 415-493-2111
Data-Design Labs., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730 714-987-2511
§ International Laser Sys., 3404 N. Orange Blossom Trail, Orlando, FL 32804 305-295-4010
Kappa Scientific Corp., Box 30585, Santa Barbara, CA 93105 805-687-9648
RE Instruments Corp., 31029 Center Ridge Rd., Westlake, OH 44145 ... 216-871-7617

Modulators, AM-1900 — *See Vol. D*

Modulators, FM-1900 — *See Vol. D*

Modulators, Light-3700

§† **Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1497**
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1279,1281
† Cleveland Crystals, Box 17157, Euclid, OH 44117 216-486-6100
Data-Design Labs., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730 714-987-2511
Displaytech, Inc., 2200 Central Ave., Boulder, CO 80301 303-449-8933
† Electro-Optical Industries, Box 3770, Santa Barbara, CA 93130 ..... 805-964-6701 (ext. 280)
FG Engineering, Box 476, Fredonia, AZ 86022 602-643-7375
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
INTELCO, 8 Craig Road, Acton, MA 01720 617-264-4485
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
RE Instruments Corp., 31029 Center Ridge Rd., Westlake, OH 44145 ... 216-871-7617
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433

Modulators, Magnetic-2200 — *See Vol. D*

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Modules, Switching-5100

Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983 ..... D•1143
Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1658
Colimer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244, 800-527-0251;214-233-1589 ..... A•2127-2128
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
CYTEC Corp., 2555 Baird Road, Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1236
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
§ **Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1461**
Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Powerex, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697 412-925-7272
† Racal-Dana Instrs. Inc., 4 Goodyear St., Irvine, CA 92718 714-859-8999
Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§ WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4 514-694-9136

Modules (MIL), Electronic-2440

† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1165
† Modular Devices, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, 516-345-3100 ..... D•2128
RTS Systems, Inc., 1100 W. Chestnut St., Burbank, CA 91506, 818-840-7119 ..... B•1026, D•1074-1075
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271

† Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
Integrity Technology, 105 Serra Way, Ste. 230, Milpitas, CA 95035 408-262-8640
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735 516-293-3100

Modules (MIL), Standard Electronic-2440

† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716, 516-567-5600 ..... D•1165
† Koep Precision Standards, Inc., IC Coan Place, Metuchen, NJ 08840, 201-549-9280/9282 ..... D•1283
Densepac Microsystems, Inc., 7321 Lincoln Way, Garden Grove, CA 92641-1428 ..... 714-898-0007;800-64-CHIPS
§ Ericson Manufacturing Co., 4215 Hamann Pkwy., Willoughby, OH 44094 216-951-8000
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831

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Monitors, Phase & Phase Angle-2900 — *See Vol. D*

Monitors, Phase Sequence & Loss-2200 — *See Vol. D*

Monitors, Power, AC & DC-2200 — *See Vol. D*

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Monitors, Power, RF-2900 — *See Vol. D*

Monitors, Response Time-2900 — *See Vol. D*

Monitors, Television, Fiberoptic-2475

§ Conrac Display Products Group, A Mark IV Industries Co., 1724 S. Mountain Ave., Duarte, CA 91010 818-303-0095
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200

Monitors, Temperature-Also See Controls, Temperature-5300

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ Beede Electrical Instrument Co., Inc., S. Main St., Penacook, NH 03303, 603-753-6362 ..... D•1357-1359
† Chromalox Instrs. & Controls, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, 615-793-3900 ..... D•1124
† CML MACARR Div., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, 718-857-2400 ..... D•2084
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048, 617-339-3000 ..... D•1154
§ Digitec Corp., 959 Cheney Ave., Marion, OH 43302, 614-387-3444 ..... D•1363
† Dranetz Technologies, Inc., 1000 New Durham Rd., P.O. Box 4019, Edison, NJ 08818-4019, 201-287-3680 ..... D•1240
Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855, 203-866-2573 ..... D•1130
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1856,1859
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1137
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... D•1392-1393,1420
PPM, Inc., 5385 Harper Rd., Cleveland, OH 44139, 216-349-2300 ..... D•1313
Sensor Scientific, Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1868-1869
Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
Active Control Instrumentation, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037 305-451-1000
§ Acurex-Autodata, 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039 415-967-9100
ADAC Corp., 70 Tower Office Pk., Woburn, MA 01801 617-935-6668
Advanced Techn. Research Labs., 5645 K General Washington Dr., Alexandria, VA 22312 703-750-2920
§ Amprobe Instrument, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563 516-593-5600
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 313-779-8700
§ ARGA Controls, 35 E. Glenarm St., Pasadena, CA 91105 213-682-3314
§ Atkins Technical Inc., 3401 S.W. 40th Blvd., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§ Beckman Industrial Corp., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123 619-495-3200
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
Burling Instruments, P.O. Box 298, Chatham, NJ 07928 201-635-9481
§ Capintec Instruments, 6 Arrow Rd., Ramsey, NJ 07446 201-825-9500
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Climatronics, 140 Wilbur Pl., Bohemia, NY 11716 516-567-7300
Controlex, Inc., Francestown Turnpike, New Boston, NH 03070 603-487-5512
† Control Technology Co., Inc., 41-16 29th St., Long Island City, NY 11101 718-361-2133
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
Cybernetic Micro Sys., P.O. Box 3000, 3000 Hwy. 84, San Gregorio, CA 94074 415-726-3000
Data World Products, Second N.H. Tpke., Francestown, NH 03043 603-588-3746
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Digital Dynamics, Inc., 275 Technology Circle, Scotts Valley, CA 95066 408-438-6823
Electric Tachometer, 68th & Upland Sts., Philadelphia, PA 19142 ..... 215-SA6-7723
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ E-Squared Technology Corp., 4475 Dupont Ct # 9, Ventura, CA 93003 805-644-9544
Esterline Angus Instrument Corp., Box 24000, Indianapolis, IN 46224 317-244-7611
Fast Feedback Technologies, 1505 Aviation Blvd., Redoudo Beach, CA 90278 213-379-6100
§ Fenwal, 400 Main St., Ashland, MA 01721 505-881-2000
Flotek Corporation, 1300 E. Floriza St., Ste. 101, Tucson, AZ 85714 602-294-9222
§ Fluke, John, Manufacturing Co., Box C9090, MS 250C, Everett, WA 98206 206-356-5400
† FTS Systems, Inc., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484 800-824-0400
Gordon Co., 5710 Kenosha St., Richmond, IL 60071 815-678-2211
Gordon Products, 67 Del Mar Dr., Brookfield, CT 06804 203-775-4501
§ Hafstrom Technical Products, Inc., P.O. Box 9829, San Diego, CA 92109 619-274-8822
Hancock Electronics Corp., 135 King St., P.O. Box 557, Cohasset, MA 02025 617-383-6610
§ Helm Instrument Co., Inc., 1387 Dussel Drive, Maumee, OH 43537 419-893-4356
† Howell Instruments, 3479 W. Vickery Blvd., Ft. Worth, TX 76107 817-336-7411
† Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
International Instruments, A Prime Technology Co., Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471 203-481-5721
§ Intra-computer, 101 W. 31st St., New York, NY 10001 212-947-5533
Kaye Instruments, Inc., 15 De Angelo Dr., Bedford, MA 01730 617-275-0300
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857 814-781-1591
Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
Lake Shore Cryotronics, Inc., 64 E. Walnut St., Westerville, OH 43081 614-891-2243
Leeds & Northrup, General Signal, Sumneytown Pike, North Wales, PA 19454 215-643-2000
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820
Metra Instruments, 2056 Bering Dr., San Jose, CA 95131 408-436-8530
Metrix Instrument Co., 1711 Townhurst, Houston, TX 77043 713-461-2131
Metrosonics, Inc., Box 23075, Rochester, NY 14692-3075 716-334-7300
§† Mikron Instr., 445 W. Main St., Wyckoff, NJ 07481 201-891-7330
Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705 714-540-4914
§ Non-Linear Systems/Div. of Kaypro Corp., 533 Stevens Ave., Solana Bch., CA 92075 619-481-3953
§ Pacific Transducer Corp., 2301 Federal, Los Angeles, CA 90064 213-478-1134
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
† Relco Products, 5594 E. Jefferson Ave., Denver, CO 80237 303-756-1143
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
Rochester Instrument Systems, 255 N. Union St., Rochester, NY 14605 716-263-7700
† Rustrak Instruments, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818 ..... 401-884-6800;800-332-3202
Serial Lab Prods., Inc., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752 617-481-1684
§ S. F. Products Corporation, P. O. Box 369, Southport, CT 06490 203-929-6180
Solder Absorbing Technology (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108 800-628-8862
§ Spanta, Inc., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417 201-848-0033
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
Strawberry Tree Computers, 160 S. Wolfe Rd., Sunnyvale, CA 94086 408-736-3083
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§ Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
† Syscon Intl., Inc., 1108 So. High St., So. Bend, IN 46618-1096 219-232-3900
§ Tempil Div., Big Three Inds., Hamilton Blvd., S. Plainfield, NJ 07080 201-757-8300
§ Temptronic Corporation, 55 Chapel St., Newton, MA 02158 617-969-2501
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177

† Thermo Electric, 109 Fifth St, Saddle Brook, NJ 07662 201-843-5800
§ TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310 305-739-4300
† VirTis Co., Rte. 208, Gardiner, NY 12525 914-255-5000
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200
§ Yellow Springs Instrument Co., Box 279, Yellow Springs, OH 45387 513-767-7241
§ Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Monitors, Touch — See Touch Monitors (Vol. D)

Monitors, Vibration-2200 — *See Vol. D*

Monitors, Video-1900 — *See Vol. D*

Monitors, Voltage — See Meters, Volt (Vol. D)

Monitors, Waveform — See Oscilloscopes (Vol. D)

Monitors (MIL), Data-3475 — *See Vol. D*

Motor & Generator Armatures, Rotors, Stators-3500

§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, 818-998-4850 ..... B•1195
Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
† Georator Corp., Box 70, Manassas, VA 22110-0070, 703-368-2101 .. D•2110-2112
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
Penn-Tran Corp., Box 1321, Rte. 144N, Wingate, PA 16880, 814-355-1521 ..... A•1280, D•1862
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ... B•1030,1267
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Danmar Inds., 9705 Lurline Ave., Chatsworth, CA 91311 ..... 818-882-7979/5280
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
† Fabricast, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733 ... 818-443-3247
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
Framar Metal Products Co., Inc., 345 Carnegie Avenue, Kenilworth, NJ 07033 201-241-0710
† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116 918-438-7800
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
† Pacific Scientific, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101 805-963-2055
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
§ Powertron, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348

Motor Assemblies with Integral Tachometer/Encoder-3500

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237,1898
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... B•1247
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
Data Technology, Inc., 4 Gill St., Woburn, MA 01811 617-935-8820
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
Hitachi America, Ltd., 50 Prospect Ave., Tarrytown, NY 10591 914-332-5800
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
† Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635 602-459-1150
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
§ Westamp, 1542 15th St., Santa Monica, CA 90404 213-393-0401

Motor Generator Sets-4000 — *See Vol. D*

Motorized Micropositioners-4900 — *See Vol. D*

Motorized Translation Stages-4900 — *See Vol. D*

Motor Speed Drives — See Controls, Motor Speed (Vol. D)

Motors, Brush, DC-3500

Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
† Eltrol Corporation, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, 818-709-0131 ..... B•1203
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218-1219
Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... B•1231
† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... B•1247
Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008, 619-438-3321 ..... B•1256-1257
TS Products, Inc., 12455 Branford St., Bldg. 22, Arleta, CA 91331, 818-896-6676 ..... D•2175
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
§ Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
Fincor, 3750 E. Market St., York, PA 17402 717-751-4206
§ General Industries, Taylor & Olive St., Elyria, OH 44035 216-323-3136
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
Hitachi America, Ltd., 50 Prospect Ave., Tarrytown, NY 10591 914-332-5800
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., Universal Magnetics Corp., 12627 Hidden Creek Way, Cerritos, CA 90702 213-926-0927
Industrial Indexing Systems, Inc., 626 Fishers Run, Victor, NY 14564 716-924-9181
† Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010 415-697-9614
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 ... 215-675-6500
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
§ Westamp, 1542 15th St., Santa Monica, CA 90404 213-393-0401

Motors, Brushless, DC-3500

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, 516-694-6700 ..... B•1184-1185
Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1194
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, 818-998-4850 ..... B•1195
† BEI Motion Systems Company, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, 619-744-5671 ..... B•1880

Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606, 919-469-8522 ..... **C•1653**
§† **Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700** ..... **B•1199**
† **Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000** ..... **B•1200**
† **Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424** ..... **B•1883**
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... **B•1202**
§ **ebm Inds., Inc., 525 New Britain Ave., Unionville, CT 06085, 203-674-1515** ..... **C•1656-1657**
† **Eltrol Corporation, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, 818-709-0131** ..... **B•1203**
ETRI, Inc., 608 Broome St., Monroe, NC 28110, 704-289-5423 ..... **C•1664-1665**
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... **B•1213**
† **Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495** ..... **B•1218-1219**
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... **B•1895**
Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... **B•1232**
MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... **B•1233**
† **Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1180,1235,1237,1898**
† **Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041** ..... **B•1239-1241**
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... **B•1242, C•1690**
† **Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880** ..... **B•1243**
§ **Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879** ..... **B•1245-1246**
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840, 401-849-8810 ..... **C•1692-1694**
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... **B•1248-1249**
POWR-UPS Corp., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, 516-345-5700;1-800-333-POWR ..... **B•1251**
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... **B•1252-1253**
§ **Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266** ..... **B•1255**
† **Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008, 619-438-3321** ..... **B•1256-1257**
† **Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300** ..... **B•1259**
§ **Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264** ..... **B•1263**
Synektron Corporation, 12000 S. W. Garden Place, Portland, OR 97223, 503-684-3090 ..... **B•1264-1265**
† **Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, 619-428-5581** ..... **B•1268**
Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Dynamics, Inc., 2 Gill St., Woburn, MA 01801 617-935-4944
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
§ Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
Brailsford & Co., 670 Milton Rd., Rye, NY 10580 914-967-1820
§ EG & G Rotron, Commercial Div., Saugerties, NY 12477 914-246-3615
† EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
Hitachi America, Ltd., 50 Prospect Ave., Tarrytown, NY 10591 914-332-5800
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
Industrial Indexing Systems, Inc., 626 Fishers Run, Victor, NY 14564 716-924-9181
† Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635 602-459-1150
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., 2142 Industrial Ct., Bldg. "F", Vista, CA 92083 619-727-7430
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
† Pacific Scientific Co., 4301 Kishwaukee, Rockford, IL 61105 815-226-3100
Parker Hannifin Corporation, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
† Performance Controls, Inc., 433 Caredean Drive, Horsham, PA 19044 ... 215-675-6500
§ Powertron, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040 516-328-3970
Tokyo Elec. Co., Ltd., 1-1 Nishiki-Cho, Kanda, Chiyoda-Ku, Tokyo, 101, JAPAN ..... (03) 292-1011
§ Westamp, 1542 15th St., Santa Monica, CA 90404 213-393-0401
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Clock & Timing-3500

Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... **B•1192**
§ **Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515** ..... **B•1197**
§ **Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200** ..... **B•1201**
Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635, 602-459-1150 .. **B•1217**
Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... **B•1231**
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... **B•1180**
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
Bertsch U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083 619-727-7420
§† Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820 603-742-3330
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Box 23, Princeton, IN 47670-0023 .. 812-385-3415
§ Landis & Gyr, Inc., 99 Castleton St., Pleasantville, NY 10570 914-747-3540
Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514 219-262-4418
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348

Motors, Control-3500

Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... **B•1192-1193**
§ **Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660** ..... **B•1196**
§ **Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515** ..... **B•1197**
Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, 201-933-0220 ..... **B•1198**
§ **Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700** ..... **B•1199**
† **Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000** ..... **B•1200**
† **Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424** ..... **B•1883**
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... **B•1201**
† **Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495** ..... **B•1218**
Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635, 602-459-1150 .. **B•1217**
Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... **B•1231**
† **Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614** ..... **B•1232**
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... **B•1180**
† **Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041** ..... **B•1239-1241**
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... **B•1248**
Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... **B•1255**
† **Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008, 619-438-3321** ..... **B•1257**
§† **Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561** ..... **B•1260**
§ **Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264** ..... **B•1263**
† **Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040, 516-328-3970** ..... **B•1266**
Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, 619-428-5581 ..... **B•1268**

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St, Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
§ Anaheim Automation, 910 E. Orangefair La., Anaheim, CA 92801 714-992-6990
Applied Systems Corp., 26401 Harper Ave., St. Clair Shores, MI 48081 .. 313-779-8700
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065 818-998-4850
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§ Berkeley Process Control, Inc., 5327-K Jacuzzi St., Richmond, CA 94804 415-526-3333
Bertsch U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083 619-727-7420
Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606 919-469-8522
§ Carter Motor, 2707 W. George St., Chicago, IL 60618-7898 312-588-7700
Centent Co., 3879 S. Main St., Santa Ana, CA 92707 714-979-6491
§† Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
§ Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
§† Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fincor, 3750 E. Market St., York, PA 17402 717-751-4206
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
Honeywell Inc., Commercial Div., MN 27-7246, Honeywell Plaza, Minneapolis, MN 55408 612-870-5357
§ Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
Industrial Indexing Systems, Inc., 626 Fishers Run, Victor, NY 14564 716-924-9181
§ Inertial Motors, 280 N. Broad St., Doylestown, PA 18901 215-345-1010
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
§ Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
Lincoln Laser Co., 234 East Mohave, Phoenix, AZ 85004 602-257-0407
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Magnum Opus Custom Elctrn. Engrg., 284 Kennedy St., Iselin, NJ 08830 201-283-4925
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., 2142 Industrial Ct., Bldg. "F", Vista, CA 92083 619-727-7430
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503 213-515-2879
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne, NJ 07506 201-427-3100
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St., Covington, KY 41012 606-431-0900
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525
§ Westinghouse Electric Corp., Control Division, P.O. Box 819, Oldsmar, FL 34667 813-855-4621

Motors, DC Timing-3500

Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1194
Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... B•1231
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
Bertsch U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083 619-727-7420
Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Box 23, Princeton, IN 47670-0023 .. 812-385-3415
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Motors, Drag Cup-3500

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Vernitech, 300 Marcus Blvd., Deer Pk, NY 11729 516-586-5100

Motors, Fractional Horsepower-3500

† Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1194
Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192-1193
§ Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
† BEI Motion Systems Company, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, 619-744-5671 ..... B•1880
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
§ Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, 201-933-0220 ..... B•1198
Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606, 919-469-8522 ..... C•1653
§† Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000 ..... B•1200
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
§ ebm Inds., Inc., 525 New Britain Ave., Unionville, CT 06085, 203-674-1515 ..... C•1655-1657
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
§ Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... B•1231
† Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... B•1232
MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1233
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... B•1260
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
Synektron Corporation, 12000 S. W. Garden Place, Portland, OR 97223, 503-684-3090 ..... B•1264-1265
† Techno, A DSG Company, 2101 Jericho Turnpike, New Hyde Park, NY 11040, 516-328-3970 ..... B•1266
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020

† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
† Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065 818-998-4850
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
Berger-Lahr Corp., Fitzgerald Dr., Jaffrey, NH 03452 603-532-7701
Bertsch U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083 619-727-7420
§ Carter Motor, 2707 W. George St., Chicago, IL 60618-7898 312-588-7700
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
§† Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
EG & G Rotron, Commercial Div., Saugerties, NY 12477 914-246-3615
† EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
EG & G Torque Systems, 36 Arlington St., Watertown, MA 02172 617-924-6000
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
§ Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
§ Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
Fincor, 3750 E. Market St., York, PA 17402 717-751-4206
§ General Industries, Taylor & Olive St., Elyria, OH 44035 216-323-3136
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
§ Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Box 23, Princeton, IN 47670-0023 .. 812-385-3415
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
† Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
† McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550 609-799-0100
† Merrill, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437 .. 215-643-2116
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
Motor-Tronics, Inc., 2142 Industrial Ct., Bldg. "F", Vista, CA 92083 619-727-7430
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
† Pacific Scientific Co., 4301 Kishwaukee, Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840 401-849-8810
Parker Hannifin Corporation, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438 215-256-6601
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
§ Powertron, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210 704-525-8962
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 .. 516-328-3300
Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Gearhead-3500

Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192
§ Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
§ Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, 201-933-0220 ..... B•1198
§† Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218
† Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... B•1232
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... B•1249
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
§ Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... B•1260
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1267
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§† Berger-Lahr Corp., Fitzgerald Dr., Jaffrey, NH 03452 603-532-7701
Bertsch U.S., Sycamore Resch. Ctr., 2142F Industrial Ct., Vista, CA 92083 619-727-7420
Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606 919-469-8522
§ Carter Motor, 2707 W. George St., Chicago, IL 60618-7898 312-588-7700
§† Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
§ Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
§ Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
§ General Industries, Taylor & Olive St., Elyria, OH 44035 216-323-3136
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
† Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
Motor-Tronics, Inc., 2142 Industrial Ct., Bldg. "F", Vista, CA 92083 619-727-7430
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000

Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514 219-262-4418
Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne, NJ 07506 201-427-3100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Gyro-3500

† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1267
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065 818-998-4850
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
§† Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581

Motors, Hysteresis-3500

§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1267
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
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§ Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820 603-742-3330
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
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§ General Industries, Taylor & Olive St., Elyria, OH 44035 216-323-3136
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Box 23, Princeton, IN 47670-0023 .. 812-385-3415
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
Lincoln Laser Co., 234 East Mohave, Phoenix, AZ 85004 602-257-0407
Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
† McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550 609-799-0100
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840 401-849-8810
Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Incremental, Stepping — See Motors, Stepping (Vol. B)

Motors, Induction-3500

Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1219
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Dynamics, Inc., 2 Gill St., Woburn, MA 01801 617-935-4944
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065 818-998-4850
§ Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§ Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072 201-933-0220
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
† Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
† McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550 609-799-0100
† Merrill, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437 .. 215-643-2116
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840 401-849-8810
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
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Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Linear-3500

Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1194
Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Anorad Corp., 110 Oser Ave., Hauppauge, NY 11788 516-231-1995
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116 918-438-7800
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
Kaiser ElectroPrecision, Kaiser Aerospace & Elctrns., 1700 S. Redhill Ave., Irvine, CA 92714 714-250-1015
Magnetic Systems, 1021 Pecten Ct., Milpitas, CA 95035 408-263-6680

Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
Parker Hannifin Corporation, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
Unico, 3725 Nicholson Rd., Franksville, WI 53126-0505 414-886-5678

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Motors, Permanent Magnet-3500

† Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1194
† Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192-1193
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, 818-998-4850 ..... B•1195
§ Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
† BEI Motion Systems Company, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, 619-744-5671 ..... B•1880
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606, 919-469-8522 ..... C•1653
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000 ..... B•1200
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
† Eltrol Corporation, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, 818-709-0131 ..... B•1203
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218-1219
† Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635, 602-459-1150 ..... B•1214-1216
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311, 818-341-6161 ..... B•1895
§ Mabuchi Motor America Corp., 475 Park Ave. South, New York, NY 10016, 212-686-3622 ..... B•1231
† Maxon Precision Motors, Inc., 838 Mitten Rd., Burlingame, CA 94010, 415-697-9614 ..... B•1232
MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1233
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... B•1242
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... B•1247
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... B•1252-1253
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
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§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
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† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
§ Anaheim Automation, 910 E. Orangefair La., Anaheim, CA 92801 714-992-6990
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§ Asgalium S.A., P.O. Box 906, La Chaux-de-Fonds, SWITZERLAND CH-2301 ..... 01141 39 281 351
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
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† EG & G Rotron, Custom Div., Hasbrouck La., Woodstock, NY 12498 914-679-5201
EG & G Torque Systems, 36 Arlington St., Watertown, MA 02172 617-924-6000
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
§ Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
§ Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
§ Electrol Co., 321 Dewey St., P.O. Box 29, York, PA 17405 717-848-1722
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
† Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
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§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
Hankscraft Motors, Div. of Gerber Prods. Co., P.O. Box 120, Reedsburg, WI 53959 608-524-4341
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
IMC Magnetics Corp., IMC/Hansen, Box 23, Princeton, IN 47670-0023 .. 812-385-3415
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
§† Inertial Motors, 280 N. Broad St., Doylestown, PA 18901 215-345-1010
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
§ Landis & Gyr, Inc., 99 Castleton St., Pleasantville, NY 10570 914-747-3540
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Ormec Systems Corp., 19 Linden Park, Rochester, NY 14625 716-385-3520
† Pacific Scientific Co., 4301 Kishwaukee, Rockford, IL 61105 815-226-3100
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840 401-849-8810
Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
Servo-Tek Products Co., 1086 Goffle Rd., Hawthorne, NJ 07506 201-427-3100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
§ Westamp, 1542 15th St., Santa Monica, CA 90404 213-393-0401
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Selsyn — See Motors, Synchronous (Vol. B)

Motors, Servo-4900 — *See Vol. D*

Motors, Squirrel Cage-3500

§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
§ Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
§ Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072 201-933-0220
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820 603-742-3330
§ ebm Inds., Inc., 525 New Britain Ave., Unionville, CT 06085 203-674-1515
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
Electro-Pacific, 5770 Thornwood Dr., Goleta, CA 93117 805-964-0751
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
† McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550 609-799-0100
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514 219-262-4418

† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Stepping-3500

Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192-1193
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
§† Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000 ..... B•1200
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635, 602-459-1150 ..... B•1214-1215,1217
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1898
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... B•1242, C•1690
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... B•1252-1253
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
§† Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... B•1260
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040, 516-328-3970 ..... B•1266
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ... B•1030,1267
† Abrams Instrument Corp., 2859 W. Jolly Rd., Okemos, MI 48864 517-332-6405
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
§ Aerotech, Inc., 101 Zeta Dr., Pittsburgh, PA 15238 412-963-7470
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
§ Anaheim Automation, 910 E. Orangefair La., Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§† Berger-Lahr Corp., Fitzgerald Dr., Jaffrey, NH 03452 603-532-7701
Cyberpak Co., 905 W. Hillgrove Ave., La Grange, IL 60525 312-354-0012
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
Electric Motor Engineering, 1847 Victory Blvd., Glendale, CA 91201 818-502-1866
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ FDK America, Inc., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701 213-404-1770
† GAP Instrument Corp., 40 Oser Ave., Hauppauge, NY 11787 516-273-0909
§† Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
Icon, 156 Sixth St., Cambridge, MA 02142 617-868-5400
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311 818-341-6161
Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Matrix Corp., 1203 New Hope Rd., Raleigh, NC 27610 919-833-2000
Maxwell Electronics, P.O. Box 12033, Research Triangle Park, NC 27609 919-846-1633
Mesur-Matic Elctrns., 10 Colonial Rd., Ste. 6, Salem, MA 01970-2294 ... 617-745-7000
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
† Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
Namiki Precision Jewel Co., Ltd., 15 Warren Street, Hackensack, NJ 07601 201-343-3080
Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
Parker Hannifin Corporation, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952 ..... 707-778-1244;800-358-9068
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
Rotorque Technology Corp., 47915 Westinghouse Drive, Fremont, CA 94539 415-659-1552
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Tokyo Elec. Co., Ltd., 1-1 Nishiki-Cho, Kanda, Chiyoda-Ku, Tokyo, 101, JAPAN ..... (03) 292-1011
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348

Motors, Synchronous-3500

Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192-1193
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... B•1252-1253
§ Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
§† Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... B•1260
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1267
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Anaheim Automation, 910 E. Orangefair La., Anaheim, CA 92801 714-992-6990
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§† Berger-Lahr Corp., Fitzgerald Dr., Jaffrey, NH 03452 603-532-7701
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
§† Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
Fincor, 3750 E. Market St., York, PA 17402 717-751-4206
§ General Industries, Taylor & Olive St., Elyria, OH 44035 216-323-3136
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
§† Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§† Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
§† Hurst Manufacturing Corp., Emerson Elec. Co., Box 326, Princeton, IN 47670 812-385-2564
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
† Inland Motor, Kollmorgen Corp., 501 First St., Radford, VA 24141 703-639-9045
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
§ Landis & Gyr, Inc., 99 Castleton St., Pleasantville, NY 10570 914-747-3540
Lincoln Laser Co., 234 East Mohave, Phoenix, AZ 85004 602-257-0407
Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
† McLean Engineering, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550 609-799-0100
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Molon Motor & Coil Corp., 3737 Industrial Ave., Rolling Meadows, IL 60008 312-259-8700
† Motion Control Group, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054 619-439-7500
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Papst Mechatronic Corp., Aquidneck Indl. Pk., Newport, RI 02840 401-849-8810
§ Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321

§ SPS Inc. (Muirhead Vactric), 51 Commerce St, Springfield, NJ 07081 ... 201-376-1222
Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348
† Western Gear Corp., Applied Tech. Div., 14724 E. Proctor, City of Industry, CA 91744 818-968-6525

Motors, Synchronous, Polarized — See Motors, Synchronous (Vol. B)

Motors, Timing — See Motors, Clock & Timing (Vol. B)

Motors, Torque (Incl. Torquers)-3500

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, 516-694-6700 ..... B•1184-1185
Airpax Corporation, International Div., West Johnson Ave., Cheshire, CT 06410, 203-272-0301 ..... B•1192-1193
§ Axial Magnetics, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, 818-998-4850 ..... B•1195
Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
Brevel Motors, Inc., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, 201-933-0220 ..... B•1198
Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, 215-622-1000 ..... B•1200
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1201
Eastern Air Devices, Inc., 1 Progress Dr., Dover, NH 03820, 603-742-3330 ..... B•1202
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
† Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1218,1220
† Inland Motor, 4020 E. Inland Rd., Sierra Vista, AZ 85635, 602-459-1150 ..... B•1214-1215,1217
MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... B•1233
† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
NMB Technologies, 9730 Independence Avenue, Chatsworth, CA 91311, 818-341-3355 ..... B•1242
§ Oriental Motor U.S.A. Corporation, 2701 Toledo Street, Suite 702, Torrance, CA 90503, 213-515-2879 ..... B•1245-1246
PITTMAN, Penn Engrg. & Mfg. Corp., 343 Godshall Dr., Harleysville, PA 19438, 215-256-6601 ..... B•1247,1249
SAIA Inc., Div. of American Electronic Components, 1010 N. Main Street, Elkhart, IN 46514, 219-262-4418 ..... B•1252-1253
Shinano Kenshi Corp. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, 818-764-4266 ..... B•1255
Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040, 516-328-0200;328-3300 ..... B•1259
Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... B•1260
§ Supervexta, Div. of Oriental Motor, 2701 Plaza Del Amo, Ste. 702, Torrance, CA 90503-7395, 213-515-2264 ..... B•1263
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, 619-428-5581 ..... B•1268
Aeroflex Laboratories, Inc., Microelectronics Div., 35 S. Service Rd., Plainview, NY 11803 516-694-6700
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
Arc Systems, Inc., 2090 Joshuas Path, Hauppauge, NY 11788 516-582-8020
† Ashland Electric Products, 80 39th Street, Brooklyn, NY 11232 718-965-0770
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
Buehler Products, Inc., P. O. Box 33400, Raleigh, NC 27606 919-469-8522
Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
† Dresser Inds., 1505 Elm St, Dallas, TX 75201 214-746-6000
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
§ Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
Hertner Div., 12690 Elmwood Ave., Cleveland, OH 44111 216-252-4242
HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
IMC Components Corporation, 55 Eddy St., Providence, RI 02903 401-273-6900
IMC Magnetics Corp., Eastern Div., 570 Main St, Westbury, NY 11590 .. 516-334-7070
† Inland Motor, Kollmorgen Corp., 501 First St, Radford, VA 24141 703-639-9045
§ Japanese Products Corp., 7 Westchester Plaza, Elmsford, NY 10523 914-592-8880
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311 818-341-6161
† Magnetic Technology, 21001 Kittridge St., Canoga Pk., CA 91303 818-887-7700
Micronel U.S., 2142F Industrial Ct, Sycamore Research Center, Vista, CA 92083 619-727-7400
Motronics Corp., 15 Industrial Park, Little Falls, NY 13365 315-823-4050
Nidec-Torin Corporation, 100 Franklin Drive, Torrington, CT 06790 203-482-4422
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
PMI Motion Technologies, 49 Mall Dr., Commack, NY 11725-5703 516-864-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Robbins & Myers, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343 612-931-2700
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008 619-438-3321
SPS Inc. (Muirhead Vactric), 51 Commerce St, Springfield, NJ 07081 ... 201-376-1222
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Motors, Universal, AC or DC Operation-3500

Barber Colman Co. (A Siebe Co.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, 815-968-0660 ..... B•1196
§ Bodine Electric Company, 2500 W. Bradley Pl., Chicago, IL 60618, 312-478-3515 ..... B•1197
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239-1241
† AMETEK, Dynamics Division, AMETEK, Inc., 5649 Peck Rd., Arcadia, CA 91006 818-442-5981
† Autotrol Corporation, P.O. Box 557, Crystal Lake, IL 60014 815-459-3080
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§ Carter Motor, 2707 W. George St., Chicago, IL 60618-7898 312-588-7700
† Dynamic Air Engrg., Inc., 620 E. Dyer Rd., Santa Ana, CA 92705-5697 ... 714-540-1000
† Electric Indicator Company Inc., 272 Main Ave., Norwalk, CT 06851 203-847-5861
§† Globe Motors, 2275 Stanley Avenue, Dayton, OH 45404 513-228-3171
Parvex Division, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977 914-425-6908
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ SPS Inc. (Muirhead Vactric), 51 Commerce St, Springfield, NJ 07081 ... 201-376-1222
† Valley Electromagnetics, P.O. Box 131, Spring Valley, IL 61362 815-664-2348

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Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, 516-694-6700 ..... B•1184-1185
Hathaway Corporation, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, 918-438-7800 ..... B•1213
Industrial Drives, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, 703-639-2495 ..... B•1219
† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1180,1235,1237
† Motor Technology, Inc., 2798 Culver Ave., Dayton, OH 45429, 513-294-1041 ..... B•1239
† Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880 ..... B•1243
Sierracin/Magnedyne, 2258 Rutherford Rd., Carlsbad, CA 92008, 619-438-3321 ..... B•1256-1257
† Astromec, Inc., 1780 Forrest Way, Carson City, NV 89706 702-883-9226
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
† HHK Ind., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949 .. 215-766-0990
† IMC Magnetics Corp., Eastern Div., 570 Main St., Westbury, NY 11590 .. 516-334-7070
SPS Inc. (Muirhead Vactric), 51 Commerce St, Springfield, NJ 07081 ... 201-376-1222

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§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1838
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... B•1840-1841
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846
Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 ..... B•1864-1865
† Globe Plastics, 1342 S. Signal Dr., Pomona, CA 91766 714-623-2747
† Maury Microwave Corp., 8610 Helms Ave., Cucamonga, CA 91730 714-987-4715
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
Micro Plastics Inc., Hwy 178 North, P.O. Box 149, Flippin, AR 72634 501-453-2261
† Milross Controls, Inc., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§† Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048

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AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1271-1272
† Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
† Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1170,1221,1230
§† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
§† Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
American Photonics Inc., 71 Commerce Dr., Brookfield Center, CT 06805 203-775-8950
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Atlantic Scientific Corporation, 2711 S. Harbour City Blvd., Melbourne, FL 32901 1-800-544-4737
Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† CATEL Telecommunications, 4050 Technology Pl., Fremont, CA 94537 415-659-8988
§ Control Cable, Inc., 7261 Ambassador Rd., Baltimore, MD 21207 301-298-4411
† Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
Kinetic Systems, 11 Maryknoll Dr., Lockport, IL 60441 815-838-0005
§ Lightwave Communications, Inc., 650 Danbury Rd., Ridgefield, CT 06877 203-438-3591
† Microwave Semiconductor Corp., 100 School House Rd., Somerset, NJ 08873 201-563-6300
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
RE Instruments Corp., 31029 Center Ridge Rd., Westlake, OH 44145 ... 216-871-7617
Rockwell International Telecommunications, 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
§ SC Technology, Inc., 2450 Armstrong St., Livermore, CA 94550 415-373-9230
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Toyo Comm. Equip. Co., Ltd., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, TOKYO, JAPAN 105 ..... 03-459-7320/03-459-7310

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§ Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1871
CTS Corp., Resistor Network Div., (Formerly CTS Corp., Berne Div.), 406 Parr Rd., Berne, IN 46711, 219-589-3111 ..... A•1912
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1928-1931
§† Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1917
Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1924
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1939, B•1011
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
† Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957, B•1014
† Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... A•1959, B•1014
† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957, B•1014
Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
† Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
Sprague Electric Company, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, 619-575-9353 ..... A•2031
§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
† Northwest Microcircuits, Inc., 5464SW Philomath Blvd., Corvallis, OR 97333 503-753-8242
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Sprague Electric Company, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051 603-881-7200
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810

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§ PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1347
Axis Corporation, 7825 Engineer Rd., Ste. 208, San Diego, CA 92111 ... 619-560-7737
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530

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Optical Component Mounts & Accessories-3700

§ Aerotech, Inc., 101 Zeta Dr., Pittsburgh, PA 15238 412-963-7470
† Balzers Optical Corporation, 170 Locke Dr., Marlboro, MA 01752 617-481-9860
§ BEA electro-optics, inc., 690 First Ave., Des Plaines, IL 60016 312-298-1420
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
† D. O. Industries, 317 E. Chestnut St., E. Rochester, NY 14445 716-385-4920
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
§† Ercona, 101 Main/Patchogue Rd., Port Jefferson Sta., NY 11776 516-331-5500
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
§† General Cable Co., Fiber Optics Div., 160 Fieldcrest Ave., P.O. Box 7810, Edison, NJ 08818-7810 201-225-4780
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101 718-361-0800
† KLC/Karl Lambrecht Corp., 4204 N. Lincoln Ave., Chicago, IL 60618 312-472-5442
† Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
† Melles Griot, Optics, 1770 Kettering St., Irvine, CA 92714 714-261-5600
Noll, J. A. Co., P.O. Box 312, Monroeville, PA 15146 412-733-1089
§ Optics for Research, Inc., P.O. Box 82, Caldwell, NJ 07006 201-228-4480
Optima Precision, Inc., 3626 Hightide Drive, Rancho Palos Verdes, CA 90274 ..... 800-544-4418;213-377-4118
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Oriel Corp., 250 Long Beach Blvd., Stratford, CT 06497-0872 203-377-8282
Photobell, 40 Vreeland Ave., Totowa, NJ 07512 201-785-0049
Photon, Inc., 970 University Ave., Los Gatos, CA 95030 408-354-5600
† Pomfret Research Optics, P. O. Box 1265, Orange, VA 22960 703-854-4350
Rolyn Optics Co., 706 Arrowgrand Circle, Covina, CA 91722-2199 ..... 818-915-5707/5717
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
§† SpecTran Corp., 50 Hall Road, Sturbridge, MA 01566 617-765-0851
† Teledyne Camera Sys., 131 N. Fifth Ave., Arcadia, CA 91006 818-359-6691
† Unique Optical Co., Diversified Optical Corp., P.O. Box 585, Farmingdale, NY 11735 516-420-0288
† Carl Zeiss, Inc., One Zeiss Drive, Thornwood, NY 10594 914-747-1800

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§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876, 401-762-3800 ..... B•1269
§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461 ..... B•1278
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1179,1282-1286
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

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§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461 ..... B•1278
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1179,1282-1286
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
§ General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

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Austron, Inc., P.O. Box 14766, Austin, TX 78761-4766, 512-251-2341 .... A•1342
† Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506, 814-838-3571 ..... A•1345
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1363
† CTS Corp., Frequency Control Div., (Formerly Knights Div.), 400 Reimann Ave., Sandwich, IL 60548, 815-786-8411 ..... A•1369,1379-1381,1384
Dale Electronics, Inc., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, 602-967-7874 ..... A•1390
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1413,1415
MF Elctrns. Corp., 10 Commerce Dr., New Rochelle, NY 10801, 914-576-6570 ..... A•1418-1419
Micro Crystal Division, SMH, 35 E. 21st Street, New York, NY 10010, 212-505-5340 ..... A•1421-1422
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
§† Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1426-1427

† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1451-1452
† Reeves-Hoffman Div., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, 717-243-5929 ..... A•1454
Spectrum Technology, Inc., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, 805-964-7791 ..... A•1465-1468
Statek Corp., 512 N. Main St., Orange, CA 92668, 714-639-7810 .... A•1474-1475
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480-1482
Xsis Electronics, Inc., 12620 W. 63rd St., Shawnee, KS 66216, 913-631-0448 ..... A•1488-1489
Comstron Corp., 10 Hub Dr., Melville, NY 11747 516-756-1100
† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
Datum Inc., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790 714-533-6333
† Frequency and Time Systems, Inc., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915 508-927-8220
Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
† FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† Greenray Inds., Inc., 840 W. Church Rd., Mechanicsburg, PA 17055 717-766-0223
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
† Microwave Systems Inc., 6075 E. Molloy Rd., Syracuse, NY 13211-2100 315-437-9951
MITEQ Inc., 100 Davids Drive, Hauppauge, NY 11788 516-436-7400
Motorola, Inc., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131 312-451-1000
† Ovenaire, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901 804-977-8050
† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211
† Piezo Technology Inc., 2525 Shader Rd., Orlando, FL 32804 407-298-2000
† Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831
§ Zeta Labs., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134 408-434-3600

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§† Andersen Laboratories, 1280 Blue Hills Ave., Bloomfield, CT 06002, 203-242-0761 ..... A•1335
Ball Corp., Efratom Division, 3 Parker, Irvine, CA 92718-1605, 714-770-5000 ..... A•1344
† Connor-Winfield Corp., 1865 Selmarten Rd., Aurora, IL 60505, 312-851-4722 ..... A•1362
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† McCoy Electronics Co., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, 717-486-3411 ..... A•1414
Microsonics Inc., 60 Winter St., Weymouth, MA 02188, 617-337-4200 .... A•1425
Monitor Products Co., Inc., 502 Via Del Monte, Oceanside, CA 92054, 619-433-4510 ..... A•1427
M-Tron Industries, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, 605-665-9321 ..... A•1429
† Q-Tech Corp., 10150 W. Jefferson Blvd., Culver City, CA 90232-3510, 213-836-7900 ..... A•1451
† Vectron Laboratories, Inc., 166 Glover Ave., Norwalk, CT 06850, 203-853-4433 ..... A•1480
† Z Communications, Inc., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, 305-735-1000 ..... A•1491
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† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† Central Microwave Co., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043 314-291-5270
† Communication Techniques Inc., 36 Route 10, East Hanover, NJ 07936 201-884-2580
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† Crystek Corp, P.O. Box 06135, Ft. Myers, FL 33906 813-936-2109
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† K & L Quartztek, K & L Microwave, 20 S. 48th Ave., Phoenix, AZ 85043 602-272-7944
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MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
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† Phonon Corporation, 7 Herman Drive, P.O. Box 549, Simsbury, CT 06070 203-651-0211
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† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
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† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
† E-L Products Corp., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052 716-655-0800
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§† **Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332** ..... **A•2089**
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† **Precision Control Manufacturing, Inc., 1509 B Queen Anne Ave. N., Seattle, WA 98109, 206-281-9380** ..... **A•2097**
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§† Injectorall Electronics (Woman Owned), 110 Keyland Court, Bohemia, NY 11716, 516-563-3388 ..... C•1123
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† ISC Cardion Electronics, Inc., Long Island Expwy., Woodbury, NY 11797 516-921-7300
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Matrox Electronic Systems, 1055 St. Regis Blvd., Dorval, QU, CANADA H9P 2T4 514-685-2630

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§ Westberg Manufacturing Inc. (WESTACH), 3400 Westach Way, Sonoma, CA 95476 707-938-2121

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Rectifiers, Ultrafast-4800 — ***See Vol. A***

Rectifiers (MIL), Semiconductor-2440

† Electronic Devices, Inc., 21 Gray Oaks Ave., Yonkers, NY 10710, 914-965-4400 ..... **A•2131**
† Voltage Multipliers, Inc., 8711 W. Roosevelt Ave., Visalia, CA 93291, 209-651-1402 ..... **A•2151**
§† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015

§† Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
§ Texet Semiconductors, 301 Texet Dr., Allen, TX 75002 214-727-1111
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

Reducers, Speed – See Gear Heads & Speed Reducers (Vol. B)

Reels, Tape – See Tape Recording Accessories (Vol. D)

Reference Books – See Technical Books (Vol. D)

References, DC Voltage-2900 – *See Vol. D*

Refrigerants, Spray-1600 – *See Vol. C*

Refrigerated Cooling Equipment – See Air Conditioners (Vol. C)

Refrigerators, Environmental Test-2550 – *See Vol. D*

Regulators, Current-4000 – *See Vol. D*

Regulators, Frequency-4050 – *See Vol. D*

Regulators & References, Silicon-Also See Diodes, Zener & Stabistors-4800 – *See Vol. A*

Regulators & Stabilizers, Voltage-Also See Transformers, Voltage Regulating-4000 – *See Vol. D*

Regulators, Pulse-Width Modulating, Surface Mount-3130 – *See Vol. A*

Regulators, Voltage, Surface Mount-4800 – *See Vol. A*

Relays, Antenna – See Relays, RF (Incl. Antenna & Coaxial) (Vol. B)

Relays, Audio Operated – See Relays, Frequency Selective (Vol. B)

Relays, Coaxial – See Relays, RF (Vol. B)

Relays, Contact – See Relays, Power (Vol. B)

Relays, Cradle-4500

§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1360,1363
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1378
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... B•1412-1413
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211 408-747-0550
§ Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771

Relays, Crystal Can, 1/2 Crystal Can-4500

§† Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
† Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1359
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1388,1390-1391,1393
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416-1419
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483-1485,1487
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1561,1568
§† Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
§† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
† Wall, A. T., Co., 55 Service Ave., Warwick, RI 02886 401-739-0740

Relays, Current Sensing-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1377
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1403,1405
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1424-1425
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
§† Heinemann Electric Co., Brunswick Pike; Alt. Rte. # 1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1315
§ Instrumentation & Control Sys., 520 Interstate Rd, Addison, IL 60101, 312-543-6200 ..... B•1499
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1525
† Logitek, Inc., 101 Christopher St., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1532-1534
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1540
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1602
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, 219-563-2191 ..... B•1610
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735 .. 516-694-5100
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§ Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770

Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Sigma Instruments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
§ Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

Relays, Differential-4500

§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§ Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

Relays, Frequency Selective-4500

§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
† Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
§ Tetragenics, 55 E. Granite, P.O. Box 1338, Butte, MT 59701 406-782-9161
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

Relays, General Purpose-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1363
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1380
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... B•1383
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1388-1391
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1398
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1400-1401
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1648,1650, B•1412-1413
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1414-1415
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420-1421
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1428-1429,1431-1433,1435-1446
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1449,1451
Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1453
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1457,1463
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1464
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483,1486
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1494-1496
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 ..... B•1501
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1502-1503,1506-1509
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1525
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... B•1536
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1538-1539
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1544,1546
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550-1552,1554
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1564
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592-1593
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1598
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l Pk., Westbrook, CT 06498 203-399-6253
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
§† Associated Electronics & Mfg. Corp., 546 Valley Rd., Upper Montclair, NJ 07043 201-783-7800
§ Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Davis Elec. Co., Box 38, Cape Girardeau, MO 63701 314-335-5547
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls, A Wickes Mfg. Co., Box 16100, Austin, TX 78761 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501 206-574-5000
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861 .. 401-727-1300
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520

Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
§ Interconnect Devices, Inc., 5101 Richland Ave., Kansas City, KS 66106 .. 913-342-5544
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
† Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Syracuse Elctrns., P.O. Box 4770, Syracuse, NY 13221 315-488-4911
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484 203-926-1801
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
§ Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Relays, High Voltage (500 Volts & Over)-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1362
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366-1367,1369
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1379
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1396,1398
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402-1403,1406,1410
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422,1425
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1453,1456
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1457,1463
Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1492
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 ..... B•1501
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 ..... B•1510-1511,1513-1515
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1547-1548
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1588
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§† Interconnect Devices, Inc., 5101 Richland Ave., Kansas City, KS 66106 .. 913-342-5544
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
MSI Electronics, Inc., 34-32 57th St., Woodside, NY 11377 718-672-6500
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191

Relays, Hybrid-4500

§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1624-1625
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1459-1461
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1498
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1565
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1588
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1606
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730 704-628-1711
Control Engrg., Inc., 1686 Riverdale St., West Springfield, MA 01089 413-781-1330
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906 ..... 915-772-1061; 1-800-MIDTEX1
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§ Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700

Relays, Impulse — See Relays, Stepping (Vol. B)

Relays, I/O Modules — See Modules, I/O Relays (Vol. A)

Relays, Latching-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1363
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1378,1380-1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1390-1392
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ... B•1401
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1405-1406
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... B•1412-1413
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416-1417
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1421
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422-1423
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1441
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1498
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1504-1508
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 .. B•1513-1514
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524-1529
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1539
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1544,1547-1548
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550,1552-1554
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1565,1568
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1599-1601
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, 219-563-2191 ..... B•1611
A.D. Data Sys., Techtran Industries, 200 Commerce Dr., Rochester, NY 14623 716-334-9649
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Newburg Rd., P.O. Box 503, Hackettstown, NJ 07840 201-852-1122
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Control Engrg., Inc., 1686 Riverdale St., West Springfield, MA 01089 413-781-1330
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 .. 805-650-0260
§ Eagle Signal Controls, A Wickes Mfg. Co., Box 16100, Austin, TX 78761 512-837-8300
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§† IMO Delaval, Inc., Cowles Rd, Plainville, CT 06062-9990 203-677-1311
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469 716-657-7074
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
† Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Relays, Mercury-Wetted Contacts-4500

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§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375
§† Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384-1385
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1404-1406
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1421
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1446
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1453-1456
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1457,1463
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, 818-992-6776 ..... A•1773
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1542
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1547
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§† Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
§ Cosar Corporation, 10375 Brockwood Rd., Dallas, TX 75238 ..... 214-340-4584; 800-527-1207
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§ Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520

Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191

Relays, Meter-4500

§ Beede Electrical Instrument Co., Inc., S. Main St., Penacook, NH 03303, 603-753-6362 ..... D•1357-1359
Digitec Corp., 959 Cheney Ave., Marion, OH 43302, 614-387-3444 ..... D•1363
§ International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714, 602-748-7900 ..... D•1377
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... B•1083, D•1386
§ Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, 312-697-2260 .. D•1400
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
A & D Elec. Instrs., 73-07 88th St, Glendale, NY 11385 718-275-6516
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410 203-272-0301
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
§ ARGA Controls, 35 E. Glenarm St., Pasadena, CA 91105 213-682-3314
§ Beckman Industrial Corp., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123 619-495-3200
Calex Mfg. Co., Inc., 3355 Vincent Rd., Pleasant Hill, CA 94523 415-932-3911
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Electro Industries, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590 516-334-0870
§† International Instruments, A Prime Technology Co., Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471 203-481-5721
§ Jewell Electrical Instruments, Grenier Industrial Air Park, 850 Perimeter Rd., Manchester, NH 03108-4038 603-669-6400
§ Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800
§ LFE, Instruments Div., 55 Green St., Clinton, MA 01510 617-835-1000
Martel Electronics, 27 Roulston Rd., P.O. Box 897, Windham, NH 03087 ..... 603-893-0886;800-821-0023
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Mercer Electronics, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120 312-697-2260
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705 714-540-4914
Q.V.S., Inc., 20 North 15th St., East Orange, NJ 07017 201-673-3996
§ Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
Texmate, Inc., 348 S. Cedros Ave., P.O. Box 2000, Solana Beach, CA 92075 619-481-7177
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Relays, Motor Start-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1408-1410
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1418
FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1425
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1430,1442
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1463
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1476
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1505
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524-1528
§ Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1542-1543
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861 .. 401-727-1300
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 714-727-3001
§ KB Electronics, 73 Wortman Ave., Brooklyn, NY 11207 718-257-3300
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000

Relays, Phase Sensing-4500

§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1529
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1541-1543
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1587
§† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1591
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701 213-865-3536
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
† Logitek, Inc., 101 Christopher St., Ronkonkoma, NY 11779 516-467-4200
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Syracuse Elctrns., P.O. Box 4770, Syracuse, NY 13221 315-488-4911
† Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

Relays, Plug-in-4500

† Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1359,1361,1363
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1377-1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1386-1388,1390-1392
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1400-1401
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416-1419
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1431,1438-1442
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 .. B•1449
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1463

§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1464
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 .... B•1478,1483,1485
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1498
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 .... B•1505,1509
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 .... B•1518
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 .... B•1529
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 .... B•1531
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 .... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 .... B•1538-1539
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 .... B•1553-1554
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 .... B•1559,1561-1563,1566,1568-1570,1572-1573
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 .... B•1579-1584
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 .... B•1591
§† Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 .... B•1592-1596
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498 203-399-6253
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY .... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469 716-657-7074
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 516-937-3475
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 .... 201-291-3334; 800-221-0714
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 .... 718-478-5000; 800-221-0487
§ Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§ Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
Zlatech, 3433 Roberto Ct., San Luis Obispo, CA 93401 805-541-0488

Relays, Power-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 .... B•1357
§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 .... B•1361
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 .... B•1365,1640, C•1162
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 .... B•1372-1373
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 .... B•1375,1379-1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 .... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 .... B•1391
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 .... B•1395
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 .... B•1396,1398
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 .... B•1400-1401
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 .... B•1404,1408-1410
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 .... A•1648, B•1412-1413
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 .... B•1415
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 .... B•1422,1425
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 .... B•1437-1442
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 .... B•1449,1451
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 .... B•1457-1458,1463
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1464
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 .... B•1467
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 .... B•1471-1476
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 .... B•1478,1483,1485
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 .... B•1494-1495,1497
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 .... B•1501
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 .... B•1505,1509
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 .. B•1510-1512
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 .... B•1524,1528-1529
§ Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 .... B•1531
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 .... B•1535
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 .... D•2132
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 .... B•1538-1543
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 .... B•1546,1549
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 .... B•1552-1553
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 .... B•1557
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 .... B•1559,1566-1568
§† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 .... B•1577
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 .... B•1579-1584
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 .... B•1586-1588
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 .... B•1592,1595
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 .... B•1603,1606
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498 203-399-6253
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
AT&T, 555 Union Blvd., Allentown, PA 18103 .... 1-800-372-2447;In Canada:1-800-553-2448
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741 516-585-3400
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561

Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§ Curtis Instruments, Inc., 200 Kisco Ave., Mt. Kisco, NY 10549 914-666-2971
Davis Elec. Co., Box 38, Cape Girardeau, MO 63701 314-335-5547
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 .. 805-650-0260
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501 206-574-5000
§ Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861 .. 401-727-1300
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014 815-459-5000
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
§ Power Control, 122 Gamma Dr., Pittsburgh, PA 15238 412-782-3120
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Syracuse Elctrns., P.O. Box 4770, Syracuse, NY 13221 315-488-4911
† Teledyne Microelectronics, 12964 Panama St., Los Angeles, CA 90066 ..... 213-822-8229;213-870-9831
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
† Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

Relays, Printed Circuit Mounting (Incl. Transistor & DIP Case Types)-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1359,1362-1363
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366-1370
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1381
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... B•1383
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384-1385
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1386-1392
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1396,1398
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402-1406,1410
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1648,1651, B•1412-1413
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1414-1415
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416-1417,1419
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420-1421
FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1424
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1428-1446
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1450
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1455-1456
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1457,1459
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1464-1465,1714-1718
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1468-1476
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483-1484
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1497-1498
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1502-1509
Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 .. B•1512-1513
Leach Controls Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... B•1518
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1529
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, 317-636-5353 ..... B•1536
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1538-1539,1541-1543
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1544-1548
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550-1554
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 ..... B•1557
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559-1564,1569-1574
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1585
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1587
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1576
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592-1596
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1599-1600,1603,1605-1606,1608
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, 219-563-2191 ..... B•1610-1611
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk, Westbrook, CT 06498 203-399-6253
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Cosar Corporation, 10375 Brockwood Rd., Dallas, TX 75238 ..... 214-340-4584; 800-527-1207
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366

GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Solid State Relays, 71 Regent, Oak Brook, IL 60521 312-932-1660
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Thermosen, P.O. Box 1254, Stamford, CT 06904 203-324-6125
§† Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700

Relays, Programmable-4500

§ Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, 818-992-6776 ..... A•1773
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1543
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1569
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498 203-399-6253
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
CYTEC Corp., 2555 Baird Road, Penfield, NY 14526 ..... 716-381-4740;800-346-3117
§ Eagle Signal Controls, A Wickes Mfg. Co., Box 16100, Austin, TX 78761 512-837-8300
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ IMO Delaval, Inc., Cowles Rd, Plainville, CT 06062-9990 203-677-1311
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469 716-657-7074
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336

Relays, RF (Incl. Antenna & Coaxial)-4500

§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1388-1390,1393
Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741, 516-585-3400 ..... B•1677
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1414-1415
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1421
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422-1425
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1450
Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1452-1454
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483,1487
§ ITT Components, ITT Corporation, 5 Jenner st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1506
Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 ..... B•1510-1512,1514-1515
Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524,1526-1529
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, 818-992-6776 ..... A•1773
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1599-1601
§ Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
§ Cosar Corporation, 10375 Brockwood Rd., Dallas, TX 75238 ..... 214-340-4584; 800-527-1207
CYTEC Corp., 2555 Baird Road, Penfield, NY 14526 ..... 716-381-4740;800-346-3117
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143
§† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 805-650-0260
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501 206-574-5000
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376 312-564-8800
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786 714-982-8988
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
§ Nepenthe, Inc., 2471 E. Bayshore Road, Palo Alto, CA 94303 ..... 415-856-9332; 800-NEPENTHE
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Thermosen, P.O. Box 1254, Stamford, CT 06904 203-324-6125
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191

Relays, Reed-4500

§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366-1368
American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1376,1381
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384-1385
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402-1406
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1414-1415
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1443-1445
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1452,1454-1456
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1457,1463
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1468-1470
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1542-1543
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1545,1547
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559-1560
§ Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287, B•1576
§† Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592,1595,1597
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, 219-563-2191 ..... B•1610-1611
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010

§ Cosar Corporation, 10375 Brockwood Rd., Dallas, TX 75238 ..... 214-340-4584; 800-527-1207
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
§ Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469 716-657-7074
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§ Interconnect Devices, Inc., 5101 Richland Ave., Kansas City, KS 66106 .. 913-342-5544
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
§ MKC Electronics Corp., 9205 Quivira Road, Overland Park, KS 66215 ... 913-894-9711
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Solid State Relays, 71 Regent, Oak Brook, IL 60521 312-932-1660
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Thermosen, P.O. Box 1254, Stamford, CT 06904 203-324-6125

Relays, Reed, Surface Mount-4500

§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366,1368
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
§ Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
§ Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1445
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1452
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1469
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1497-1498
Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559-1560
Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ Baknor Industries Limited, 2209 Dunwin Drive, Mississauga, ONT., CANADA L5L 1X1 416-828-2400
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757 501-636-5000
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191

Relays, Sealed-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
† Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1359,1361,1363
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366-1370
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714, 714-660-1670 ..... B•1372-1373
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1380
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384-1385
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1386-1392
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1400-1401
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402-1406
Eichhoff Electronics, 205 Hallene Rd., Warwick, RI 02886, 401-738-1440 ..... A•1648-1651, B•1412-1413
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1417-1418
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1428-1429,1431,1434,1437-1438,1442-1446
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1452-1456
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1458-1460,1463
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1464
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1468,1471-1476
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483,1486-1487
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1497
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1502-1504,1506-1507
Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 ..... B•1510
Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... B•1516-1523
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1529
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1538,1541-1543
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1544,1548
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550-1554
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559-1561,1565,1568-1570
Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1591
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1599-1601,1604-1605
Advanced Components Inds., Inc., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245 213-322-4249
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns./Sangamo Weston Comps. Div., 1605 E. Rodney-French Blvd., New Bedford, MA 02741 617-996-8561
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224 213-631-1143
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§† Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
§ Inmark Corp., 147 West Cedar St., Norwalk, CT 06854 203-866-8474
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Thermosen, P.O. Box 1254, Stamford, CT 06904 203-324-6125

Relays, Solid State-4500

§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1362
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375,1381
AT&T, 555 Union Blvd., Allentown, PA 18103, 1-800-372-2447;In Canada:1-800-553-2448 ..... B•1383
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1396-1399
§ Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402-1403,1407-1410
§ Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
§ Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1458-1459

§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1464
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483,1488,1492
IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1498
§ Instrumentation & Control Sys., 520 Interstate Rd, Addison, IL 60101, 312-543-6200 ..... B•1499
§ International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 ..... B•1501
† International Sensor Systems, Inc., Aurora Industrial Pk., Box 345, Aurora, NE 68818, 402-694-6111 ..... A•1742
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1540-1543
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... C•1891
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550-1551
§ Opto 22, 15461 Springdale St., Huntington Bch., CA 92649, 714-891-5861 ..... B•1557
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1562,1571-1575
§ Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1585
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586-1587
§ SSAC Incorporated, P.O. Box 1000, Baldwinsville, NY 13027, 315-638-1300 ..... B•1589
§† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1599-1600,1602-1608
Allen-Bradley Co., Industrial Control Div., 1201 S. Second St, Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Newburg Rd., P.O. Box 503, Hackettstown, NJ 07840 201-852-1122
§† Antex Electronics Corp., 16100 S. Figueroa St, Gardena, CA 90248 213-532-3092
† Applied Controls Co., Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006-2828 201-227-5454
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§ Basler Elec., Rte. 143, Highland, IL 62249 618-654-2341
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Brown Boveri Elec., Norristown Rd., Spring House, PA 19477 215-628-7400
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
† Dionics, 65 Rushmore St., Westbury, NY 11590 516-997-7474
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501 206-574-5000
Enerco, Inc., 9615 W. Marginal Way S., Seattle, WA 98108 206-762-1422
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Vimsberger Strasse 51, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§ IMO Delaval, Inc., Cowles Rd, Plainville, CT 06062-9990 203-677-1311
Klockner Moeller, 4 Strathmore Rd., Natick, MA 01760 617-655-1910
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620 714-739-0770
MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 608-297-2106
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
§ MKC Electronics Corp., 9205 Quivira Road, Overland Park, KS 66215 ... 913-894-9711
National Controls Corp., 1725 Western Dr., W. Chicago, IL 60185 312-231-5900
Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385 718-441-4728
§ Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254 617-890-6107
† Preferred Electronics, Inc., Main Line Dr., P.O. Box 248, Westfield, MA 01086 413-568-2301
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 215-257-3621
Regent Controls, Inc., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767 203-736-2924
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
† Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Solid State Relays, 71 Regent, Oak Brook, IL 60521 312-932-1660
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
§† Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
§ Wheelock, Inc., 273 Branchport Ave., Long Branch, NJ 07740 201-222-6880

Relays, Solid State, Surface Mount-4500

Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1541
Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001 812-386-1000

Relays, Stepping-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1392
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1896-1897
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ Bellofram Corporation, Pulpit Rock Rd., Pelham, NH 03076 ..... 603-635-2103; 800-343-0039
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906 ..... 915-772-1061; 1-800-MIDTEX1
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501

Relays, Telephone-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1392
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ... B•1400
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420-1421
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054, 408-727-1700 ..... B•1434,1445
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1463
International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, 213-772-2000 ..... B•1501
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1505
§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1544
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1550-1551
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670

§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Davis Elec. Co., Box 38, Cape Girardeau, MO 63701 314-335-5547
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001 516-328-9292
§† Interconnect Devices, Inc., 5101 Richland Ave., Kansas City, KS 66106 .. 913-342-5544
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§ ITT Components, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718 714-727-3001
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
Lear Siegler, Inc., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406 213-452-5444
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435 815-725-2241
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906 ..... 915-772-1061; 1-800-MIDTEX1
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§† Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000
§ Wheelock, Inc., 273 Branchport Ave., Long Branch, NJ 07740 201-222-6880

Relays, Thermal-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357,1835
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350, 805-252-8330 ..... B•1415
§ Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1453
Gordos Corporation, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, 501-636-5000 ..... B•1459-1460
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1542
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 203-599-2075
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
Electronic Instruments & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-5300
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 215-257-3621
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907 419-756-5911
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200

Relays, Time Delay-4500

§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1362
§† Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375
Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1397
§ Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1402,1407
§† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416,1419
Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 .. B•1449
§ Heinemann Electric Co., Brunswick Pike, Alt. Rte. # 1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1315
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1498
§ Instrumentation & Control Sys., 520 Interstate Rd, Addison, IL 60101, 312-543-6200 ..... B•1499
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... B•1516-1519
† Logitek, Inc., 101 Christopher St., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1534
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376, 312-564-8800 ..... B•1535
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1540-1543
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1569-1570
Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ Silicon Power Cube Corp., 6015 Obispo Ave., Long Beach, CA 90805, 213-634-9390 ..... B•1586
§ SSAC Incorporated, P.O. Box 1000, Baldwinsville, NY 13027, 315-638-1300 ..... B•1589
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1591
§† Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592,1594-1595,1597
§ Air-O-Tronics, Trush Group, Route 20 E., Cazenovia, NY 13035 315-655-2387
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876 201-359-4454
§† Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
Amerace Corp., Elastimold Div., Newburg Rd., P.O. Box 503, Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l Pk., Westbrook, CT 06498 203-399-6253
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
§† Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
§ Artisan Controls Corp., P.O. Box 233, 5 Eastmans Rd., Ste. 100, Parsippany, NJ 07054 201-428-1770
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
† Babcock, Inc., 1717 West Collins Ave., Orange, CA 92667 714-633-3700
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§ Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§ Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215 414-671-6800
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 .. 812-426-2806
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§ Eagle Signal Controls, A Wickes Mfg. Co., Box 16100, Austin, TX 78761 512-837-8300
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
§ IMO Delaval, Inc., Cowles Rd, Plainville, CT 06062-9990 203-677-1311
† International Sensor Systems, Inc., Aurora Industrial Pk, Box 345, Aurora, NE 68818 402-694-6111
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St, Chicago, IL 60622 312-421-1090
Jay-El Prods., Sub. Ducommun Inc., 1859 W. 169th St, Gardena, CA 90247 213-323-7130
† Jettron Products, P.O. Box 337, E. Hanover, NJ 07936 201-887-0571
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
§ Law, R. E. Instrument, Inc., 7735 W. 112th Pl, Palos Hills, IL 60465 312-974-4000
§ Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ MKC Electronics Corp., 9205 Quivira Road, Overland Park, KS 66215 ... 913-894-9711
§ National Controls Corp., 1725 Western Dr., W. Chicago, IL 60185 312-231-5900
Nolatron, P.O. Box 4042, Harrisburg, PA 17111 717-564-3398
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173 312-843-7900
Paragon Electric Co., Inc., 606 Parkway Blvd., Two Rivers, WI 54241 414-793-1161
Regent Controls, Inc., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767 203-736-2924
† Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621

§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
† Sigmapower, Inc., 20790 Leapwood Ave., Carson, CA 90746 ..... 213-32-Sigma
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§† Syracuse Elctrns., P.O. Box 4770, Syracuse, NY 13221 315-488-4911
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
† Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907 419-756-5911
Timeco, Inc., 1035 - 26th St., P.O. Box 8038, Huntington, WV 25705 304-523-5149
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 718-441-4759
§ Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

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Relays, Vacuum-4500

§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422-1423,1425
§ Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 ..... B•1510-1512
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600

Relays, Voltage Sensitive-4500

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1363
Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ American Relays, Inc., 10306 Norwalk Blvd., Santa Fe Springs, CA 90670, 213-944-0447 ..... B•1366,1368,1370
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1375-1377
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, 312-262-7700 ..... B•1384
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1391
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ..... B•1396,1398
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1403-1404,1410
Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416-1417
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1471,1473
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478,1483
IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1498
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, 714-727-3001 ..... B•1505
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... B•1520-1523
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1529
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
† Logitek, Inc., 101 Christopher St., Ronkonkoma, NY 11779, 516-467-4200 ..... B•1534
§ Midtex Relays, Inc., 9B2 Butterfield Trail, El Paso, TX 79906, 915-772-1061;1-800-MIDTEX1 ..... B•1541-1543
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1551
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1561-1564
Schrack North America Corp., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, 516-737-0099 ..... B•1579-1584
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592-1593
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1602
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
§ Antex Electronics Corp., 16100 S. Figueroa St., Gardena, CA 90248 213-532-3092
§ ARGA Controls, 35 E. Glenarm St., Pasadena, CA 91105 213-682-3314
† Argent Electronics, 3245 S. County Rd., 25A, Troy, OH 45373 513-335-0031
† Calex Mfg. Co., Inc., 3355 Vincent Rd., Pleasant Hill, CA 94523 415-932-3911
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
Control Engrg., Inc., 1686 Riverdale St., West Springfield, MA 01089 413-781-1330
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
§ Diversified Electronics, Inc., P.O. Box 1140, Evansville, IN 47706-1140 812-426-2806
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hamilton Standard Controls, 9100 Airport Dr., P.O. Box 11648, Fort Wayne, IN 46859 219-747-6142
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
ITT Cannon, 666 E. Dyer Road, Santa Ana, CA 92705-5684 714-557-4700
§ ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 714-727-3001
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800
§ Magnecraft Electric Co., 1910 Techny Road, Northbrook, IL 60062-5376 312-564-8800
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Sigma Instuments, Pacific Scientific, 170 Pearl St., Braintree, MA 02184 617-843-5000
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507 ..... 619-566-7680;800-826-5053
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191
§ Ward Leonard Electric Co., Inc., 31 South St., Mt. Vernon, NY 10550 914-664-1000
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200
† Wilmar Electronics, Inc., 2430 Amsler St., Torrance, CA 90505 213-326-6668

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† Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
† Allied Control, Div. of Telemanique, Inc., 100 Relay Rd., Plantsville, CT 06479, 203-621-6771 ..... B•1359-1360
§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ..... B•1386-1390,1393
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803, 914-738-1611 ..... B•1394
† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1416,1419
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1422-1425
§† Genicom Corp., 1 Genicom Dr., Waynesboro, VA 22980, 703-949-1471 ..... B•1448-1449,1451
§† Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1478-1485
Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 ..... B•1510,1512,1514-1515
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk., CA 90620, 714-739-0770 ..... B•1516-1523
§† Leach Relay Division, Leach Corporation, 5915 Avalon Blvd., Los Angeles, CA 90003, 213-232-8221 ..... B•1524-1526,1528-1529
§† Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559,1568,1570
Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901, 609-589-7500 ..... B•1592,1596-1597
§† Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1598-1605
Bliley Electric Co., 2545 W. Grandview Blvd., Erie, PA 16506 814-838-3571
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
† Cornell-Dubilier Elctrns., Wayne Interchange, Plaza 1, Wayne, NJ 07470 201-256-2000
§† Deutsch Relays, Inc., 65 Daly Road, East Northport, NY 11731 516-499-6000
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350

Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
† Solid State Electronics Corp., 18646 Parthenia St., Northridge, CA 91324 818-993-8257
§† Teledyne Solid State, A Div. of Teledyne Relays, 12525 Daphne Ave., Hawthorne, CA 90250 213-777-0077
Telemecanique, Inc., Allied Control, 100 Relay Rd., Plantsville, CT 06479 203-621-6771
† Theta-J Corporation, 8 Corporate Pl., 107 Audobon Rd., Wakefield, MA 01880 617-246-4000

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§ Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1874
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1903
Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1926,1928-1931
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937-1938
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1950
§ KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1951,1953
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... A•1967
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2017
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2039
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
§ Gamble, Charles T., Inds., 605 Perkins La., Delanco, NJ 08075 609-461-1900
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501 818-990-1192
§ Liberty Intl. Corp., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505 213-539-6452
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§† Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
§ RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355 .. 215-644-1300
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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Resistors, Oil Filled-4700 — *See Vol. A*

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Resistors, Precision-4700 — *See Vol. A*

Resistors, Pressure Sensitive-4700 — *See Vol. A*

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Resistors, Surge-4700 — *See Vol. A*

Resistors, Surface Mount-4700 — *See Vol. A*

Resistors, Tapped-4700 — *See Vol. A*

Resistors, Temperature Sensitive-5300

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836-1838
† Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1932
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1935
§ International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1937

Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1945
§† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952-1953
§† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1964, B•1850
Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2005
§† Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 .. B•1864
RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2013-2016
Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2049
Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601 402-564-3131
§ Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701 402-371-0080
Degussa Corp., 104 New Era Drive, So. Plainfield, NJ 07080 201-757-6500
§ Jaro Components, Inc., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883 305-771-7000
† Lake Shore Cryotronics, Inc., 64 E. Walnut St., Westerville, OH 43081 ... 614-891-2243
§ Raltron Electronics, 2315 N.W. 107th Ave., Miami, FL 33172 305-593-6033
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053 603-625-8994
† Thermometrics, Inc., 808 U.S. Hwy. # 1, Edison, NJ 08817-4695 201-287-2870
Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502 .. 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Resistors, Tin Oxide-4700 — *See Vol. A*

Resistors, Variable — See Potentiometers (Vol. A), Rheostats (Vol. A), Resistors, Adjustable (Vol. A)

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Resistors, Zero-Ohm-4700 — *See Vol. A*

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§† Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, 915-592-4888;800-592-4888 ..... A•1854-1856,1858-1859,1867
Angstrohm Precision, Inc., A Sub of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1852-1853
§† Bourns, Inc., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, 714-781-5050 ..... A•1870
§† Bradford Electronics, Inc., 550 High Street, Bradford, PA 16701, 814-362-5700 ..... A•1872-1873,1875
Caddock Electronics, Inc., 1717 Chicago Ave., Riverside, CA 92507, 714-788-1700 ..... A•1878-1880,1882-1887,1891,1900-1901
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111, 201-371-9500 .... A•1903
§† Dale Electronics, Inc., Columbus Div., 2064 12th Ave., Columbus, NE 68601, 402-564-3131 ..... A•1927-1931
Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... A•1916-1917
§† Dale Electronics, Inc., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, 402-371-0080 ..... A•1918,1920-1922,1924
Electro-Films, Inc., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, 401-738-9150 ..... A•1933
Elliott/Jordan, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, 215-644-1300 ..... A•1934
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... A•1941
§† International Resistive Company, P.O. Box 1860, Boone, NC 28607, 704-264-8861 ..... A•1938, B•1011
Julie Research Labs., 211 West 61st St., New York, NY 10023, 212-245-2727 ..... A•1961
Kelvin Industries, Inc., 14724 Ventura Blvd., No. 1003, Sherman Oaks, CA 91403-3501, 818-990-1192 ..... A•1944-1945
§ KOA Speer Electronics, Bolivar Dr., P.O. Box 547, Bradford, PA 16701, 814-362-5536 ..... A•1948
† KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1952-1953
† Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957-1958, B•1014
† Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, 317-463-2536 ..... B•1014
† Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957, B•1014
Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ..... A•1963-1965
† Milwaukee Resistor Corp., 700 W. Virginia St., Milwaukee, WI 53204, 414-271-9900 ..... A•1970
† Mini-Systems, Inc., 20 David Rd., North Attleboro, MA 02761, 617-695-0203 ..... A•1975
§ Nytronics Components Grp., Inc., 700 Orange St., Darlington, SC 29532, 803-393-5421 ..... A•1979
§† Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076, 312-675-2600 ..... A•1980,1982-1984,1986,1993
† Ohmtek Inc., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, 716-283-4025 ..... A•2020,2022-2025
† Pacific Resistor Co., 18300 Oxnard St., Tarzana, CA 91356, 818-345-7811 ..... A•1998-1999
Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... D•1863,1874-1875
Piconics, 26 Cummings Road, Tyngsboro, MA 01879, 617-649-7501 ..... A•2001
Precision Resistive Products, Inc., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, 319-394-9131 ..... A•2003
† Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647, 813-541-5771 ..... A•2004-2005
§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103, 603-669-0054 ..... A•2010-2011
§† RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2012-2016
Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, 716-278-2000 ..... A•2032
State of the Art, Inc., 2470 Fox Hill Rd., State College, PA 16803-1797, 814-355-8004 ..... A•2035-2036
§† Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ... A•2026
Tel Labs, Inc., Sfernice, Inc., 154 Harvey Rd., PO Box 375, Londonderry, NH 03053, 603-625-8994 ..... A•2030
§† Ultronix, Inc., Sfernice, Inc., P.O. Box 1090, Grand Junction, CO 81502, 303-242-0810 ..... A•2027-2029
Vermont Precision Resistor, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, 802-253-8567 ..... A•2038
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, 216-248-9300 ..... A•2040
§† Vishay Resistive Systems Group, 63 Lincoln Hwy., Malvern, PA 19355, 215-644-1300 ..... A•2046-2047,2049
§† Beckman Industrial Corp., Subsidiary of Emerson Electric Co., 4141 Palm Street, Fullerton, CA 92635 714-447-2700
California Micro Devices, Inc., 215 Topaz Street, Milpitas, CA 95035 408-263-3214
Corning Glass Works, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830 607-974-8725
Dale Electronics, Inc., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771 704-479-6451
Electro Comp., Inc., 2415 Main St., Stratford, CT 06497 203-375-5811
Electronic Precision Components Corporation, 11 W. Sandford Blvd., Mt. Vernon, NY 10550 914-664-2333
† Hycomp, Inc., 165 Cedar Hill St., Marlborough, MA 01752 617-485-6300
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Memcor-Truohm, Inc., 1320 Flaxmill Rd., Huntington, IN 46750 219-356-4300
† Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Microplex, Inc., 1977 State College Blvd., Anaheim, CA 92806 ..... 714-979-8833; 714-634-1535
† Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
§† RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Universal Voltronics, 27 Radio Circle Dr., Mt. Kisco, NY 10549 914-241-1300
§† Vamistor Corp., 115 Industrial Pk., Sevierville, TN 37862 615-453-0001

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§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1559
§ American Zettler, 16881 Hale Ave., Irvine, CA 92714 714-660-1670
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714

Retainers, Transistor & Diode-2800 — *See Vol. C*

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Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167
Dolan-Jenner Inds., Box 1020, Woburn, MA 01801 617-935-7444
Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Rehlander Assocs., 118A Bridge St, Beverly, MA 01915 617-922-5961
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945

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Disc Instruments, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, 714-433-0343 ..... B•1885-1886
Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1898
§ Bloxcom Corporation, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090 312-520-8010
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
§† Dova Controls, 4052 148th Ave. N.E., Redmond, WA 98052 206-881-7414
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† Precision Level Vial Co., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925 ..... 215-794-0800;800-345-7517
† Precision Specialties, Inc., 19414 Londelius St., Northridge, CA 91324 ... 818-349-9774
† Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351

Sensors, CCD Image-3700

Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
§ Fairchild Weston Systems, Inc., CCD Imaging Division, 810 W. Maude Ave., Sunnyvale, CA 94086 408-720-7600
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
§ Texas Instruments, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265 214-995-6611

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Sensors, Fiber Optic-2475

Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167
† Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1230
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915, 617-922-5961 .. B•1274
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1179
Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720 617-264-9550
Dolan-Jenner Inds., Box 1020, Woburn, MA 01801 617-935-7444
Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ..... 215-524-2000;800-441-8246
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
† Galileo Electro-Optics Corp., Galileo Pk., Sturbridge, MA 01518 617-347-9191
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Scanning Devices, Inc., 108 Elm St., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
† Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
C. G. Soar, Inc., 434 Windsor Pk. Dr., Dayton, OH 45459 513-434-7643
§ Stenning Instrments, Inc., 671 Enchanted Way, Pacific Palisades, CA 90272 213-459-2930
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945
† York Technology, Inc., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502 818-955-8927

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§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, 805-583-2088 ..... B•1167
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461 ..... B•1278
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915, 617-922-5961 .. B•1274
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1294
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901, 518-561-3160 ..... B•1295
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590
Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
§ Advanced Detector Corp., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746 818-369-6886
† Atlantic Solar Products, P.O. Box 70060, Baltimore, MD 21237 ..... 301-686-2500; 800-237-6527
§ CCD Imaging, Fairchild Weston Systems, Inc., 810 W. Maude Ave., Sunnyvale, CA 94086 408-720-7600
Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720 617-264-9550
EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
§ EG&G Reticon, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197 408-738-4266
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
Evershed & Vignoles, Ltd., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, ENGLAND W4 5HJ 01-994-3670
Femco, Inc., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159 408-946-1188
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
§ Grasslin Controls Corp., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446 201-825-9696
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
LEL Co., 5 Burns Pl, Cresskill, NJ 07626 201-569-8641
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
† MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998 213-828-7496
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Scanning Devices, Inc., 108 Elm St., Waltham, MA 02154 617-891-8991
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
† Silicon Detector Corp., 855 Lawrence Dr., Newbury Park, CA 91320 805-498-6737
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036 617-853-5000
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085
§ THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200
United Detector Technology, 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129
Welch Allyn, Inc., Industrial Products Division, Jordan Rd., Skaneateles Falls, NY 13153-0187 315-685-8945

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E-T-A Circuit Breakers, 7400 N. Croname Rd., Chicago, IL 60648, 312-647-8303 ..... B•1890
Hi-G Company, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, 203-522-8600 ..... B•1488,1493
Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ..... 215-524-2000;800-441-8246
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
† Thermometrics, Inc., 808 U.S. Hwy. #1, Edison, NJ 08817-4695 201-287-2870

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Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1294
§ Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
§ Moisture Register Products Div., Aqua Measure Instrument Co., 2583 Pomona Blvd., Pomona, CA 91768-3267 714-594-5545
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277

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§ **Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800** ..... **C•1607,1613-1614**
MFM Technology, Inc., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, 516-467-5151 ..... **B•1233**
† **Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529** ..... **B•1898**
H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... **C•1709**
§ B & B Motor & Control Corp., B & B Long Island City, Apple Hill Commons, Burlington, CT 06013 ..... 203-673-7151;800-638-7807
§† Berg, W. M., Inc., 499 Ocean Ave., East Rockaway, NY 11518 516-599-5010
§ Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012 1-212-777-6571
Control Inds. Inc., 530 Burnside Ave., Inwood, NY 11696 212-471-9800
§ Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
§† Norelcom Inds., 63 Marine St., Farmingdale, NY 11735 516-249-7245
PIC Design, P.O. Box 1004, Middlebury, CT 06762 203-758-8272
§ Vemaline Prods. Div., 333 Strawberry Field Rd., P.O. Box 6979, Warwick, RI 02887 401-739-7600

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† Libbey-Owens-Ford Co., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014 412-224-1800

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Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, 201-436-2230 ..... **B•1186-1191**
† **Fabricast, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, 818-443-3247** ..... **B•1206,1208-1211**
† **Graphite Metallizing Corp., 1036 Nepperhan Ave., P.O. Box 110, Yonkers, NY 10702, 914-968-8400** ..... **B•1212**
† **Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751** ..... **B•1221-1230**
† Danmar Inds., 9705 Lurline Ave., Chatsworth, CA 91311 ..... 818-882-7979/5280
† Engelhard Corp., Menlo Pk., CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638 609-393-8350
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
† Precision Specialties, Inc., 19414 Londelius St., Northridge, CA 91324 ... 818-349-9774
§† Superior Carbon Products, Inc., Hwy. 35, Superior Place, Walnut Grove, MS 39189 601-253-2442
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 201-944-2221
† Unit Industries, 1140 E. Valencia Dr., Fullerton, CA 92631 714-871-4161

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§ **Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933** ..... **B•1108,1110-1111,1113**
§ **Aries Electronics, Box 130, Frenchtown, NJ 08825, 201-996-6841** ..... **C•1278**
§ **Bivar, Inc., 4 Thomas, Irvine, CA 92718, 714-951-8808** ..... **C•1017**

Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ **Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1122-1123**
† **Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801, 617-935-4442 ..... B•1126-1127**
§ **Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... C•1375**
§ **Industrial Devices, Inc., 260 Railroad Ave., Hackensack, NJ 07601, 201-489-8989 ..... B•1130,1132**
§ **Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1153**
§ **ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1737**
§ **Kulka (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1412**
§† **Lamptronix Co., Ltd., 81 N. Williams St., Crystal Lake, IL 60014, 815-455-0400 ..... B•1136**
† **Ledtronics, Inc., 4009 Pacific Coast Hwy., Torrance, CA 90505, 213-676-7996 ..... B•1125**
§† **Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016, 312-824-1188 ..... B•1137**
§ **Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1146-1147**
§ **Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155-1160**
† **Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161**
§† **Sylvania Miniature Lighting, GTE Corporation, W. Main St., Hillsboro, NH 03244, 603-464-5533 ..... B•1163-1165**
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§ American Ultraviolet, 562 Central Avenue, Murray Hill, NJ 07974 201-665-2211
§ Assmann Components, Div. of ebm Industries, Inc., 525 New Britain Ave., Unionville, CT 06085 203-674-1515
§† Associated Electronics & Mfg. Corp., 546 Valley Rd., Upper Montclair, NJ 07043 201-783-7800
§ Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
Auto-Swage Prods., 726 River Rd., Shelton, CT 06484 203-929-1401
§ Bulbtronics, Inc., 45 Banfi Plaza, Farmingdale, NY 11735 ..... 516-249-2272; 1-800-654-8542
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Data Display Products, Box 91072, Los Angeles, CA 90009 213-640-0442
Display Devices, Inc., Box 667, Encinitas, CA 92024 619-753-0113
† Drawn Metal Products, 6143 W. Howard St., Niles, IL 60648 312-647-8941
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Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† Electronic Essentials, 60-20 34th Avenue, Woodside, NY 11377 718-898-8300
Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
§† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
Fastex, 195 Algonquin Rd., Des Plaines, IL 60016 312-299-2222
§† Garry Electronics, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047 215-949-2300
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
§† Genisco Technology Corp., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 213-537-4750
GTI/Electronics Div., P.O. Box 2096, Hadley, PA 16130 412-253-3161
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
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Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
§† Ledco Div., 346 Chester St., St. Paul, MN 55107 612-222-2791
§ Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
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Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Star Porcelain, 71 Muirhead Ave., Trenton, NJ 08638 609-392-3154
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630 312-792-2700
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
§ Trimm, Inc., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048 312-362-3700
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
§† UVP, Inc., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778 818-285-3123
§ Wall-Able Mfg. Corp., 2201 Landmeier Rd., Elk Grove Vl, IL 60007 312-956-8000
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791
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† **AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165-1166**
Aries Electronics, Box 130, Frenchtown, NJ 08825, 201-996-6841 ..... C•1283
CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... C•1316
Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1115,1122-1123
Garry Electronics, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047, 215-949-2300 ..... C•1371
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607,1619
† **Jettron Products, P.O. Box 337, E. Hanover, NJ 07936, 201-887-0571 ... C•1407**
Oshino Electric Lamp Works, Ltd., 5-2, Minami-Shinagawa 2-chome, Shinagawa-Ku, Tokyo, JAPAN, 03-471-8548 ..... B•1147
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1142
Panduit Corp., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, 312-532-1800 ..... C•1478
§† **Precicontact, Inc., 835 Wheeler Way, Langhorne, PA 19047, 215-757-1202 ..... C•1525**
Sloan Co., 7704 San Fernando Rd., Sun Valley, CA 91353-0367, 213-875-1123 ..... B•1155-1160
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703, 508-699-3800;508-699-3450 ..... C•1569-1570,1573
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
† Eby Company, Pullman Co., 2751 Southampton Rd., Philadelphia, PA 19154 215-969-4200
§† H & T Components Inc., Unitech Plc., 35 Carlough Road, Bohemia, NY 11716 516-567-2282
Mark Eyelet Inc., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716 203-756-8847
Master Electronic Controls, P.O. Box 25905, Los Angeles, CA 90025 213-452-1336
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Wells Electronics, 1701 S. Main St., South Bend, IN 46613 219-287-5941

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Soldering Guns, Irons & Desoldering Tools-4600 — *See Vol. C*
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Soldering (MIL)-2440

Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1274-1275
GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093, 301-252-1768 ... C•1851
† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272
Cardinal Control Co., 110 Kensington Rd., Kensington, CT 06037 203-828-6379
§† Chemtronics Inc., 681 Old Willets Path, Hauppauge, NY 11788 ..... 516-582-3322; 800-645-5244
† DataCon, Inc., 60 Blanchard Rd., Burlington, MA 01803 617-273-5800
† Elvo Electronics Corporation, 140 Kisco Avenue, Mt. Kisco, NY 10549 .. 914-241-1008
† Fusion Inc., 4658 E. 355th. St., Willoughby, OH 44094 216-946-3300
§† Gardiner Solder Co., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632 312-847-0100
Kantz Electronic Industry, 1804 Wall Church Rd., Wall Township, NJ 07719 201-974-0090
† Miller, L.C., Co., 717 Monterey Pass Rd., Monterey Pk., CA 91754 213-268-3611
Multicore Solders, Cantiague Rock Rd., Westbury, NY 11590 516-334-7997
§† OK Industries, Inc., 4 Executive Plaza, Yonkers, NY 10701 914-969-6800

Solenoids, Linear-4550

Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1357
§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1614-1617
§† Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619-1621
Electro-Mechanisms, Inc., 2745 E. Huntington Dr., Duarte, CA 91010, 818-359-2535 ..... B•1622-1623
† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1624-1625
Liberty Controls, 500 Brookforest Ave., Shorewood, IL 60435, 815-725-2241 ..... B•1626
§† Linear Motions Co., 17025 Dubesor St., Valinda, CA 91744, 818-918-7806 ..... B•1627
§† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1632
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§† Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513, 312-485-5152 ..... B•1634-1635
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
§ Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505 213-530-3530
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
The Five Star Co., 120 W. Main St., Plantsville, CT 06479 203-628-5561
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
Mors Technologies Inc., Mors Group-France, 3430 Griffith, St. Laurent, Quebec, CANADA H4T 1A7 514-735-4411
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
Vanguard Relay Corp., 333 Strawberry Field Rd., Warwick, RI 02886 401-732-0700
† West Coast Elec. Mfg., 14045 Garfield Ave, Paramount, CA 90723 213-633-1010

Solenoids, Proportional-4550

Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1614-1617
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1630
Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513, 312-485-5152 ..... B•1634-1635
§ Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200

Solenoids, Rotary-4550

† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033, 203-659-3573;1-800-331-1137 ..... B•1531
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1631
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513, 312-485-5152 ..... B•1634
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
§† Densitron Corporation, 2540 W. 237th St., Torrance, CA 90505 213-530-3530
Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† Ideal Precision Meter, 214 Franklin St., Brooklyn, NY 11222 212-383-6904
† IMC Magnetics Corp., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702 213-926-0927
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200

Solenoids, Stepping-4550

Dormeyer Inds., A. F. Dormeyer Mfg. Co., Inc., 3418 N. Milwaukee, Chicago, IL 60641, 312-283-4000 ..... B•1619-1621
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1629-1630,1632

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† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1624-1625
† Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701 301-663-5141
† A.P.W. Co., Inc., 72 W. Main, Rockaway, NJ 07866 201-627-0643
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Ideal Precision Meter, 214 Franklin St., Brooklyn, NY 11222 212-383-6904
† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
Mors Technologies Inc., Mors Group-France, 3430 Griffith, St. Laurent, Quebec, CANADA H4T 1A7 514-735-4411

† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200

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Source & Detector Assemblies (SDAs)-3700

Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
† Texas Optoelectronics, Inc., 714 Shepherd Dr., Garland, TX 75042 214-487-0085

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Spark Gaps-4300

Connector Corp., 6025 N. Keystone Ave., Chicago, IL 60646, 312-539-3108 ..... C•1310
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
EG&G, Inc., Electronics Components Div., 35 Congress St., Salem, MA 01970 617-745-3200
§ Hobson Bros., 4940 W. Lawrence Ave., Chicago, IL 60630-3884 312-283-3600
Ion Physics Co., 323 Andover St., Wilmington, MA 01887 617-658-6030
Joslyn Electronic Systems, P.O. Box 817, Goleta, CA 93116 805-968-3551
† Lightning Protection Corp., Box 6086, Santa Barbara, CA 93160 .. 805-967-5089/4577
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
§ PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237 ..... 702-782-2511;800-325-7170
† Pulsar Products Div., Physics International, 2700 Merced St., San Leandro, CA 94577 415-577-7236
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139 216-248-9300

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Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590, 516-935-3640 ..... D•1025
§† Audiosone, Inc., 617 Fan Hill Rd., Monroe, CT 06468 ..... 203-268-4372/6703
§† MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† MISCO/Minneapolis Speaker Co, 3806 Grand Avenue, Minneapolis, MN 55409 612-825-1010
† Oaktron Industries, Inc., 704 30th St., Monroe, WI 53566 608-328-5560
§ Poly-Planar Inc., 50 Graphic Pl., Moonachie, NJ 07074 201-641-2206
† Speco Div., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757 ..... 516-957-8700;800-645-5516

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AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1272
† Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
Power Technology, Inc., P.O. Box 9769, Little Rock, AR 72219, 501-568-1995 ..... D•1937
§† Western Electronic Products Co., 915-G Calle Amanecer, San Clemente, CA 92672, 714-492-4677 ..... C•1761
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000

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† Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
§† AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
§† General Cable Co., Fiber Optics Div., 160 Fieldcrest Ave., P.O. Box 7810, Edison, NJ 08818-7810 201-225-4780
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
§† TRW Fiber Optic Prods., Connector Div., TRW Elctrn. Comps. Grp., 401 N. Broad St., Philadelphia, PA 19108 215-922-8900

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§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Baldor Electric Company, P.O. Box 2400, Fort Smith, AR 72902 501-646-4711
Power Functions Engineering, 3831 Cavalier Dr., Garland, TX 75042 214-278-0996

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† **Canon U.S.A., Elctrn. Comps. Div., One Canon Plaza, Lake Success, NY 11042, 516-488-6700 ..... B•1199**
Epson America, Inc., 3415 Kashiwa St., Torrance, CA 90505, 213-534-4500 ..... A•1395
† **Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... B•1267**
Advanced Micro Systems, Inc., 31 Flagstone Drive, Hudson, NH 03051 603-882-1447
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
Design Components, Inc., 1 Kenwood Circle, Franklin, MA 02038 ..... 617-528-7300; 800-341-4811
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
Escap Products, 36 Central Ave., Hauppauge, NY 11788 516-234-3900
Maxwell Electronics, P.O. Box 12033, Research Triangle Park, NC 27609 919-846-1633
Portescap U.S., Inc., 36 Central Ave., Hauppauge, NY 11788 516-234-3900
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Stock Drive Products, Div. of Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Pk., NY 11040 ..... 516-328-0200;328-3300
§† Superior Electric, 383 Middle St., Bristol, CT 06010 203-582-9561
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Steppers, Indexing, Switch-5100

Femco, Inc., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159 408-946-1188
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
§ SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222

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Acme Electric Corporation, 20 Water Street, Cuba, NY 14727, 716-968-2400 ..... D•1534
Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836-1838
Amphenol Corporation, Corporate Headquarters, 358 Fall Avenue, Wallingford, CT 06492, 203-281-3200 ..... C•1275
Atlantic Scientific Corporation, 2711 S. Harbour City Blvd., Melbourne, FL 32901, 1-800-544-4737 ..... B•1299
BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337, 612-894-9590 ..... A•1206
† **Controlled Power Co., 1955 Stephenson Hwy., Troy, MI 48083, 313-528-3700;1-800-521-4792 ..... D•2085-2086**
Displex, Inc., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542, 516-671-4400 ..... D•2091
§ **E.P.D., 1045 So. East Street, Anaheim, CA 92805-8508, 714-520-0881;1-800-343-1813 ..... D•2113**
Fagor Elctrn. Comps., Inc., Natl. Mktg. Sls. Offs., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304, 818-718-2500;800-624-5367 ..... A•2132
Hipotronics Inc., P.O. Drawer A, Brewster, NY 10509, 914-279-8091 ..... D•2114-2116
Hitran Corp., Agex, 362 Highway 31, Flemington, NJ 08822-9301, 201-782-5525 ..... D•2119
Instrument Specialties Co., P.O. Box A, Delaware Water Gap, PA 18327, 717-424-8510 ..... C•1748
ITW Paktron, Div. of Illinois Tool Works, P.O. Box 4539, 1205 McConville Rd., Lynchburg, VA 24502, 804-239-6941 ..... A•1097
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1847
Maida Development Co., 20 Libby St., Hampton, VA 23663, 804-723-0785 ..... A•1104,1107,1954-1955
Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... A•1108
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132-2133
§† **MCG Elctrns., 12 Burt Dr., Deer Park, NY 11729, 516-586-5125 ..... B•1327-1341**
Micro Devices Product Group, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, 419-756-5911 ..... B•1873
§ **Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1853-1854,1857-1858**
† **Pacific Power Source Corp., 15122 Bolsa Chica St., Huntington Bch., CA 92649, 714-898-2691;800-854-2433 ..... D•2134**
§ **Perma Power Elctrns., 5601 W. Howard Ave., Chicago, IL 60648, 312-647-9414 ..... B•1346, C•1706-1707**
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ..... D•1140
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2134-2135
† **Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•1270-1271**
§ **PolyPhaser Corporation, 1425 Industrial Way, P.O. Box 1237, Gardnerville, NV 89410-1237, 702-782-2511;800-325-7170 ..... B•1347**
§ **Pulizzi Engineering, Inc., 3260 S. Susan St., Santa Ana, CA 92704-6865, 714-540-4229 ..... D•2146**
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025, 415-361-3860 ..... B•1349
§ **Ritz Electronics/Relco, 196 Queen St. N., New Dundee, Ont., CANADA N0B 2E0, 519-696-2616 ..... C•1089**
§ **Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830, 201-321-3400 ..... B•1350-1351**
§† **Superior Electric, 383 Middle St., Bristol, CT 06010, 203-582-9561 ..... D•2155**
Teledyne Relays, Teledyne, Inc., 12525 Daphne Ave., Hawthorne, CA 90250, 213-777-0077 ..... B•1602
Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123-1165, 619-279-0831 ..... D•2156-2157
Tri-Mag, Inc., 8210 West Doe Ave., Visalia, CA 93291, 209-651-2222 ..... A•1703
§ **U.S. Power Converting Company/Relco, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, 213-316-9984 ..... C•1089**
§ Acme Electronic Distribution, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 ..... 919-738-9202;800-247-7507
Acme Transformer, Acme Electric Corporation, Rte. 4, Box 54, Lumberton, NC 28358 919-738-1121
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923 ..... 617-777-8888;800-826-2726
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
AT&T, 555 Union Blvd., Allentown, PA 18103 ..... 1-800-372-2447;In Canada:1-800-553-2448
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
§ Beswick, Dubilier International Plc., Alert Works, Frome, UNITED KINGDOM BA11 1PP ..... (0373) 64311
§ Brooks Manufacturing Corp., 4001 N. American St., Philadelphia, PA 19140 215-228-4433

Brooks Power Systems, 1810 Byberry Rd., Bensalem, PA 19020 ..... 215-244-0264; 1-800-523-1551
§† Bud Industries, Inc., 4605 E. 355th St., Willoughby, OH 44094-0431 216-946-3200
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
§ Codi Semiconductor, Inc., 144 Market St., Kenilworth, NJ 07033 201-298-0400
§ Collmer Semiconductor, Inc., 14368 Proton Rd., Dallas, TX 75244 ..... 800-527-0251; 214-233-1589
Computer Power Inc., 124 W. Main St., High Bridge, NJ 08829 ..... 201-638-8000; 800-526-5088
§ Computerware, Inc., 8480-I Tyco Rd., Vienna, VA 22180 703-821-8200
§† Control Concepts Corp., P.O. Box 1380, Binghamton, NY 13902-1380 ... 607-724-2484
Cuesta Systems Corporation, 3440 Roberto Ct., San Luis Obispo, CA 93401 ..... 805-541-4160;800-332-3440
§ Current Technology, Inc., 1400 S. Sherman, # 202, Richardson, TX 75081 214-238-5300
§ The Cylix Corporation, 2637 Townsgate Rd., Ste. 200, Westlake Vl, CA 91361 805-379-3155
§ Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078 605-665-9301
§ Datatran Corp., 355 Yuma St., Denver, CO 80223 303-778-0870
Deltron, Inc., P.O. Box 1369, Wissahickon Ave., N. Wales, PA 19454-9990 215-699-9261
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
DVE/Caltronic Co., Ltd., A Sub. of Dee Van Entrp. Co., Ltd., 407 S. Palm Ave., Alhambra, CA 91803 818-289-0310
§ Dyma Engineering, Box 1535, Los Lunas, NM 87031 505-865-6700
§ EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† EFI Corporation, 350 West 2700 South, Salt Lake City, UT 84115 ..... 801-486-5871; 800-221-1174
Electrocube, 1710 So. Del Mar Ave., San Gabriel, CA 91776 818-573-3300
§ Electronic Specialists, 171 South Main St., Natick, MA 01760 ..... 617-655-1532; 800-225-4876
Electro Standards Lab., Inc., P.O. Box 9144, Providence, RI 02940 401-943-1164
Elgar Corp., 9250 Brown Deer Rd., San Diego, CA 92121 ..... 619-450-0085; 800-854-2213
§ Energy Electronic Systems, Inc, 9486 Deereco Rd., Timonium, MD 21093 ..... 301-252-2240;800-233-4544
§ Ericson Manufacturing Co., 4215 H..mann Pkwy., Willoughby, OH 44094 216-951-8000
§ FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† General Semiconductor Ind., Inc., Square D Company, 2001 W. 10 Pl., Tempe, AZ 85281 602-968-3101
§ Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
§ Hi-Tech Components, Mitsubishi International Corp., 520 Madison Ave., New York, NY 10022 212-605-2607
† International Power Machines, 2975 Miller Park North, Garland, TX 75042 800-527-1208
Inter-Technical Group Inc., WIMA Div., One Bridge Street, Irvington, NY 10533 914-591-8822
§ ISKRA Electronics, Inc., 222 Sherwood Ave., Farmingdale, NY 11735 ..... 516-753-0400; 800-862-2101
JMK, Inc., 15 Caldwell Dr., Amherst, NH 03031 ..... ;;;603-886-4115
Joslyn Electronic Systems, P.O. Box 817, Goleta, CA 93116 805-968-3551
Kalglo Elctrns. Co., Inc., 6584 Ruch Rd., E. Allen Twp., Bethlehem, PA 18017-9359 ..... 215-837-0700;800-524-0400
L-Com Inc., 1755 Osgood St., N. Andover, MA 01845 617-682-6936
§ L.E.A. Dynatech, Inc., Dynatech Corporation, 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990 213-944-0916
† Lightning Protection Corp., Box 6086, Santa Barbara, CA 93160 .. 805-967-5089/4577
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427 513-898-3621
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750 219-356-6500
§† Microsemi Corp., 2830 S. Fairview St., Santa Ana, CA 92704 714-979-8220
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080 404-436-1300
† Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§† Power Integrity Corp., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27429-0682 ..... 919-379-9773;800-237-6260
§ RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§ SAFE Power Systems, 528 W. 21st St., Tempe, AZ 85023 602-894-6864
§ SAFE Power Systems, Acme Electric Corporation, 528 W. 21st St., Tempe, AZ 85282 602-894-6864
Sanford-Miller Corp., 8 John St., Lynbrook, NY 11563 .... 516-593-2025;800-645-5900
§ San-O Industrial Corp., 85 Orville Dr., Bohemia, NY 11716 516-567-5556
Semicon Components, Inc., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803 617-272-9015
§ Semikron, Inc., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066 ..... 603-883-8102;1-800-258-1308
Semtech, 652 Mitchell Rd., Newbury Park, CA 91320 805-498-2111
Shape Magnetronics, Inc., 901 DuPage Ave., Lombard, IL 60148 312-620-8394
† Shindengen America Inc., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361 805-373-1130
§ SL Waber, Inc., 300 Harvard Ave., Westville, NJ 08093 ... 609-456-5400;800-257-8384
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Staffall Inc., 7 Woodland St., Providence, RI 02908 401-351-8282
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§† St-Semiconductors of Indiana, Inc., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609 812-332-1435
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
§† Surgeonics Ltd., 50 Pine St., Hudson Falls, NY 12839 518-747-2156
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
§ Teccor Electronics, Inc., 1801 Hurd Dr., Irving, TX 75038 214-580-1515
§ Techni-Tool, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462 215-825-4990
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405 818-781-1642
§ Telebyte Technology, Inc., Remark Datacom Div., 270 East Pulaski Road, Greenlawn, NY 11740 ..... 516-423-3232;800-835-3298
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ TII Industries Inc., 1385 Akron St., Copiague, NY 11726 516-789-5000
§† Transtector Systems, Inc., P.O. Box 300, Hayden Lake, ID 83835 800-635-2537
§ Tripp-Lite, 500 No. Orleans, Chicago, IL 60610 312-329-1777
§† Tycor Electronic Products Ltd., 6107-6 Street S.E., Calgary, Alberta, CANADA T2H 1L9 403-259-3200
Victoreen, Inc., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139 216-248-9300
† Victor Elec. Wire & Cable, 618 Main St., W. Warwick, RI 02893 .... 401-821-1700;SALES 401-821-7800
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
Xentek, Inc., 760 Shadow Ridge Dr., Vista, CA 92083 619-727-0940

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Surveillance Systems (MIL), Radio Frequency-3475 — *See Vol. D*

Surveillance/Warning Systems (MIL), Control-3475 — *See Vol. D*

Switch Arrays-5100

CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1686
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1713-1714
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1803
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665 714-974-1701
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
§† Telmos, Inc., Universal Semiconductor, Inc., 1925 Zanker Rd., San Jose, CA 95112 408-436-1906

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† Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983 ..... D•1143
Bytex Corp., 120 Turnpike Rd., Southborough, MA 01772 617-480-0840
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Communication Cables & Connectors, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830 614-828-2468
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
§ Electro Standards Lab., Inc., P.O. Box 9144, Providence, RI 02940 401-943-1164
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222

Switches, Cam-5100

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1672
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695

Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090, 312-537-1800 ..... B•1727
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1743
† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
Allen Bradley Co., Electronic Components Div., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936 ..... 915-592-4888;800-592-4888
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498 203-399-6253
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Chicago Lock Co., 4311 W. Belmont Ave., Chicago, IL 60641 312-282-7177
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Datametrics Inc., 340 Fordham Road, Wilmington, MA 01887 617-658-5410
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070 ..... 203-658-2740; 203-651-9557
§ Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
§† General Control Co., 11 Cote Indl. Pk., Goffston, NH 03045 603-669-2844
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§† Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Techniques, Inc., 235 Jackson St., Englewood, NJ 07631 201-569-5900

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§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1672
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... B•1681
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698-1699
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... B•1707
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1714,1719
Hartmann, 10097 Tyler Place, Ijamsville, MD 21754, 301-831-1055 ..... B•1722
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1728
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1747
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1751
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752
Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... B•1771
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1789,1793
§† Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... B•1796
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
Enerco, Inc., 9615 W. Marginal Way S., Seattle, WA 98108 206-762-1422
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629 312-581-4555
§ Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 .....312-390-6680; 800-323-6693
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
§ Via West Inc., 534 N. Stone Ave., Tucson, AZ 85705 602-623-5716

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Switches, Decade-5100

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1672
§ Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
Hartmann, 10097 Tyler Place, Ijamsville, MD 21754, 301-831-1055 ..... B•1722
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1789
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... B•1796
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201

Switches, Diode-3450 — *See Vol. A*

Switches, DIP-5100

§† American Research & Irrigation, 1500 Executive Dr., Elgin, IL 60123, 312-888-7245 ..... B•1642
§† AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1257-1258
§ Aries Electronics, Box 130, Frenchtown, NJ 08825, 201-996-6841 ..... C•1278
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1658
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1663
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1682-1686
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698
§† Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1713-1714
Hartmann, 10097 Tyler Place, Ijamsville, MD 21754, 301-831-1055 ..... B•1722
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... B•1756-1757
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2088-2089, B•1771
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777

Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
§ Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1790,1793
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
§ Indek Corporation, 2360 Qume Dr., No. A, San Jose, CA 95131 408-432-1199
ITT Components, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718 714-727-3001
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201 317-636-5353
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† Minelco Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459 203-283-8261
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§ VRN International, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743 813-347-2181

Switches, Fiber Optic-2475

AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1272
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492, 203-269-8701 ..... B•1665
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1719
Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1170
† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1175
§ Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1571
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460 203-877-4577
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Fiberoptic Systems, Inc., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063 805-583-2088
† Frequency Control Products, Inc., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729 516-243-5730
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786 714-982-8988
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Penn Keystone Corp., Div. of C & K Components, Ives Road, Wallingford, CT 06492 203-269-8701
§ SC Technology, Inc., 2450 Armstrong St., Livermore, CA 94550 415-373-9230
† York Technology, Inc., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502 818-955-8927

Switches, Float-5100

Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
§† IMO Delaval, Inc., Cowles Rd, Plainville, CT 06062-9990 203-677-1311
Modern Controls Corp., 2233 Indl. Blvd., Sarasota, FL 33580 813-355-5183
† Pressure Controls, Inc., 406 Cortlandt St., Belleville, NJ 07109 201-751-5003
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600

Switches, Foot Pedal, Mat, Ribbon, etc.-5100

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ General Control Co., 11 Cote Indl. Pk., Goffston, NH 03045 603-669-2844
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Lektra Service Corp., 129-07 18th Ave., P.O. Box 222, College Point, NY 11356 718-939-7171
§† Linemaster Switch, Box 52, Woodstock, CT 06281 203-974-1000
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Switches, Hall Effect-5100

§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1773
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, 617-853-5000 ..... D•1142
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514 219-264-1116
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
Linemaster Switch, Box 52, Woodstock, CT 06281 203-974-1000
§ Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
SGS Semiconductor Corporation, 1000 E. Bell Road, Phoenix, AZ 85022 602-867-6100
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

Switches, High Voltage (Over 250 Volts)-5100

§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1670
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1410
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... B•1696
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1710
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1467
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
Hermetic Switch, Box 1325, Hwy. 92, Chickasha, OK 73018, 405-224-4046 ..... B•1724
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1780
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1798-1799
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
§† ASM, 525 Truck La., Smithfield, NC 27577 919-934-3104
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Beckman Industrial Corp., Cedar Grove Div., 89 Commerce Rd., Cedar Grove, NJ 07009 201-239-6200
Carbone-Ferraz, Inc., 14 Eastmans Rd., Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
Del Elctrns. Corp., 250 E. Sandford Blvd., Mt. Vernon, NY 10550 914-699-2000
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
EG&G, Inc., Electronics Components Div., 35 Congress St., Salem, MA 01970 617-745-3200
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504 818-846-1800
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140 805-684-4560
Landis & Gyr, Inc., 99 Castleton St., Pleasantville, NY 10570 914-747-3540
Maxwell Laboratories, 8888 Balboa Avenue, San Diego, CA 92123-1506 619-279-5100
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Millen Components, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180 617-438-6951
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Powerright Products, Inc., 2739 Oakland Avenue, Garland, TX 75041 214-840-0575
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
† Pulsar Products Div., Physics International, 2700 Merced St., San Leandro, CA 94577 415-577-7236
† Radio Switch Corp., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746 201-462-6100
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100

§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
† Tech Labs., Inc., 500 10th St, Palisades Pk., NJ 07650 201-944-2221
Teledyne Kinetics, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075 619-755-1181
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St, Covington, KY 41012 606-431-0900

Switches, Interlock-5100

§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1660
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1670
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1675
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... B•1696
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1702
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1711
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1753
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1799
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801,1803
§ C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§† Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
† Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140 805-684-4560
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 312-964-2330

Switches, Keyboard-5150

§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1675
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1713,1715
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621, 714-671-3931 ..... B•1720
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1730-1731
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1749
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767,1826-1827
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1770
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1786
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806-1807
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct, P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ Corby Industries, Inc., 1501 E. Pennsylvania St, Allentown, PA 18103 ... 215-433-1412
Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
† Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
ITW Cortron, Illinois Tool Works, 400 W. Grand Ave., Elmhurst, IL 60126 312-279-9110
Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ Marsh Products, Inc., 336 McKee St, Batavia, IL 60510 312-879-8008
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
Mechatronics/SAB Inc., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040 206-236-1000
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131 414-785-6506
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Nissei Sangyo America, Ltd., 1701 Golf Rd., Ste. 401, Rolling Meadows, IL 60008 312-981-8989
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2601 S. Moorland Rd., New Berlin, WI 53151 414-785-6506
† Risk, George, Inds., 802 S. Elm St, Kimball, NE 69145 308-235-4645
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Spectra Lux Corp., 12840 N.E. 21 St. Pl., Bellevue, WA 98005 206-747-0560
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
Standard Grigsby Inc., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Technical Panels, Inc., 9162 La Rosa Dr., Temple City, CA 91780 818-285-3105
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Thermotech, Div. of FL Industries, Inc., 1203 S. 5th St, Hopkins, MN 55343 612-933-9400
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

Switches, Key Lock-5100

§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1663-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1671
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1675
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, 617-335-5200 ..... B•1705

§ Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... B•1706
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... B•1707
EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§ Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090, 312-537-1800 ..... B•1726-1727
ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1751
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
§ Osio Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
Ark-Les, 51 Water St, Watertown, MA 02172 617-924-2330
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410 201-796-2886
§ C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Chicago Lock Co., 4311 W. Belmont Ave., Chicago, IL 60641 312-282-7177
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Communication Cables & Connectors, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830 614-828-2468
§ Corby Industries, Inc., 1501 E. Pennsylvania St., Allentown, PA 18103 215-433-1412
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504 714-250-8770
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Switches, Leaf, Single/Multiple-5100

Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070 ..... 203-658-2740; 203-651-9557
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 312-964-2330

Switches, Lever-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1650-1651
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1658-1659
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1664
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1672-1673,1812
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1692
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1743,1745
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1768
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1777
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1784
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., 5740 Corsa Ave. #104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§† General Control Co., 11 Cote Indl. Pk., Goffston, NH 03045 603-669-2844
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Milli-Switch Corp., Box 67, Gladwyne, PA 19035 ..... 215-MI2-9222
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§† Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173 312-843-7900
Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578 312-438-4000
† Radio Switch Corp., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746 201-462-6100
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§† Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277

Switches, Limit-5100

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365, C•1162
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1660
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300 ..... D•1144
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1711
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734
§† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1785

§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ American Switch Corp., 134 Water St., Wakefield, MA 01880 617-246-1007
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720 617-264-9550
Datametrics Inc., 340 Fordham Road, Wilmington, MA 01887 617-658-5410
§ Dillon, W. C., & Co., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031 507-238-4461
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
Gordon Products, 67 Del Mar Dr., Brookfield, CT 06804 203-775-4501
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504 818-846-1800
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Magnetoelastic Devices, Box 625, Pittsfield, MA 01201 413-445-5608
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§† Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173 312-843-7900
Parker Hannifin Corp., 17325 Euclid Ave., Cleveland, OH 44112 216-531-3000
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543 ..... 914-698-2026; 800-431-2625 (outside NY)
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 800-482-2828
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Sterling Instruments, 2101 Jericho Turnpike, New Hyde Pk., NY 11040 516-328-3300
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
† Techno, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040 516-328-3970
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310 305-739-4300
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201

Switches, Lock – See Switches, Key Lock (Vol. B)

Switches, low Voltage-5100

§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1668
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1688
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 617-964-6400
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504 714-250-8770
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734 ..... 517-652-2656; 800-234-7525
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260 602-991-0942
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850 308-324-4600
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St., Covington, KY 41012 606-431-0900
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Switches, Matrix-5100

Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... B•1678
CYTEC Corp., 2555 Baird Road, Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1236
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1767
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469, 716-657-7074 ..... D•1168-1169
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734
† MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, 818-992-6776 ..... A•1773
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
† Aiken Advanced Systems, Inc., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
Bytex Corp., 120 Turnpike Rd., Southborough, MA 01772 617-480-0840
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
† FEI Microwave, Inc., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086 408-732-0880
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Giltronix, 3780 Fabian Way, Palo Alto, CA 94303 415-493-1300
§ Glasgal Communications, Inc., 151 Veterans Dr., Northvale, NJ 07647 201-768-8082
† Grim Corporation, Box 67, Triangle Industrial Center, Medford, NJ 08055 609-267-7950
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
L-Com Inc., 1755 Osgood St., N. Andover, MA 01845 617-682-6936
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
§ Micom Systems, Inc., 4100 Los Angeles Ave, P.O. Box 8100, Simi Valley, CA 93062-8100 805-583-8600
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§† Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405 203-488-1033
Precision Filters, 240 Cherry St., Ithaca, NY 14850 607-277-3550
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
Stoelting Co., 1350 S. Kostner Ave., Chicago, IL 60623 312-522-4500
Technical Panels, Inc., 9162 La Rosa Dr., Temple City, CA 91780 818-285-3105
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

Switches, Membrane-5150

Bergquist, 5300 Edina Ind'l., Minneapolis, MN 55435, 800-328-3882 ..... B•1809
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673
EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698,1700
Endicott Research Group, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, 607-754-9187 ..... D•1719
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... B•1819

The Hall Company, 420 East Water St., Urbana, OH 43078, 513-652-1376 ..... **B•1822**
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... **B•1731**
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... **B•1749**
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... **B•1824**
Memtron Technologies, Inc., 1400 Weiss St., Frankenmuth, MI 48734, 517-652-2656;800-234-7525 ..... **B•1828**
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... **B•1775**
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... **B•1778,1830**
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
AMP, Box 3608, Harrisburg, PA 17105 800-362-5673
† Barrington Plastics, 3838 Church Road, Mt. Laurel, NJ 08054 609-235-5151
† Basic Electronics, Inc., 11762 Western Ave. "Q", Stanton, CA 90680 714-530-2400
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct, P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† C.A.M. Graphics Co., Inc., 15 Ranick Dr. W., Amityville, NY 11701 516-842-3400
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 617-964-6400
Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
Dorman Bogdonoff Corp., Corp. Center, Willow Pond, Andover, MA 01810 617-470-0001
† Dow Switch, Screenprint/Dow, 271 Ballardvale St, P.O. Box 1332, Wilmington, MA 01887 617-935-6395
E/M Corporation, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906 317-497-6100
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
† GraphTec Services, Inc., 1600 N.W. Madrid Way, P.O. Box 1380, Boca Raton, FL 33432 305-392-3373
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Hallmark Nameplate, Inc., 1855 New Highway, Farmingdale, NY 11735 800-645-9502
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
§ Lucas Duralith Corporation, 525 Orange St., Millville, NJ 08332 609-825-6900
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
§ Marsh Products, Inc., 336 McKee St, Batavia, IL 60510 312-879-8008
† Membronics Division, Chicago Decal Company, 3310 North Elston Avenue, Chicago, IL 60618 312-463-4007
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131 414-785-6506
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§† Miller Dial Corp., 4400 N. Temple City Blvd., El Monte, CA 91731 818-444-4555
Moxness Products, Inc., Versa Technologies, 1914 Indiana St, Racine, WI 53405 ..... 414-554-5050;800-558-5706
Nissei Sangyo America, Ltd., 1701 Golf Rd., Ste. 401, Rolling Meadows, IL 60008 312-981-8989
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2601 S. Moorland Rd., New Berlin, WI 53151 414-785-6506
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
† Sheldahl, Inc., P.O. Box 170, Hwy 3 North, Northfield, MN 55057 507-663-8000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
Technical Panels, Inc., 9162 La Rosa Dr., Temple City, CA 91780 818-285-3105
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§ Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386
Valmark Industries Inc., 1376 Borregas Ave., Sunnyvale, CA 94089 408-734-4253

Switches, Mercury Displacement-5100

§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... **B•1696**
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... **B•1420-1421,1710**
Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... **B•1712**
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... **B•1721**
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... **B•1772-1773**
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ..... **B•1833**
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... **B•1798**
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121

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Switches, Momentary Action-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1646-1647,1649-1652,1654-1655
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1660
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1907
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1688-1689
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1693
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1702-1703
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1715
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621, 714-671-3931 ..... B•1720
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1725
§ Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090, 312-537-1800 ..... B•1727
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1730-1731
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734-1735,1738-1739,1742,1744
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1749
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1750
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1752-1753
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200 ..... B•1765-1766
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1770
Microavionics Corp., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, 714-957-6904 ..... D•1136
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
§ Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1784-1785
Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
§ Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801-1803
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806
Aerospace Optics, Inc., 3201 Sandy La., Fort Worth, TX 76112 817-451-1141
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
† Basic Electronics, Inc., 11762 Western Ave. "Q", Stanton, CA 90680 714-530-2400
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct, P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 516-935-3640

§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659 714-835-6000
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
§† Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316 203-283-4388
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
§ Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 9254 Deering Avenue, Chatsworth, CA 91311 818-709-1247
† Hoffman Engineering Corp., 20 Acosta St., Stamford, CT 06902 203-325-8933
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665 714-974-1701
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710 213-534-0959
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 312-364-6038
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578 312-438-4000
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
† Risk, George, Inds., 802 S. Elm St, Kimball, NE 69145 308-235-4645
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021 516-466-0911
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Stacoswitch, 1139 Baker St., Costa Mesa, CA 92626 714-549-3041
Switches Unlimited, Inc., 34-11,56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect., IL 60056 312-297-0070
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 312-964-2330
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Switches, Multiposition-5100

AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1258
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1655
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1688
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698-1699
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... B•1706
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... B•1707
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1715-1716,1718-1719
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1740
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1747
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1750
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752-1753
† Microavionics Corp., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, 714-957-6904 ..... D•1136
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1785
§ Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1788-1789,1791-1793
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... B•1796-1797
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1802-1803
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ..... B•1805
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ American Switch Corp., 134 Water St, Wakefield, MA 01880 617-246-1007
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
§† ASM, 525 Truck La., Smithfield, NC 27577 919-934-3104
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 617-964-6400
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Chicago Lock Co., 4311 W. Belmont Ave., Chicago, IL 60641 312-282-7177
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 805-650-0260
§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
§† Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Judco Mfg. Inc., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710 213-534-0959
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140 805-684-4560
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 312-364-6038
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578 312-438-4000
Radio Switch Corp., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746 201-462-6100
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 818-964-6565
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Switches, Optical-3700

HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... B•1272-1273
§ Marktech International Corp., 120 Broadway, Menands, NY 12204, 518-436-5865 ..... B•1138-1139,1275
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, 617-853-5000 ..... D•1142
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
§ EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
HEI, Inc., Optoelectronics Div., 1495 Steiger Lake La., P.O. Box 5000, Victoria, MN 55386 612-443-2500
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§ Optek Technology, Inc., 345 Industrial Blvd, McKinney, TX 75069 214-542-9461
§ Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
§ SC Technology, Inc., 2450 Armstrong St., Livermore, CA 94550 415-373-9230
† UCE, Inc., 35 Rockland Rd., Norwalk, CT 06854 203-838-7509

Switches, Paddle Handle-5100

§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1651
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1666-1667,1669
§ Dai-ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1741
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200 ..... B•1764-1765
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
Airpax Corp., Woods Rd., Cambridge, MD 21613 301-228-4600
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ American Switch Corp., 134 Water St., Wakefield, MA 01880 617-246-1007
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630 312-792-2700
§ Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211

Switches, Peripheral-5100

Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983 ..... D•1143
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
§ Dataprobe, 170 Coolidge Ave., Englewood, NJ 07631 201-569-6464
Electro Standards Lab., Inc., P.O. Box 9144, Providence, RI 02940 401-943-1164
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
§ Glasgal Communications, Inc., 151 Veterans Dr., Northvale, NJ 07647 .. 201-768-8082
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484 203-926-1801
† Terminal Data Corp., 15733 Crabbs Branch Way, Rockville, MD 20855 .. 301-921-8282
§ Via West Inc., 534 N. Stone Ave., Tucson, AZ 85705 602-623-5716

Switches, Photoelectric-3700

§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
HEI, Inc., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, 612-443-2500 ..... B•1272-1273
§ Banner Engineering Corp., 9714 - 10th Ave. N., Minneapolis, MN 55441 612-544-3164
Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ..... 215-524-2000;800-441-8246
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ Grasslin Controls Corp., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446 201-825-9696
HEI, Inc., Optoelectronics Div., 1495 Steiger Lake La., P.O. Box 5000, Victoria, MN 55386 612-443-2500
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173 312-843-7900
§ Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069 214-542-9461
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
§ Redington Counters, 130 Addison Rd., Windsor, CT 06095 203-688-6205
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
Scanning Devices, Inc., 108 Elm St., Waltham, MA 02154 617-891-8991
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

Switches, Port Sharing-5100

Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983 ..... D•1143
Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Capulum Cable Technology, Ltd., 106-195 Stafford Road, Nepean, Ontario, CANADA K2H 9C1 613-726-1966
§ Complexx Systems, Inc., Astrocom Corp., 4930 Research Dr., Huntsville, AL 35805 205-830-4310
§ Dataprobe, 170 Coolidge Ave., Englewood, NJ 07631 201-569-6464
§ Electro Standards Lab., Inc., P.O. Box 9144, Providence, RI 02940 401-943-1164
§ Glasgal Communications, Inc., 151 Veterans Dr., Northvale, NJ 07647 .. 201-768-8082
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469 716-657-7074
L-Com Inc., 1755 Osgood St., N. Andover, MA 01845 617-682-6936
§ Micom Systems, Inc., 4100 Los Angeles Ave, P.O. Box 8100, Simi Valley, CA 93062-8100 805-583-8600
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484 203-926-1801
§ Terminal Data Corp., 15733 Crabbs Branch Way, Rockville, MD 20855 .. 301-921-8282
§ Via West Inc., 534 N. Stone Ave., Tucson, AZ 85705 602-623-5716

Switches, Power-5100

Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1655
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1377
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1663-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1674
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1908
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1688
§ Dai-ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... B•1696
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1702-1703
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§† Heinemann Electric Co., Brunswick Pike, Alt. Rte. # 1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1316
Hermetic Switch, Box 1325, Hwy. 92, Chickasha, OK 73018, 405-224-4046 ..... B•1724
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1733
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1740
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 .. B•1510,1512
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
Marway Prods. Inc., 311 N. Clara St., Santa Ana, CA 92703, 714-973-1800 ..... D•2132
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1769
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1785

§ **Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000** ..... **B•1786**
† **Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621** ..... **B•1577**
§ **Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311** .. **C•1547-1548**
Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... **B•1791-1793**
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... **B•1794-1795**
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... **B•1798-1799**
† **STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053** ..... **B•1590**
§ **Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700** ..... **B•1803**
Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... **B•1805**
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St, Milwaukee, WI 53201 414-382-2000
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
§ American Switch Corp., 134 Water St, Wakefield, MA 01880 617-246-1007
† Arra Inc., 15 Harold Ct, Bay Shore, NY 11706 516-231-8400
§† ASM, 525 Truck La., Smithfield, NC 27577 919-934-3104
§ Augat Alcoswitch, 1551 Osgood St, N. Andover, MA 01845 617-685-4371
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515 219-262-8608
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
Carbone-Ferraz, Inc., 14 Eastmans Rd., Parsippany, NJ 07054 ..... 201-428-8400; 800-526-9067
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 .. 805-650-0260
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
§ Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504 818-846-1800
§ Landis & Gyr, Inc., 99 Castleton St, Pleasantville, NY 10570 914-747-3540
Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427 513-898-3621
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† MICRA Corp., 120 Ricefield Lane, Hauppauge, NY 11788 516-231-8600
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
§ Payne Engineering, Box 70, Scott Depot, WV 25560 304-757-7353
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Radio Switch Corp., 64 S. Main St, P.O. Box A, Marlboro, NJ 07746 201-462-6100
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
Schaffner EMC, Inc., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083 ..... 201-851-0644; 800-367-5566
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901 609-589-7500
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
Teledyne Kinetics, Div. of Teledyne, Inc., 410 S. Cedros Ave., Solana Beach, CA 92075 619-755-1181
§ USD Products, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656 312-867-4600

Switches, Pressure-5100

† **Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY)** ..... **B•1787**
§ Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
§† Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
† Edcliff Div., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016 818-358-4571
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
§ Marsh Products, Inc., 336 McKee St., Batavia, IL 60510 312-879-8008
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
† Pressure Controls, Inc., 406 Cortlandt St., Belleville, NJ 07109 201-751-5003
§ Reliance Electric Co., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199 800-245-4501
Sigma-Netics, Inc., One Washington Ave., Fairfield, NJ 07006 201-227-6372
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000

Switches, Program-5100

§† **American Research & Engineering, 1500 Executive Dr., Elgin, IL 60123, 312-888-7245** ..... **B•1642**
AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... **C•1165,1258**
Aries Electronics, Box 130, Frenchtown, NJ 08825, 201-996-6841 ..... **C•1278**
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... **B•1674**
Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... **B•1678**
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... **B•1681**
§† **Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600** ..... **B•1694**
§† **EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000** ..... **B•1698**
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... **B•1717-1718**
Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... **B•1728**
§ **Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217** ..... **B•1823**
§ **IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151** ..... **B•1747**
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... **B•1748**
§ **Jolo Industries, 13921 Nautilus Dr., Garden Grove, CA 92643, 714-554-6840** ..... **C•1410**
† **Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621** ..... **B•1630**
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... **B•1778**
Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... **B•1790,1793**
§† **Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300** ..... **B•1796**
† **Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221** ... **B•1805**
§ Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§ American Control Products, Div. of Precision Timer Co., Inc., 13 Westbrook Ind'l. Pk., Westbrook, CT 06498 203-399-6253
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Augat Alcoswitch, 1551 Osgood St, N. Andover, MA 01845 617-685-4371
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
CDS - Colorado Data Sys., 3301 W. Hampden, Unit C, Englewood, CO 80110 ..... 303-762-1640;800-CDS-ATE1
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ Cramer Co., Mill Rock Rd., Old Saybrook, CT 06475 203-388-3574
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§† CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St, Milwaukee, WI 53216 414-449-7487
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
§ Grasslin Controls Corp., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446 201-825-9696
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
† Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260 602-991-0942
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440

§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Precision Mechanisms, 44 Brooklyn Ave., Westbury, NY 11590 ..... 516-ED3-5955
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St., Middletown, CT 06457 203-632-1000
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Standard Grigsby Inc., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Techniques, Inc., 235 Jackson St., Englewood, NJ 07631 201-569-5900
§ Tenor Company, 17020 W. Rogers Dr., New Berlin, WI 53151 414-782-3800

Switches, Proximity-5100

§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1659
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1404
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... B•1696
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1711
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1747
§† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1798-1799
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
† Computer Components, Inc., 629 Fifth Ave., Pelham, NY 10803 914-738-1611
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ..... 215-524-2000;800-441-8246
† Eldec Corporation, Sensing Systems Div., 22000 Bothell Way-S.E., Bothell, WA 98041-3002 206-487-4000
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
§ Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
§ Gordon Products, 67 Del Mar Dr., Brookfield, CT 06804 203-775-4501
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551 414-648-2361
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
§ Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
§† NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081 201-376-6070
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173 312-843-7900
§ Photoswitch Div., Allen Bradley Co., 265 Winter St., Waltham, MA 02154 617-466-8000
† Raymond Engrg. Inc., Raycorder Prods. Div., 217 Smith St., Middletown, CT 06457 203-632-1000
§ Redington Counters, 130 Addison Rd., Windsor, CT 06095 203-688-6205
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 415-471-9717
Sensor Corp., Box 140, Scottdale, PA 15683 412-887-4080
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
Skan-A-Matic, Electro Corporation, Route 5 West, Elbridge, NY 13060 .. 315-689-3961
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
§ Tri-Tronics Co. Inc., 6902 Cypress Park Drive, Tampa, FL 33622 ..... 813-886-4000; 800-237-0946
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
† Whittaker Corp., 10880 Wilshire Blvd., Los Angeles, CA 90024 213-475-9411

Switches, Pushbutton, Illuminated-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1652,1654-1655
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1659
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1663
§† C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492, 203-269-8701 ..... B•1665
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1675
CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1689
§ Dai-ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1693
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1702-1703
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1725
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734-1739
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752-1753
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1760-1761
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1770
† Microavionics Corp., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, 714-957-6904 ..... D•1136
§† Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1786
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. C•1547-1548
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
§ Sorenson Lighted Controls, 75 Locust St., Hartford, CT 06114, 203-527-3092;1-800-243-0240 ..... B•1161
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801-1803
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806-1807
§ Adalet-PLM Div, Div. Scott & Fetzer Co., 4801 W. 150th St., Cleveland, OH 44135 216-267-9000
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
† Aerospace Optics, Inc., 3201 Sandy La., Fort Worth, TX 76112 817-451-1141
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
† Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557

§ Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
§† E-Tron Corporation, 30 Ethel Rd., Edison, NJ 08817 201-287-9039
§† Furnas Elec., 1197 McKee St., Batavia, IL 60510 312-879-6000
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ General Control Co., 11 Cote Indl. Pk., Goffston, NH 03045 603-669-2844
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
§ Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504 714-250-8770
§† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504 818-846-1800
† Jay-El Prods., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247 213-323-7130
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
† Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 312-867-9600
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† Milli-Switch Corp., Box 67, Gladwyne, PA 19035 ..... 215-MI2-9222
§ MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532 312-969-4550
§ Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543 ..... 914-698-2026; 800-431-2625 (outside NY)
§ Qualtek Electronics Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 .. 216-951-3300
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Saint-Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
† Stacoswitch, 1139 Baker St., Costa Mesa, CA 92626 714-549-3041
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Switches, Pushbutton, Nonilluminated-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1652,1654-1655
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1659
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1674-1675,1812
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1692
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§† Electro-Mech Components, Inc., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, 818-442-7180 ..... B•1703
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621, 714-671-3931 ..... B•1720
§ IDEC Corporation, 1213 Elko Drive, Sunnyvale, CA 94089-2211, 408-747-0550 ..... B•1725
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1728
International Resource Svcs., 7792 N.W. 72nd Ave., Miami, FL 33166, 305-884-2924 ..... B•1729
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734-1739
IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1747
§† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1751
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752-1753
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1760-1762
§ Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767
§ Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1770
§† Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
§ Osio Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
§† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1784-1785
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1786
§ Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. C•1547-1548
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1553
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801,1803
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806-1807
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Amptronix, Inc., P.O. Box 8146, Rowland Heights, CA 91748 714-595-5814
Ark-Les, 51 Water St., Watertown, MA 02172 617-924-2330
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
† Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316 203-283-4388

§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119 206-284-2200
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525 312-354-1040
§† Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
ITT Components, ITT Corporation, 5 Jenner st., Ste. 100, Irvine, CA 92718 714-727-3001
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504 714-250-8770
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
† Korry Electronics Co., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109 206-281-1300
Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† Milross Controls, Inc., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 312-364-6038
Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Qualtek Electronics Corp., 7158 Industrial Pk. Blvd., Mentor, OH 44060 216-951-3300
Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 818-964-6565
† Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
Standard Grigsby Inc., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY 0911-65521
Switches Unlimited, Inc., 34-11 56th St, Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
§ Tektone Sound & Signal, 1331 S. Killian Dr., Lake Park, FL 33403 305-844-2383
† Thermo Electric, 109 Fifth St., Saddle Brook, NJ 07662 201-843-5800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 312-964-2330
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

Switches, Reed-5100

Coto Corporation, 55 DuPont Drive, Providence, RI 02907, 401-943-2686 ..... B•1395
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1404
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1711
§† Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 .... B•1721,1891
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
Hermetic Switch, Box 1325, Hwy. 92, Chickasha, OK 73018, 405-224-4046 ..... B•1724
MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1855-1856
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
† Risk, George, Inds., 802 S. Elm St., Kimball, NE 69145, 308-235-4645 ... B•1833
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... A•1287, B•1576,1798-1799
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
Douglas Electronics, 718 Marina Blvd., San Leandro, CA 94577 415-483-8770
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
Electric Device, PO Box 337, Canfield, OH 44406 216-533-1111
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
Fujitsu Components of America, 3320 Scott Blvd., Santa Clara, CA 95054 408-727-1700
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Numberg 82, WEST GERMANY ..... (0)911/65521 or 65520
INRESCO, Inc., 654 Ocean Road, Pt. Pleasant, NJ 08742 201-892-5881
§ Maxi-Switch Co., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433 612-755-7660
§ Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191

Switches, RF-5100

Bell Inds., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, 213-537-5200 ..... A•1204
† Compac, 1320-13 Lincoln Ave., Holbrook, NY 11741, 516-585-3400 ..... B•1677
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1689
CYTEC Corp., 2555 Baird Road, Penfield, NY 14526, 716-381-4740;800-346-3117 ..... D•1236
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1767
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420,1711
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, 408-292-4025 ..... B•1424
Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ..... A•1398
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701, 516-226-8900 ..... A•1770
Hermetic Switch, Box 1325, Hwy. 92, Chickasha, OK 73018, 405-224-4046 ..... B•1724
Information Transfer Indl. Inc., Box 357, Holcomb, NY 14469, 716-657-7074 ..... D•1168
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1751
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798, 201-227-2000 ..... A•1771
Kilovac Corp., Box 4422, Santa Barbara, CA 93140, 805-684-4560 .. B•1510-1511
† MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ..... B•1758
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, 818-992-6776 ..... A•1773
Mini-Circuits Lab., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, 718-934-4500 ..... A•1775
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... B•1797
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
† Aiken Advanced Systems, Inc., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197 703-370-0900
† Alan Industries Inc., P.O. Box 1203, Columbus, IN 47201 812-372-8869
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc., 20 Sylvan Rd., Woburn, MA 01801 617-935-5150
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Applied Research, Inc., 111 New South Rd., Hicksville, NY 11802 516-938-9700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 516-231-8400
† Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
§ Control Cable, Inc., 7261 Ambassador Rd., Baltimore, MD 21207 301-298-4411
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678

§† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 .. 805-650-0260
Dow Switch, Screenprint/Dow, 271 Ballardvale St., P.O. Box 1332, Wilmington, MA 01887 617-935-6395
† Eagle, P.O. Box 911, Fallbrook, CA 92028 619-728-6000
Eaton Corporation, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086 408-730-6410
§ EH Electronics, Inc., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538 415-651-2340
§ Glasgal Communications, Inc., 151 Veterans Dr., Northvale, NJ 07647 .. 201-768-8082
Glassman High Voltage Inc., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889 201-534-9007
Hirose Electric U.S.A., Inc. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 9254 Deering Avenue, Chatsworth, CA 91311 818-709-1247
Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
KDI Electronics, Inc., Engelmann & Pyrofilm Divisions, 60 S. Jefferson Rd., Whippany, NJ 07981 201-887-8100
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 201-569-8282
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
M/A-COM Microwave Components, Inc., South Avenue, Burlington, MA 01803 617-272-3000
§† M/A-COM Omni Spectra, Inc., 21 Continental Blvd., Merrimack, NH 03054 603-424-4111
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
§† Micronetics, 36 Oak St., Norwood, NJ 07648 201-767-1320
§ Namco Controls, An Acme-Cleveland Co., 7567 Tyler Blvd., Mentor, OH 44060 216-946-9900
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 617-943-7440
Peca, Inc., 592 Winks Lane, Bensalem, PA 19020 215-245-1550
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Radio Switch Corp., 64 S. Main St., P.O. Box A, Marlboro, NJ 07746 201-462-6100
Reeve Electronics, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612 312-670-0150
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† RMS Electronics Inc., 50 Antin Pl., Bronx, NY 10462 ..... 212-892-6700;800-223-8312
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ..... 603-645-6000 Ext. 4299
† Sivers IMA, Div. of Philips, 5669 Selmaraine Drive, Culver City, CA 90230 213-390-7477
Summit Engineering Corp., Box 938, Bozeman, MT 59715 406-587-4511
Support Systems Intl. Corp., 150 South Second St., Richmond, CA 94804 415-234-9090
† Tachonics Corporation, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536 609-275-2550
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
Til-Tek Limited, 500 Van Buren St., P.O. Box 550, Kemptville, Ontario, CANADA K0G 1J0 613-258-5928
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Trompeter Electronics, Inc., 31186 La Baya Dr., P.O. Box 5069, Westlake Village, CA 91359-5069 818-707-2020
† Vectronics Microwave Corp., 113 Lincoln Blvd., Middlesex, NJ 08846 ... 201-356-2377
§ Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610
§ Wabash Relay & Electronics, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992 219-563-2191
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010
† Waveline, Box 718, W. Caldwell, NJ 07006 201-226-9100
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 .... 301-948-3434; 800-638-2048
Western Multiplex Corp., 1320 Bayport Avenue, San Carlos, CA 94070 .. 415-592-8832
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Switches, Rocker-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1644-1647,1649
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1666-1668
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1689
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1692
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1713-1714
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
§† Heinemann Electric Co., Brunswick Pike, Alt. Rte. #1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1316
Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090, 312-537-1800 ..... B•1726
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1741
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... B•1756
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1760-1763
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200 ..... B•1764-1766
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1773
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Oslo Controls, 328 Industrial Ave., Cheshire, CT 07096-1511, 203-272-2794 ..... B•1782
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1053
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801-1802
Airpax Corp., Woods Rd., Cambridge, MD 21613 301-228-4600
§ Alpha Products, Inc., 5740 Corsa Ave. #104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Ark-Les, 51 Water St., Watertown, MA 02172 617-924-2330
§ Ark-les Special Products Corp., Stackpole Switches, P.O.BOX 14466, Raliegh, NC 27620 919-828-6201
Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
§ Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Judco Mfg. Inc., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710 213-534-0959
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
† Measurement Systems, Inc., 121 Water St., Norwalk, CT 06854 203-838-5561
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000
§ SL Waber, Inc., 300 Harvard Ave., Westville, NJ 08093 ... 609-456-5400;800-257-8384
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351

Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St, Attleboro, MA 02703 617-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Switches, Rotary-5100

§ Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, 201-436-2230 ..... B•1191
§ AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1655
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1663-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
CTS Corp., Electromechanical Div., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, 219-295-3575 ..... A•1907-1908, B•1681
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1685-1686
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, 617-335-5200 ..... B•1705
§ Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... B•1706
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538, 415-656-3400 ..... B•1707
† EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
§† Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1716-1719
Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1733
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1739
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
§† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1750-1751
† Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1221,1230
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752-1754
§† Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1768-1769
§ Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... A•2088-2089, B•1771
† Microavionics Corp., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, 714-957-6904 ..... D•1136
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772-1773
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1780-1781
Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1785
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... A•2098
§ Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1788-1789,1791-1793
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795
§† Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... B•1796-1797
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St, Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., 5740 Corsa Ave. #104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St, San Jose, CA 95134 408-946-6000
Ark-Les, 51 Water St, Watertown, MA 02172 617-924-2330
§† ASM, 525 Truck La., Smithfield, NC 27577 919-934-3104
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
Carson Manufacturing Co., Inc., 5453 N. Rural St, P.O. Box 20464, Indianapolis, IN 46220 317-257-3191
† Carter Manufacturing Corporation, 237 Sugar Road, Bolton, MA 01740 .. 617-779-5501
§ Clarostat Mfg. Co., Inc., Hawker Siddeley, PLC., 3 Washington St., Dover, NH 03820 603-742-1120
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Communication Cables & Connectors, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830 614-828-2468
Cord Electronics, Inc., 177 Cantiague Rock Rd, Westbury, NY 11590 ... 516-935-3640
§ CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
CTS Corporation, Microelectronics Div., 1201 Cumberland Ave., W. Lafayette, IN 47906 317-463-2565
§ Dreefs Switch, Inc., 3782 Hawthorn Ct, Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
Duncan Electronics, Inc., 2865 Fairview Rd., Costa Mesa, CA 92626 714-545-8261
§† Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
† E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680 714-669-9473
Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ GC-Thorsen, 1801 Morgan St, P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090 312-537-1800
Interface Products, Inc., 2185 S. Grand Ave., Santa Ana, CA 92705 714-549-4977
ITT Components, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718 714-727-3001
K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716 ..... 201-291-0500; 800-631-2165
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Mallory Timers, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201 317-636-5353
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
† Maurey Instrument Corp., 4555 W. 60th St, Chicago, IL 60629 312-581-4555
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
Methode Electronics, Inc., 7444 W. Wilson Ave., Chicago, IL 60656 312-867-9600
† Microlab/FXR, 10 Microlab Rd., Livingston, NJ 07039 201-992-7700
§ Microwave Development Laboratories, 10 Michigan Dr., Natick, MA 01760 617-655-0060
† Minelco Inc. - A Talley Ind., 135 S. Main St., Thomaston, CT 06787-0459 203-283-8261
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
§ Piher International Corp., 903 Feehanville Dr., Mt. Prospect, IL 60056 ..... 312-390-6680; 800-323-6693
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Radio Switch Corp., 64 S. Main St, P.O. Box A, Marlboro, NJ 07746 201-462-6100
† Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008 408-377-4621
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952 707-778-6311
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 .. 818-964-6565
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
Standard Grigsby Inc., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Numberg 82, WEST GERMANY 0911-65521
Telonic/Berkeley, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652 714-494-9401
§ Tel Tec, Inc., 7890 12th Ave. S., Minneapolis, MN 55425 612-854-9177
Tettex Instruments, Inc., P.O. Box 281, Fairview Village, PA 19409-0281 215-539-6050
† Thermo Electric, 109 Fifth St., Saddle Brook, NJ 07662 201-843-5800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070

Switches, Sealed-5100

Altech Corporation, 349 Rte. 206, Somerville, NJ 08876, 201-359-4454 ..... B•1365,1640, C•1162
§† American Research & Engineering, 1500 Executive Dr., Elgin, IL 60123, 312-888-7245 ..... B•1642
AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974, 201-464-3550 ..... B•1377
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661

§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
Bergquist, 5300 Edina Ind'l., Minneapolis, MN 55435, 800-328-3882 ..... B•1809
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1659
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1663
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1673,1675
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... B•1676
CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1682-1685
§ CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1688
Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1692
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379, 203-599-2075 ..... B•1404
§ Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... B•1696
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698-1699
§ Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, 617-335-5200 ..... B•1705
§ Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... B•1706
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1420,1710-1711
Gordos Corporation, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, 501-636-2111 ..... B•1712
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1715
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1721
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... B•1723
Hermetic Switch, Box 1325, Hwy. 92, Chickasha, OK 73018, 405-224-4046 ..... B•1724
Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1728
§ ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1739,1743,1745
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ..... B•1750
Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1170
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... B•1630,1752,1754
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... B•1757
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200 ..... B•1766
Mechanical Enterprises, 461 Carlisle Dr., Herndon, VA 22070, 703-435-9496 ..... B•1767,1826-1827
Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... B•1771
§† Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1855-1856
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... B•1775
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1784-1785
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
§ Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... B•1788-1791, 1793
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1798-1799
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801 ..... B•1804
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
Veetronix, Inc., Sub. Reach Electronics, Box 480, Lexington, NE 68850, 308-324-4600 ..... B•1806
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
† Aerospace Optics, Inc., 3201 Sandy La., Fort Worth, TX 76112 817-451-1141
§ American Switch Corp., 134 Water St, Wakefield, MA 01880 617-246-1007
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304 818-700-1933
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
§ Clare Division, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645 312-262-7700
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§ Communication Cables & Connectors, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830 614-828-2468
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010 .. 415-347-8217
ITT Components, ITT Corporation, 5 Jenner .st, Ste. 100, Irvine, CA 92718 714-727-3001
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Risk, George, Inds., 802 S. Elm St, Kimball, NE 69145 308-235-4645
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
Schroff Incorporated, Schroff GMBH, 170 Commerce Dr., Warwick, RI 02886 401-732-3770
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
§† Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
§ Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007

Switches, Slide-5100

§† American Research & Engineering, 1500 Executive Dr., Elgin, IL 60123, 312-888-7245 ..... B•1642
§ AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165,1258
Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1648
§ Aries Electronics, Box 130, Frenchtown, NJ 08825, 201-996-6841 ..... C•1278
§ Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1667
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1674
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... B•1683,1685
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1689
§ Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 ..... B•1713-1714
§ Illinois Lock Co., The Eastern Co., 303 W. Hintz Rd., Wheeling, IL 60090, 312-537-1800 ..... B•1726-1727
International Resource Svcs., 7792 N.W. 72nd Ave., Miami, FL 33166, 305-884-2924 ..... B•1729
ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1733
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1740,1743
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1748
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942 ..... B•1776-1777
§ Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Preh Electronic Industries, Inc., 470 E. Main St., Lake Zurich, IL 60047-2578, 312-438-4000 ..... B•1786
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... B•1794-1795

H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1553
§ Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1803
Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002 201-436-2230
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Ark-Les, 51 Water St., Watertown, MA 02172 617-924-2330
§ Ark-les Special Products Corp., Stackpole Switches, P.O.BOX 14466, Raliegh, NC 27620 919-828-6201
Arstan Products International Inc., 99 Jericho Tpke., Jericho, NY 11753 516-333-8100
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
Cord Electronics, Inc., 177 Cantiague Rock Rd., Westbury, NY 11590 ... 516-935-3640
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
§ Gaynor Electric Co., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Guardian Elec. Mfg. Co., 1550 W. Carroll Ave., Chicago, IL 60607 312-243-1100
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
§ Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
§ Lutron Electronics Co., Box 205, Suter Rd., Coopersburg, PA 18036 215-282-3800
† LVC Industries, Inc., 23 Hanse Ave., Freeport, NY 11520 516-868-1900
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501 515-573-1300
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

Switches, Snap Action (All Types)-5100

§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1646
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ..... B•1660
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662
§† C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492, 203-269-8701 ..... B•1665
Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1674
§† CW Industries, 130 James Way, Southhampton, PA 18966, 215-355-7080 ..... B•1689
§ Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050 ..... B•1691
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... B•1692-1693
§ Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087, 312-662-7667;800-323-9605 ..... B•1695
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719 ..... B•1704
EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557 ..... B•1701
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... B•1710
§ Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... B•1715
† Heinemann Electric Co., Brunswick Pike, Alt. Rte. # 1, P.O.Box 6800, Lawrenceville, NJ 08648-0800, 609-882-4800 ..... B•1316
ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400 ..... B•1732
§† ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1740,1742-1744
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... B•1824-1825
§ Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050 ..... B•1759
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200 ..... B•1766
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1770
§† Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ..... B•1772
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1856
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ..... B•1778
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1780
§† Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171 ..... B•1784
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700 ..... D•1053
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
Airpax Corp., Woods Rd., Cambridge, MD 21613 301-228-4600
§ Allen-Bradley Co., Industrial Control Div., 1201 S. Second St., Milwaukee, WI 53201 414-382-2000
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Ark-Les, 51 Water St., Watertown, MA 02172 617-924-2330
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
§† Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
§ Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
Chicago Lock Co., 4311 W. Belmont Ave., Chicago, IL 60641 312-282-7177
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
§† Columbus Electric Mfg. Co., Switch Division, Route 3, Box 90, Piney Flats, TN 37686 1-800-251-7828
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
CTS Corporation, 905 West Blvd. North, Elkhart, IN 46514 219-293-7511
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460 203-877-4577
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
§† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
ELMA Electronic Inc., 41440 Christy Street, Fremont, CA 94538 415-656-3400
† Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861 .. 401-727-1300
§ Entech Systems, Inc., 17B Herman Dr., Simsbury, CT 06070 203-651-9557
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
The Hall Company, 420 East Water St., Urbana, OH 43078 513-652-1376
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
§ J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Kaut & Bux Manufacturing Co., 675 Tower Rd., P.O. Box 867, Mundelein, IL 60060 312-949-8505
§ Landis & Gyr, Inc., 99 Castleton St., Pleasantville, NY 10570 914-747-3540
Leecraft Mfg., 21-02 44th Rd., Long Island City, NY 11101 718-392-8800
Linemaster Switch, Box 52, Woodstock, CT 06281 203-974-1000
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Mantex Corp., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051 313-628-8200
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
† Milli-Switch Corp., Box 67, Gladwyne, PA 19035 ..... 215-MI2-9222
Milross Controls, Inc., 511 Second St. Pike, Southampton, PA 18966 215-355-0200
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260 602-991-0942
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Roanwell, 180 Varick St., New York, NY 10014 212-989-1090
† Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
Schroff Incorporated, Schroff GMBH, 170 Commerce Dr., Warwick, RI 02886 401-732-3770
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
Shin-Etsu Polymer, 34135 7th St., Union City, CA 94587 415-475-9000

§ SL Waber, Inc., 300 Harvard Ave., Westville, NJ 08093 ... 609-456-5400;800-257-8384
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 ... 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
† Square D Co., Executive Plaza, Palatine, IL 60067 ... 312-397-2600
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 ... 312-844-4300
† Sundstrand Data Control Inc., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701 ... 206-885-3711
Switches Unlimited, Inc., 34-11 56th St, Woodside, NY 11377 ... 718-478-5000; 800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 ... 315-468-6211
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 ... 602-792-2230
Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650 ... 201-944-2221
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 ... 617-699-3800
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 ... 312-297-0070
§ Torq Corp., 32 W. Monroe St., Bedford, OH 44146 ... 216-232-4100
Tricon Industries, Inc., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076 ... 312-964-2330
§ United Electric Controls, 85 School St., Watertown, MA 02172 ... 617-WA6-1000
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St., Covington, KY 41012 ... 606-431-0900
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 ... 813-371-4242

Switches, Solid State-5100

§ Burgess Switch Co., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, 219-262-8608 ... B•1660
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ... B•1663
§ Crydom Company, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, 213-865-3536 ... B•1396-1398
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ... A•1767
§ Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ... B•1693
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, 617-335-5200 ... B•1705
† Frequency Electronics, Inc., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, 516-794-4500 ... A•1398
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ... B•1734
† MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988 ... B•1758
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600 ... B•1773
Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ... B•1778
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ... B•1780
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ... D•1140
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ... A•2134-2135
Sprague Electric Company, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, 617-853-5000 ... D•1142
† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ... B•1590
§† Adams-Russell, Anzac Div., 80 Cambridge St., Burlington, MA 01803 671-273-3333
Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 ... 516-694-6700
† Aiken Advanced Systems, Inc., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197 ... 703-370-0900
† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 ... 617-681-8520
† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 ... 617-329-4700
† Arra Inc., 15 Harold Ct., Bay Shore, NY 11706 ... 516-231-8400
Astro-Geo-Marine, Inc., 202 E. Cota St., Santa Barbara, CA 93101 ... 805-965-7005
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 ... 516-328-1600
§ Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 ... 213-589-6181
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 ... 617-425-2346
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 ... 514-739-3274
Coaxial Dynamics, 15210 Industrial Parkway, Cleveland, OH 44135 .... 1-800-COAXIAL
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 ... 617-268-2100
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 ... 412-776-1591
Datel, Inc., 11 Cabot Blvd., Mansfield, MA 02048 ... 617-339-3000
† Dionics, 65 Rushmore St., Westbury, NY 11590 ... 516-997-7474
§ Douglas Randall, 6 Pawcatuck Ave., Pawcatuck, CT 06379 ... 203-599-2075
Dynage/Controls, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012 ... 605-296-3487
§ EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460 ... 203-877-4577
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 ... 714-642-2427
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 ... 414-449-7487
Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ... 215-524-2000;800-441-8246
Elec-Trol, Inc., 26477 N. Golden Valley Rd., Saugus, CA 91350 ... 805-252-8330
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 ... 312-882-5757
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ... 214-470-2106/2107
Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604 ... 919-833-0707
Enerco, Inc., 9615 W. Marginal Way S., Seattle, WA 98108 ... 206-762-1422
§ General Instr., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304 ... 415-493-0400
General Magnetics, 211 Grove St., Bloomfield, NJ 07003 ... 201-743-2700
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 ... 516-226-8900
† Genisco Technology Corp., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221 ... 213-537-4750
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ... (0)911/65521 or 65520
§ Halmar Electronics, Inc., 900 N. Hague Ave., Columbus, OH 43204 ... 614-275-0530
HEI, Inc., Optoelectronics Div., 1495 Steiger Lake La., P.O. Box 5000, Victoria, MN 55386 ... 612-443-2500
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 ... 214-470-4271
† Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 ... 714-752-3800
Jay-El Prods., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247 ... 213-323-7130
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
§† Leach Control Products Div., Leach Corporation, 6900 Orangethorpe Ave., Buena Pk, CA 90620 ... 714-739-0770
Linemaster Switch, Box 52, Woodstock, CT 06281 ... 203-974-1000
† Lorch Electronics, Sub. of Vernitron Corp., 105 Cedar La., Englewood, NJ 07631 ... 201-569-8282
§ Lutron Electronics Co., Box 205, Suter Rd., Coopersburg, PA 18036 215-282-3800
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 ... 617-272-3000
† Magnum Microwave Corp., 4575 Cushing Pkwy., Fremont, CA 94538 ... 415-657-9898
† MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949 ... 608-297-2106
Matrix Systems Corp., 5177 N. Douglas Fir Rd., Calabasas, CA 91302 .. 818-992-6776
† Merrimac Industries, 41 Fairfield Pl, West Caldwell, NJ 07006 ... 201-575-1300
Microphase, 587 Connecticut Ave., Norwalk, CT 06856 ... 203-866-8000
§† Micro Power Sys. Inc., 3100 Alfred St., Santa Clara, CA 95050 408-727-5350
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
Olektron Corp., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570 ... 617-943-7440
Omega Engineering, Box 4047, Stamford, CT 06907 ... 203-359-1660
§ Payne Engineering, Box 70, Scott Depot, WV 25560 ... 304-757-7353
Power Functions Engineering, 3831 Cavalier Dr., Garland, TX 75042 214-278-0996
§† Precision Monolithics, Inc., 1500 Space Park Dr., Santa Clara, CA 95054-3499 ... 408-727-9222
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 ... 215-257-3621
RCA Solid State Div., Linear Integrated Circuits, Rte. 202, Somerville, NJ 08876 ... 201-685-6000
Regent Controls, Inc., 39 Fanny St., P.O. Box 767, Shelton, CT 06484-0767 ... 203-736-2924
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 ... 914-241-1334
Sanders Associates, Inc., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500 ... 603-645-5548
† Sanders Associates, Inc., Microwave, 955 Perimeter Rd., Manchester, NH 03108 ... 603-645-6000 Ext. 4299
§ Scientific Technologies, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544 ... 415-471-9717
Signal Systems International, P.O. Box 198, Holmdel, NJ 07733 201-741-1120
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§ SSAC Incorporated, P.O. Box 1000, Baldwinsville, NY 13027 315-638-1300
§ Struthers-Dunn, Inc., Subsidiary of Nytronics, Inc., Lamb's Rd., Pitman, NJ 08071-0901 ... 609-589-7500
§ TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 ... 602-792-2230
§ Teccor Electronics, Inc., 1801 Hurd Dr., Irving, TX 75038 ... 214-580-1515
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 ... 617-491-1670
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 ... 406-586-0291
Tempo Instrument, Inc., 87 Modular Ave., Commack, NY 11725 516-864-3700
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200
† Watkins-Johnson Co., 3333 Hillview Ave., Palo Alto, CA 94304 415-493-4141
Wide Band Engineering Co., Inc., Box 21652, Phoenix, AZ 85036 602-254-1570

Switches, Step Type-5100

§† Communications Instruments, Inc., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, 704-628-1711 ... B•1393
§ ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ... B•1734
† Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800 ... B•1750-1751
† Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ... B•1630,1754
§† Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000 ... B•1778
† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ... B•1787
§ Schurter, Inc., 1016 Clegg Ct., Petaluma, CA 94952, 707-778-6311 .. C•1547-1548
Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ... B•1793
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805

§ Airflyte Elctrns. Co., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002 201-436-2230
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
§† ASM, 525 Truck La., Smithfield, NC 27577 919-934-3104
† Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704 714-556-3100
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
GTE Switching & Telephone Products, 400 N. Wolf Rd., Northlake, IL 60164 312-681-7100
Litton Encoder Div., 20745 Nordhoff St., Chatsworth, CA 91311 818-341-6161
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
J. R. Merritt Controls, Inc., 8 Crimmins Rd., Darien, CT 06820 203-656-0143
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Ohmite Manufacturing Co., 3601 W. Howard St., Skokie, IL 60076 312-675-2600
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Sealectro-BICC Electronics, 40 Lindeman Dr., Trumbull, CT 06611 203-372-4118
§ Tenor Company, 17020 W. Rogers Dr., New Berlin, WI 53151 414-782-3800

Switches, Surface Mount-5100

§ American Research & Engineering, 1500 Executive Dr., Elgin, IL 60123, 312-888-7245 ..... B•1642
Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
† Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143 ..... A•1767
EAO Switch Corp., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, 203-877-4577 ..... B•1697
§ EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698
ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... B•1734,1740
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... B•1756-1757
Mepcopal Company, 11468 Sorrento Valley Rd., San Diego, CA 92121, 619-453-0332 ..... B•1771
Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... B•1801
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082 ... 617-964-6400
Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087 312-360-3500
§ Control Cable, Inc., 7261 Ambassador Rd., Baltimore, MD 21207 301-298-4411
§ CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446 805-238-0350
Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403 ..... 612-375-9639;800-826-8719
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344 612-934-4400
K-Two Industries, 4331 Miranda Ave., Palo Alto, CA 94306 408-720-9316
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
§ The Wadsworth Electric Manufacturing Co., Inc., 20 W. 11th St., Covington, KY 41012 606-431-0900
Wilbrecht Electronics, 346 Chester St., St. Paul, MN 55107 612-222-2791

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Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141 ..... B•1835
§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836,1838
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861, 401-727-1300 ..... B•1843-1845
Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846
Micro Devices Product Group, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, 419-756-5911 ..... B•1343,1873
§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1857
§ Selco Products Co., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, 714-521-8673 ..... B•1867
§ Aqualarm, Marine Safety Systems, Inc., 1151 D. Bay Blvd., Chula Vista, CA 92011 619-575-4011
§ Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
§ Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
Burling Instruments, P.O. Box 298, Chatham, NJ 07928 201-635-9481
Cambridge Aerofio Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Capintec Instruments, 6 Arrow Rd., Ramsey, NJ 07446 201-825-9500
† Chatham Controls, 33 River Rd., Chatham, NJ 07928 201-635-8892
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
† Dresser Inds., 1505 Elm St., Dallas, TX 75201 214-746-6000
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ E-Squared Technology Corp., 4475 Dupont Ct # 9, Ventura, CA 93003 805-644-9544
§ Fenwal, 400 Main St., Ashland, MA 01721 505-881-2000
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
Jaico Products, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622 312-421-1090
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 215-257-3621
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
§ Stancor Products, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947 219-722-2244
† Sundstrand Data Control Inc., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701 206-885-3711
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907 419-756-5911
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200

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AMP, Box 3608, Harrisburg, PA 17105, 800-362-5673 ..... C•1165
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1663-1664
§ Cherry Electrical Products, Cherry Corporation, 3600 Sunset Avenue, Waukegan, IL 60087, 312-360-3500 ..... B•1674,1812
§† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173, 312-843-2200 ..... B•1679
§† Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600 ..... B•1694
§† EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000 ..... B•1698-1699
Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... B•1706
§ Inter-Market, 1946 Lehigh Ave., Glenview, IL 60025, 312-729-5330 ..... B•1728
§ Interswitch, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, 415-347-8217 ..... B•1823
§ IVO Industries, Inc., 201 Industrial Way W., Eatontown, NJ 07724, 201-542-5151 ..... B•1076,1747
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... B•1749
§ Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300 ..... B•1768
§ Omron Elctrns., Inc., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, 312-843-7900 ..... B•1781
§ Shelly Associates, Inc., 14281 Chambers Road, Tustin, CA 92680, 714-669-9850 ..... B•1092
† Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... B•1805
American Control Technology, Microdot Graphics, Inc., 825 Village Quarter Rd., West Dundee, IL 60118 312-426-6780
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845 617-685-4371
§ Cincinnati Electrosys., 420 Wards Corner Rd., Loveland, OH 45140 513-831-4347
Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
§ Erni Components, 520 Southlake Blvd., Richmond, VA 23236 804-794-6367
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
Noble U.S.A., Inc., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008 .. 312-364-6038
§ Seacor, Inc., 123 Woodland Ave, Westwood, NJ 07675 201-666-5600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
Tansitor Electronics, West Rd., P.O. Box 230, Bennington, VT 05201 802-442-5473
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277

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Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983 ..... D•1143
§ American Switch Corp., 134 Water St., Wakefield, MA 01880, 617-246-1007 ..... B•1643
§ Arcolectric Corp., 9001 Canoga Ave., Canoga Park, CA 91304, 818-700-1933 ..... B•1651
§† Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050, 804-973-4411 ..... B•1661
§ Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371 ..... B•1656-1657
§ C & K Components, Inc., 15 Riverdale Ave., Newton, MA 02158-1082, 617-964-6400 ..... B•1662-1664
§ Carlingswitch, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156, 203-793-9281 ..... B•1669

§ **Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011, 212-691-9050** ..... **B•1691**
§ **Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400** ..... **B•1692**
§ **Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719** ..... **B•1704**
† **EnTech Corporation, 17A Herman Drive, Simsbury, CT 06070, 203-658-2740;203-651-9557** ..... **B•1701**
Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040 .... **B•1714**
Hasco Components, Inc., 247-40 Jericho Tpke., Bellrose Village, NY 11001, 516-328-9292 ..... **B•1723**
§ **ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400** ..... **B•1733**
Kay Elemetrics Corp., 12 Maple Ave., Pine Brook, NJ 07058-9798, 201-227-2000 ..... **A•1771**
§ **Marquardt Switches Inc., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, 315-655-8050** ..... **B•1759**
§ **McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383, 219-465-2200** ..... **B•1764-1765**
§† **Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600** ..... **B•1772-1773**
§ **NKK Switches of America, Inc., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, 602-991-0942** ..... **B•1776-1777**
§† **Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171** ..... **B•1784-1785**
Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... **B•1794-1795**
§ **Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530, 914-681-0700** ..... **D•1053**
H. H. Smith (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... **C•1553**
Switchcraft, Inc., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, 312-792-2700 ..... **B•1801**
§ **T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, 203-926-1801** ..... **B•1804**
† **Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221** ... **B•1805**
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
† Airpax Corp., Woods Rd., Cambridge, MD 21613 301-228-4600
§ Alpha Products, Inc., 5740 Corsa Ave. # 104, Westlake Village, CA 91362 818-889-9304
§ Amptronix, Inc., P.O. Box 8146, Rowland Heights, CA 91748 714-595-5814
Ark-Les, 51 Water St., Watertown, MA 02172 617-924-2330
§ Aromat Corp., 629 Central Avenue, New Providence, NJ 07974 201-464-3550
Augat Inc., 33 Perry Ave., Box 779, Attleboro, MA 02703 617-222-2202
Bosch, Robert, Corp., 2800 S. 25th Ave., Broadview, IL 60153 312-865-5200
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410 201-796-2886
§ C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§ Cole-Hersee Co., 20 Old Colony Ave., Boston, MA 02127-2467 617-268-2100
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
§† Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
§† Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ Electric Switches, Inc., 2478 Fletcher Dr., Los Angeles, CA 90039 213-660-1310
§ FEME Electronics, Inc., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462 215-941-0366
§ Gaynor Electric Co., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316 203-283-4388
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000
Ghielmetti, Inc., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770 213-463-5111
† Haydon Switch & Instrument, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705 203-756-7441
ICO-RALLY Corporation, 2575 E. Bayshore Rd., Palo Alto, CA 94303 415-856-9900
† Imtronics Industries, 11930 31st Ct. N., St. Petersburg, FL 33716 813-572-9010
ISL Products Int'l, Ltd., 235 P Robbins Lane, Syosset, NY 11791-6093 .. 516-937-3475
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
Jefferson Elec., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021 312-691-2400
† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
§ Littelfuse, Inc., Sub. of Tracor, Inc., 800 E. Northwest Hwy., Des Plaines, IL 60016 312-824-1188
§† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
Manufacturers Component, Inc., 2260 W. 77 St., Hialeah, FL 33016 ..... 305-556-4481; 800-367-0377
§ MEC A/S, Industriparken 23, Ballerup, DENMARK DK-2750 011-452-973366
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788 516-582-3400
† Milli-Switch Corp., Box 67, Gladwyne, PA 19035 ..... 215-MI2-9222
§ Mitsumi Elec. Co., Ltd., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, JAPAN 489-5333
§ Philmore Manufacturing, 40 Inip Dr., Inwood, NY 11696 516-239-6161
§ Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
§ Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
† Resistance Technology Inc., 1260 Red Fox Rd., St. Paul, MN 55112 612-636-9770
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
§ Schroff UK Ltd., Maylands Ave., Hemel Hempstead, Herts, ENGLAND HP2 4SG 0442-40471/6
§ SMK Electronics Corporation, U.S.A., 1901 Nancita Cir., Placentia, CA 92670 714-996-0960
§ Spemco Switches, 23425 Harper, Box 386, St. Clair Shores, MI 48080 .. 800-482-2828
Switches Unlimited, Inc., 34-11 56th St., Woodside, NY 11377 ..... 718-478-5000; 800-221-0487
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
Tane Alarm Products, 247-40 Jericho Tpke., Floral Park, NY 11001 516-328-3351
Texas Instruments, Connector Systems Division, 34 Forest Street, Attleboro, MA 02703 ..... 508-699-3800;508-699-3450
Texas Instrs., Matls. & Controls Grp., 34 Forest St., Attleboro, MA 02703 617-699-3800
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
§ Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242

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§ **Electronic Components Groupe, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, 612-375-9639;800-826-8719** ..... **B•1704**
GM Nameplate, Inc., 2040 15th Ave. West, Seattle, WA 98119, 206-284-2200 ..... **B•1819**
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621, 714-671-3931 ..... **B•1720**
The Hall Company, 420 East Water St., Urbana, OH 43078, 513-652-1376 ..... **B•1822**
§ **ITT Schadow, 8081 Wallace Rd., Eden Prairie, MN 55344, 612-934-4400** ..... **B•1732**
JAE Electronics Inc., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, 714-250-8770 ..... **B•1749**
Jayco Plastics of California, Inc., 507 W. Blueridge Ave., Orange, CA 92665, 714-974-1701 ..... **B•1824**
§ **Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032, 815-235-6600** ..... **B•1773**
MOLEX, Inc., 2222 Wellington Ct., Lisle, IL 60532, 312-969-4550 ..... **B•1775**
§ **Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000** ..... **B•1778**
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
Advanced Input Devices, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814 208-765-8000
§ Alps Electric (USA), Inc., 3553 N. First St., San Jose, CA 95134 408-946-6000
Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
§ Bowmar Instrument Corp., Data Entry Division, 4640 126th Ave. N., Clearwater, FL 34622-4796 813-573-2525
§ Brady, W. H., Co., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201 414-355-8300
C.A.M. Graphics Co., Inc., 15 Ranick Dr. W., Amityville, NY 11701 516-842-3400
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
§† Eaton Corp./MSC Products, 1640 Monrovia Avenue, Costa Mesa, CA 92627 714-642-2427
Efector, Inc., 805 Spring Dale Dr., Exton, PA 19341 ..... 215-524-2000;800-441-8246
Enerco, Inc., 9615 W. Marginal Way S., Seattle, WA 98108 206-762-1422
§ ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
† Hallmark Nameplate, Inc., 1855 New Highway, Farmingdale, NY 11735 800-645-9502
† Holt Inc., 9351 Jeronimo Rd., Irvine, CA 92718 714-859-8800
† Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
§ Lucas Duralith Corporation, 525 Orange St., Millville, NJ 08332 609-825-6900
§ Lutron Electronics Co., Box 205, Suter Rd., Coopersburg, PA 18036 215-282-3800
Mepco/Centralab, Inc., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131 414-785-6506
§† Miller Dial Corp., 4400 N. Temple City Blvd., El Monte, CA 91731 818-444-4555
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2601 S. Moorland Rd., New Berlin, WI 53151 414-785-6506
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543 ..... 914-698-2026; 800-431-2625 (outside NY)
Relay Service Co., 1300 N. Pulaski Rd., Chicago, IL 60651 312-252-2700
§ Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507 312-844-4300
§ Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703 602-792-2230
Technical Panels, Inc., 9162 La Rosa Dr., Temple City, CA 91780 818-285-3105
§ Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect, IL 60056 312-297-0070
§ Topflight, 160 East 9th Ave., York, PA 17404 ..... 717-843-9901;800-233-9386
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

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Switches (MIL), Non-RF-2440

† **Advanced Systems Concepts, 2333 N. Lake Ave., Altadena, CA 91001, 818-791-0983** ..... **D•1143**
§† **Augat Alcoswitch, 1551 Osgood St., N. Andover, MA 01845, 617-685-4371** ..... **B•1656-1657**
Cole Instruments, 2650 S. Croddy Way, Santa Ana, CA 92704, 714-556-3100 ..... **B•1676**
§ **CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350** ..... **B•1683**
§† **Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600** ..... **B•1694**

Durakool, Inc., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, 219-264-1116 ..... **B•1696**
§† **EECO Incorporated, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, 714-835-6000** ..... **B•1699**
Electroswitch, Southern Div., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, 919-833-0707 ..... **B•1706**
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... **B•1710-1711**
§† **Grayhill Inc., 561 Hillgrove Ave., La Grange, IL 60525, 312-354-1040** ..... **B•1713-1714,1716-1719**
Grimes Company, 115 S. Arovista Circle, Brea, CA 92621, 714-671-3931 ..... **B•1720**
ITW Switches, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, 312-282-4040 ..... **B•1734,1744-1745**
† **Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800** ..... **B•1750-1751**
Lucas Ledex, Inc., P.O. Box 427, Vandalia, OH 45377-0427, 513-898-3621 ..... **B•1630**
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... **B•1757**
† **Mepco/Centralab, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, 515-573-1300** ..... **B•1768-1769**
Microavionics Corp., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, 714-957-6904 ..... **D•1136**
† **Oak Switch Systems, 100 S. Main St., Crystal Lake, IL 60014, 815-459-5000** ..... **B•1778**
† **Orbit Instrument of Cal., 6431 Global Dr., Cypress, CA 90630, 714-527-0561** ..... **D•1139**
† **Otto Controls, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, 312-428-7171** ..... **B•1784-1785**
Shallco, Inc., Box 1089, Smithfield, NC 27577, 919-934-3135 ..... **B•1788-1793**
Tech Labs., Inc., 500 10th St., Palisades Pk., NJ 07650, 201-944-2221 ... **B•1805**
† Accudyne Corp., P.O. Box 1429, Janesville, WI 53547 608-752-9081
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
Aerospace Optics, Inc., 3201 Sandy La., Fort Worth, TX 76112 817-451-1141
§† Arrow Hart Components, Cooper Industries, P.O. Box 9050, Charlottesville, VA 22906-9050 804-973-4411
C & K/Unimax, Inc., C & K Components, Inc., Ives Rd., P.O. Box 152, Wallingford, CT 06492 203-269-8701
† Capitol Switch Inc., Box 890, Danbury, CT 06810 203-744-3300
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Control Products, Inc., 280 Ridgedale Ave., E. Hanover, NJ 07936 201-887-9400
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
† Electroswitch, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188 617-335-5200
† Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861 .. 401-727-1300
§† J-B-T Switches, Cutler-Hammer Prods., Eaton Corp., Box 1904, New Haven, CT 06509 203-772-2220
† Kilovac Corp., Box 4422, Santa Barbara, CA 93140 805-684-4560
† Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
§ McGill Manufacturing Co., Inc., 909 North Lafayette Street, Valparaiso, IN 46383 219-465-2200
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Orbit Instrument Corp., 80 Cabot Ct., Hauppauge, NY 11788 516-435-8300
Power Dynamics Inc., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052 201-736-5722
† Saint Switch, Inc., 103 N. 11th Ave.,Box 604, St. Charles, IL 60174 312-377-3779
† Tapeswitch Corp. of America, 100 Schmitt Blvd., Farmingdale, NY 11735 516-694-6312
§ T-Bar Incorporated, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484 203-926-1801

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Crosspoint, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, 201-941-4455 ..... **B•1678**
CTS Corporation, Switch Div., Paso Robles, 500 Linne Rd., Paso Robles, CA 93446, 805-238-0350 ..... **B•1683**
† **Daico Industries, Inc., 2139 East Del Amo Blvd., Compton, CA 90224, 213-631-1143** ..... **A•1767**
§† **Digitran Division, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, 818-791-5600** ..... **B•1694**
Fifth Dimension, Inc., 801 New York Ave., Trenton, NJ 08638, 609-393-8350 ..... **B•1710-1711**
† **Janco Corp., Box 3038-Glenoaks Sta., Burbank, CA 91504, 818-846-1800** ..... **B•1750-1751**
† **MarLee Switch Co., 933-D N. Central Ave., Upland, CA 91786, 714-982-8988** ..... **B•1758**
Standard Grigsby, Inc., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, 312-844-4300 ..... **B•1797**
Adams Rite Products, Inc., 540 W. Chevy Chase Dr., Glendale, CA 91204 818-241-5121
† Alpha Inds., Inc., Microelectronic Div., 2800 Crystal Drive, Hatfield, PA 19440 215-822-1311
† Alpha Inds., Inc., Microwave Comp. Div., 90 Glenn St., Lawrence, MA 01843 617-681-8520
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St., Methuen, MA 01844 617-682-4661
† Automatic Connector, Inc., 400 Moreland Rd., Commack, NY 11725 516-543-5000
† Bird Electronic Corp., 30303 Aurora Rd., Cleveland, OH 44139-2794 216-248-1200
Computron Display Systems, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107 818-791-5600
† Dow-Key Microwave Corporation, 1667 Walter St., Ventura, CA 93003 .. 805-650-0260
† Electrospace Systems, Inc., P. O. Box 831359, Richardson, TX 75083-1359 ..... 214-470-2106/2107
† FL Jennings, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696 408-292-4025
† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
† JFW Industries, Inc., 5134 Commerce Sq. Dr., Indianapolis, IN 46237 317-887-1340
† K&L Microwave, Inc., 408 Coles Circle, Salisbury, MD 21801 301-749-2424
Line Electric Products, 122 Naubuc Ave., Glastonbury, CT 06033 ..... 203-659-3573; 1-800-331-1137
Low Key Corporation, Strong Group, 105 Maplewood Ave., Gloucester, MA 01930 617-281-0448
† Machine Components Corp., 70 Newtown Rd., Plainview, NY 11803 516-694-7222
† MACOM, Inc., 43 Second Ave., Bldg. 8, Burlington, MA 01803 617-272-3000
† Norsal Industries, 85 D Hoffman Lane S., Central Islip, NY 11722 516-234-1200
† Premier Microwave, 35 New Broad St., Port Chester, NY 10573 914-939-8900
† Risk, George, Inds., 802 S. Elm St, Kimball, NE 69145 308-235-4645
RLC Electronics, Inc., 83 Radio Cir., Mt. Kisco, NY 10549 914-241-1334
† Sage Laboratories, Inc., 11 Huron Dr., Natick, MA 01760 617-653-0844
§ Support Systems Intl. Corp., 150 South Second St., Richmond, CA 94804 415-234-9090
† Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Transco Products, Inc., 1001 Flynn Rd., Camarillo, CA 93011-6003 805-987-8007
† Wavecom, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324 818-882-3010

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† **Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731, 516-261-3300** ..... **D•1144**
Control Sciences, Inc., 9509 Vassar Ave., Chatsworth, CA 91311, 818-709-5510 ..... **D•1151**
† **Novatronics of Canada Ltd., 677 Erie St., P.O. Box 610, Stratford, Ontario, CANADA N5A 6V6, 519-271-3880** ..... **B•1243**
† **Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, 619-428-5581** ..... **B•1268**
† American Electronics, 1600 E. Valencia Dr., Fullerton, CA 92631 714-871-3020
† Astro Instrument Corp., 2501 NW 17th Ln., Pompano Beach, FL 33064 305-973-8900
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§† Harowe Servo Controls, Bowmar Inst. Corp., Westtown Rd. at West Chester Pike, W. Chester, PA 19380 215-692-2700
† Industrial Control Co., 3100 Pineda Ave., Rockledge, FL 32955 305-259-7105
† Innovatek Microsystems, Inc., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720 914-373-9003
† Natel Engineering Co., Inc., 4550 Runway St., Simi Valley, CA 93063 805-581-3950
† SPS Inc. (Muirhead Vactric), 51 Commerce St., Springfield, NJ 07081 ... 201-376-1222
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300

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§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1837-1838
§ KRL/Bantry Components, Inc., 160 Bouchard St., Manchester, NH 03103, 603-668-3210 ..... A•1953
† Micro-Ohm Corp., 1088 Hamilton Rd., Duarte, CA 91010, 818-3575377 ... B•1850
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1853,1857,1859
Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 .. B•1864
Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516
§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
§† Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
Precision Resistor Co., Inc., 10601 75 St. N., Largo, FL 34647 813-541-5771
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710

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Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012, 1-212-777-6571 ..... C•1308
† Doran Manufacturing Co., 2834 Sidney Ave., Cincinnati, OH 45225, 513-681-5424 ..... C•1325
Jan Hardware Mfg. Co., 47-27 36th St., Long Island City, NY 11101, 718-361-0800 ..... C•1607,1619
Kulka (Dialight Company), 1913 Atlantic Ave., Manasquan, NJ 08736, 201-223-9400 ..... C•1414
Oxley, Inc., 25 Business Pk. Dr., P.O. Box 814, Branford, CT 06405, 203-488-1033 ..... B•1013
§† WECO Electrical Connectors, Inc., 16805 Hymus Blvd., Kirkland, Quebec, CANADA H9H 3L4, 514-694-9136 ..... C•1594-1595
Alpha-Tek, 7286 Murdy Circle, Huntington Beach, CA 92647 714-847-7515
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
† D-Cemco, 3200 N. San Fernando Blvd., Burbank, CA 91504 213-849-6341
Dialight Corp., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736 201-223-9400
Entrelec, Cogenel, Inc., 2 Ram Ridge Rd., Spring Valley, NY 10977 914-425-7460
FIC Corp., 12216 Parklawn Dr., Rockville, MD 20852 ..... 301-881-8124;800-638-6594
† Flight Connector, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006 309-693-3355
Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Poweright Products, Inc., 2739 Oakland Avenue, Garland, TX 75041 214-840-0575
§ Reliance Comm/Tec, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199 800-245-4501
§† Syracuse Electronics, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221 315-468-6211
TIW Systems, Inc., 1284 Geneva Drive, Sunnyvale, CA 94089 408-734-3900

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† **Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169**
† **MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172**
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1179
Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500
Augat, Inc., Interconnection Products Group, 33 Perry Ave.,P.O. Box 779, Attleboro, MA 02703 617-222-2202
§ Concord Electronics Corporation, 30 Great Jones St., New York, NY 10012 1-212-777-6571
Dubbledee Diamond Corporation, D. Drukker & Zn., N.V., 100 Stierli Ct., Mt. Arlington, NJ 07856 201-770-1420
† EOTec Corporation, 3M Corporation, 420 Frontage Road, West Haven, CT 06516 203-934-7961
Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
† Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
§ Thomas & Betts Corporation, 1001 Frontier Road, Bridgewater, NJ 08807 201-685-1600
TRW Connector Div., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007 312-981-6000
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873

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† **Advantest America, Inc., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, 312-634-2552 ..... D•1196-1199**
Berkeley Nucleonics Corp., 1121 Regatta Sq., Richmond, CA 94804, 415-234-1100 ..... D•1219
Genstar Rental Electronics, Inc., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, 800-331-3440 (in CA);800-227-8409 ..... D•1257
Ametek Controls Div., Orionics Products, 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923 ..... 617-777-8888;800-826-2726
† Anritsu, 15 Thornton Rd., Oakland, NJ 07436 ..... 201-337-1111;800-255-7234
Biddle Instruments, 510 Township Line Rd., Blue Bell, PA 19422 215-646-9200
§† Canoga-Perkins Corp., 21012 Lassen St., Chatsworth, CA 91311 818-718-6300
Contact East, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845 ... 617-682-2000
Dai-Ichi Shoji of Amer., Inc., 150 Fifth Ave., Suite 845, New York, NY 10011 212-691-9050
Digitech Industries, Inc., 66 Grove St., P.O. Box 547, Ridgefield, CT 06877 203-438-3731
EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
§ EXFO E.O. Engineering, 352 St.-Sacrement Ave., Quebec City, Quebec, CANADA G1N 3Y2 418-683-0211
§ Feedback, 620 Springfield Ave., Berkeley Hghts., NJ 07922 201-464-5181
GTE Fiberoptic Products, 2401 Reach Rd., Williamsport, PA 17701 ..... 717-326-6591; 1-800-FBR-OPTICS
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
INTELCO, 8 Craig Road, Acton, MA 01720 617-264-4485
§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
† Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Power Technology, Inc., P.O. Box 9769, Little Rock, AR 72219 501-568-1995
Siecor Corp., 489 Siecor Park-CO, Hickory, NC 28603-0489 704-327-5000
§ C. G. Soar, Inc., 434 Windsor Pk. Dr., Dayton, OH 45459 513-434-7643
Sumitronics, Inc., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086 408-737-7683
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
United Detector Technology, 12525 Chadron Ave., Hawthorne, CA 90250 213-978-0516
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Velmex, Inc., P. O. Box 38, East Bloomfield, NY 14443 ... 716-657-6151;800-642-6446
† York Technology, Inc., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502 818-955-8927

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RTS Systems, Inc., 1100 W. Chestnut St., Burbank, CA 91506, 818-840-7119 ..... B•1026
LTX, LTX Pk. @ University Ave., Westwood, MA 02090 617-461-1000
† Zehntel, Inc., 2625 Shadelands Dr., Walnut Creek, CA 94598 415-932-6900

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Thermistors-5300

§† **Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1836,1838**
§ **Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... B•1840-1841**
Digitec Corp., 959 Cheney Ave., Marion, OH 43302, 614-387-3444 ..... D•1363
§† **Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846**
§ **Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1847-1849**
Mepco/Centralab, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, 818-240-4880 ..... A•1957
Mepco/Centralab, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, 817-325-7871 ..... A•1957,1960
§ **Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1853,1857-1858**
§† **Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... A•1977**
NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1383
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... C•1891
† **Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 ..... B•1863-1864**
Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ..... B•1870-1871
† Advanced Thermal Products, Inc., P.O. Box 249, St. Marys, PA 15857 ... 814-772-0278
§ Allen Co., Inc., Robert G., 7267 Coldwater Canyon, N. Hollywood, CA 91605 ..... 818-765-8300;800-423-3186
Alpha Thermistor, Inc., 7181 Construction Ct., San Diego, CA 92121 619-549-4660
§ Atkins Technical Inc., 3401 S.W. 40th Blvd., Gainesville, FL 32608 904-378-5555
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§ Dowty Electronics Co., Thermocontrol Div., Prospect St., P.O. Box 250, Brandon, VT 05733 802-247-6811
§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
Electronic Component Assembly, Inc., 7181-Construction Ct., San Diego, CA 92121 619-549-0808
† EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543 914-698-8434
Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
§ Fenwal, 400 Main St., Ashland, MA 01721 505-881-2000
§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661
† Gordon Co., 5710 Kenosha St., Richmond, IL 60071 815-678-2211

Hughes Aircraft Co., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715 714-752-3800
Interelectronics Corp., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920 ..... 914-EL8-8000
International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861
§ Law, R. E. Instrument, Inc., 7735 W. 112th Pl, Palos Hills, IL 60465 312-974-4000
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Mepco/Centralab Corp. Hdqrtr., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404 407-881-3200
Mepco/Centralab, Inc., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906 317-463-2536
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
Philips Circuit Assemblies, A Subdivision of North American Philips Corp., 2566 Northwestern Avenue, West Lafayette, IN 47906 317-463-2536
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860
† RdF Corporation, 23 Elm Ave., Hudson, NH 03051 603-882-5195
§ Science/Electronics, P. O. Box 986, Dayton, OH 45401-0986 513-228-6011
† Sensor Scientific, Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006 ..... 201-227-7790; 800-524-1610
§† Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
† Standard Oil Engineered Materials Co., Carborundum, P. O. Box 156, Niagara Falls, NY 14302 716-278-2000
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
Sylvania GTE Control Devices, Rte. 35, Standish, ME 04084 207-642-4535
§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, JAPAN 103 ..... (03) 278-5111
§ Tegam, Inc., 7230 N. Ridge Rd., Madison, OH 44057 216-428-7505
† Thermometrics, Inc., 808 U.S. Hwy. # 1, Edison, NJ 08817-4695 201-287-2870
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
§† Unitrode Corp., 580 Pleasant St., Watertown, MA 02172 617-926-0404
§ Victory Engineering Corp., Victory Rd., Springfield, NJ 07081 201-379-5900
§† Weed Instrument Co., Inc., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78664-0300 512-255-7043
Weinschel Engineering, One Weinschel La., Gaithersburg, MD 20877 ..... 301-948-3434; 800-638-2048
§† Workman Elctrn. Prods., Box 3828, Sarasota, FL 33578 813-371-4242
§† Yellow Springs Instrument Co., Box 279, Yellow Springs, OH 45387 513-767-7241

Thermistors, Surface Mount-5300

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1838
§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... B•1840-1841
Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... B•1846
Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1848
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1852-1853
Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 ..... B•1863-1864
† Sensor Scientific, Inc., 1275 Bloomfield Ave., Fairfield, NJ 07006, 201-227-7790;800-524-1610 ..... B•1868-1869
Alpha Thermistor, Inc., 7181 Construction Ct., San Diego, CA 92121 619-549-4660
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
Electronic Component Assembly, Inc., 7181-Construction Ct., San Diego, CA 92121 619-549-0808
Instrulab, P.O. B. 98, Dayton, OH 45404 513-223-2241
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
Sfernice, Inc., 461 North 22nd Street, Grand Junction, CO 81502 303-242-0810
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
† Thermometrics, Inc., 808 U.S. Hwy. # 1, Edison, NJ 08817-4695 201-287-2870

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Thermocouple Interfaces for Personal Computers-2000 — *See Vol. D*

Thermocouples, Elements & Accessories-5300

Best Technology Inc., 400 Boren Ave. North, Seattle, WA 98109, 206-382-1300 ..... B•1839
Ceramaseal, Box 260, New Lebanon, NY 12125, 518-794-7800 ..... C•1301
Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861, 401-727-1300 ..... B•1843
NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1383
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... C•1891, D•1013
PPM, Inc., 5385 Harper Rd., Cleveland, OH 44139, 216-349-2300 ..... D•1313
Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 .. B•1865
Acme Elec. Heating Corp., 4685 E. 11th Ave., Hialeah, FL 33013 305-685-8326
§ AEMC, 99 Chauncy, Boston, MA 02111 ..... 617-451-0227;800-343-1391
Alberox Corporation, New Bedford Ind'l. Pk., New Bedford, MA 02745 ... 617-995-1725
Alpha-M Corp., 913 Highland Dr., Euless, TX 76040 817-267-7022
§ Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000
§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§ Athena Controls, Inc., 5145 Campus Dr., Whitemarsh Ind. Campus, Plymouth Meeting, PA 19462 215-828-2490
§ Atkins Technical Inc., 3401 S.W. 40th Blvd., Gainesville, FL 32608 904-378-5555
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
§† Bailey Controls Co., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092 216-585-8500
Ballantine Laboratories, Inc., P. O. Box 97, Boonton, NJ 07005 201-335-0900
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§ Bartlett Instrument Co., 14th & Ave. "M", P.O. Box 445, Ft. Madison, IA 52627 319-372-8366
§ Beckman Industrial Corp., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123 619-495-3200
Burling Instruments, P.O. Box 298, Chatham, NJ 07928 201-635-9481
§ Colber Corp., 26E Buffington St., Irvington, NJ 07111 201-371-9500
Degussa Corp., 104 New Era Drive, So. Plainfield, NJ 07080 201-757-6500
† DELTA M Corporation, 525 Warehouse Rd., Oak Ridge, TN 37830 615-483-1569
§ Digitec Corp., 959 Cheney Ave., Marion, OH 43302 614-387-3444
§ Dowty Electronics Co., Thermocontrol Div., Prospect St., P.O. Box 250, Brandon, VT 05733 802-247-6811
§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL
Electro Physics Co., Inc., 3009 Central Ave., Waukegan, IL 60085 312-249-5801
† Engelhard Corp., Menlo Pk, CN40, Edison, NJ 08818 ..... 201-632-6000;800-932-0444 (in NJ)
† Engine Systems Division, Simmonds Precision, P.O. Box 310, Norwich, NY 13815 607-335-5000
§ E-Squared Technology Corp., 4475 Dupont Ct # 9, Ventura, CA 93003 805-644-9544
§ Fenwal, 400 Main St., Ashland, MA 01721 505-881-2000
† FTS Systems, Inc., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484 800-824-0400
General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
† GIC Thermodynamics, 2611 Parmenter, Royal Oak, MI 48073 313-280-1648
† Gordon Co., 5710 Kenosha St., Richmond, IL 60071 815-678-2211
Hades Manufacturing Corp., 151 Verdi St., Farmingdale, NY 11735 516-249-4244
§† Heraeus Inc., Temp. Measurement Group, 111A Corporate Blvd., S. Plainfield, NJ 07080 201-755-4800
Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
Julie Research Labs., 211 West 61st St., New York, NY 10023 212-245-2727
§† Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
Kaye Instruments, Inc., 15 De Angelo Dr., Bedford, MA 01730 617-275-0300
† Lake Shore Cryotronics, Inc., 64 E. Walnut St., Westerville, OH 43081 ... 614-891-2243
§ Law, R. E. Instrument, Inc., 7735 W. 112th Pl, Palos Hills, IL 60465 312-974-4000
Leeds & Northrup, General Signal, Sumneytown Pike, North Wales, PA 19454 215-643-2000
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121
§ Modutec, 18 Marshall St., Norwalk, CT 06854 203-853-3636
† NANMAC Corp., 9 Mayhew St., Framingham, MA 01701 617-872-4811
† Narda Microwave Corp., Subsidiary of Loral Corp., 435 Moreland Rd., Hauppauge, NY 11788 516-231-1700
Pyrocom Co., 924 N. 143rd St., Seattle, WA 98133 206-365-3535
† RdF Corporation, 23 Elm Ave., Hudson, NH 03051 603-882-5195
§† Revere Corporation of America, 845 N. Colony Rd., Wallingford, CT 06492 203-269-7701
Richards, Arklay S., Co., Inc., 72 Winchester St., Newton Highlands, MA 02161-1793 617-527-4385
§ Science/Electronics, P. O. Box 986, Dayton, OH 45401-0986 513-228-6011
§ S. F. Products Corporation, P. O. Box 369, Southport, CT 06490 203-929-6180
C. G. Soar, Inc., 434 Windsor Pk. Dr., Dayton, OH 45459 513-434-7643
Solder Absorbing Technology (SAT), A Spirig Co., 144 Oakland St., Springfield, MA 01108 800-628-8862
§ Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
† Syscon Intl., Inc., 1108 So. High St., So. Bend, IN 46618-1096 219-232-3900
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102
§ Temptronic Corporation, 55 Chapel St., Newton, MA 02158 617-969-2501
† Thermo Electric, 109 Fifth St., Saddle Brook, NJ 07662 201-843-5800
† Thermometrics, Inc., 808 U.S. Hwy. # 1, Edison, NJ 08817-4695 201-287-2870
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
Veeco Instruments Inc., Terminal Dr., Plainview, NY 11803 516-349-8300
§† Weed Instrument Co., Inc., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78664-0300 512-255-7043
§ WestCon, 959 Cheney Ave., Marion, OH 43302 614-382-5771
§ West Instrument, A Mark IV Company, 3860 N. River Rd., Schiller Park, IL 60176 312-678-6400
Yellow Springs Instrument Co., Box 279, Yellow Springs, OH 45387 513-767-7241

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Thermostats-Also See Switches, Thermally Actuated; Controls, Temperature-5300

† **Airpax Company, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, 301-663-5141** ..... **B•1835**
† **Elmwood Sensors, 500 Narragansett Park Drive, Pawtucket, RI 02861, 401-727-1300** ..... **B•1843-1845**
Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, 617-478-5255 ..... **B•1846**
Micro Devices Product Group, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, 419-756-5911 ..... **B•1343,1873**
§ **Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602** ..... **B•1856**
Phase Control Electronics, 87-27 Myrtle Ave., Glendale, NY 11385, 718-441-4728 ..... **D•1140**
§ **Selco Products Co., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, 714-521-8673** ..... **B•1867**
† Advanced Thermal Products, Inc., P.O. Box 249, St. Marys, PA 15857 ... 814-772-0278
§† Amperite Co., Inc., 600 Palisade Ave., Union City, NJ 07087 201-864-9503
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§ Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
§† Bud Industries, Inc., 4605 E. 355th St., Willoughby, OH 44094-0431 216-946-3200
Burling Instruments, P.O. Box 298, Chatham, NJ 07928 201-635-9481
Canadian Thermostats & Control Devices Ltd., 8415 Mountian Sights, Montreal, PQ, CANADA H4P2B8 514-739-3274
† Chatham Controls, 33 River Rd., Chatham, NJ 07928 201-635-8892
Dreefs Switch, Inc., 3782 Hawthorn Ct., Waukegan, IL 60087 ..... 312-662-7667; 800-323-9605
§ Eaton Corp./Cutler-Hammer Prods, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216 414-449-7487
§ E-Squared Technology Corp., 4475 Dupont Ct # 9, Ventura, CA 93003 805-644-9544
Fasco Industries, Inc., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432 305-368-0600
§ Fenwal, 400 Main St., Ashland, MA 01721 505-881-2000
§ Grasslin Controls Corp., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446 201-825-9696
† Honeywell Inc., Commercial Div., MN 27-7246, Honeywell Plaza, Minneapolis, MN 55408 612-870-5357
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§† Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 215-257-3621
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Spanta, Inc., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417 201-848-0033
§ Texas Instrs., Inc., Box 809066, Dallas, TX 75380 ..... 800-232-3200 (ext 700)
Therm-O-Disc, Inc., Sub. Emerson Elec. Co., 1320 South Main St., P. O. Box 3538, Mansfield, OH 44907 419-756-5911
Triac Electronic Systems, Inc., 87-27 Myrtle Ave., Glendale, NY 11385 .. 718-441-4759
§ United Electric Controls, 85 School St., Watertown, MA 02172 ..... 617-WA6-1000
§ Vermont Automation Co., Inc., 18 Morse Dr., Essex Junction, VT 05452 802-879-7571
Warren G-V, Unit of Signal Co., 1 Apollo Dr., Whippany, NJ 07981 201-386-1200

Thermowells-5300

Degussa Corp., 104 New Era Drive, So. Plainfield, NJ 07080 201-757-6500
§ DELTA M Corporation, 525 Warehouse Rd., Oak Ridge, TN 37830 615-483-1569
§ GIC Thermodynamics, 2611 Parmenter, Royal Oak, MI 48073 313-280-1648
† Gordon Co., 5710 Kenosha St., Richmond, IL 60071 815-678-2211
Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
Pyrocom Co., 924 N. 143rd St., Seattle, WA 98133 206-365-3535
† RdF Corporation, 23 Elm Ave., Hudson, NH 03051 603-882-5195
† Thermo Electric, 109 Fifth St., Saddle Brook, NJ 07662 201-843-5800

Thin-Film Memory Systems, Planar — See Memory Systems (Vol. D)

Thyristors and SCRs, Surface Mount-4800 — *See Vol. A*

Thyristors (Incl. Silicon Controlled Rectifiers) - Also see DIACs; TRIACs, SIDACs-4800 — *See Vol. A*

Thyristors (MIL)-2440

§† Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
† NWL Transformers, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505 609-298-7300
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000

Ties, Wire & Cable — See Wire & Cable Ties (Vol. C)

Time Delays, Precision-2900 — *See Vol. D*

Time Dispenser, Microprocessor based-2200 — *See Vol. D*

Time Management Systems-2200 — *See Vol. D*

Timers, Counting-2200 — *See Vol. D*

Timers, Cycle & Reset-2200 — *See Vol. D*

Timers, Delay-2200 — *See Vol. D*

Timers, Electrolytic Cell-2200 — *See Vol. D*

Timers, Interval-2200 — *See Vol. D*

Timers, Programmed-2200 — *See Vol. D*

Timers, Sequence-2200 — *See Vol. D*

Timers, Solid State-2200 — *See Vol. D*

Tool Kits & Sets-5400 — *See Vol. C*

Tools & Kits, Contact Insertion/Removal-5400 — *See Vol. C*

Tools, Alignment & Tuning-5400 — *See Vol. C*

Tools, Cable Tie-5400 — *See Vol. C*

Tools, Connector-5400 — *See Vol. C*

Tools, Crimping & Swaging-5400 — *See Vol. C*

Tools, Heat Sealing-5400 — *See Vol. C*

Tools, Lead Bending & Insertion-5400 — *See Vol. C*

Tools, Magnetic Pickup-5400 — *See Vol. C*

Tools, Marking, Numbering, Engraving-5400 — *See Vol. C*

Tools, Parts Handling, Vacuum Operated-5400 — *See Vol. C*

Tools, Relay Servicing-5400 — *See Vol. C*

Tools, Resistance Soldering — See Soldering Equip., Resistance (Vol. C)

Tools, Wire Wrapping-5400 — *See Vol. C*

Torches, Soldering, Welding & Accessories-4600 — *See Vol. C*

Toroids — See Coils, Toroidal (Vol. A)

Torque Control — See Knobs, Torque, Incremental, Ratio Drive (Vol. C)

Torquers, Gyro — See Motors, Torque (Vol. B)

Totalizers, Digital-2200 — *See Vol. D*

Touch Monitors-2000 — *See Vol. D*

Touch Panels-2000 — *See Vol. D*

Touch Terminals-2000 — *See Vol. D*

Tracers, Curve-2900 — *See Vol. D*

Tracers, Signal — See Testers, Signal Tracing (Vol. D)

Trackballs, XY Positioning-2200 — *See Vol. D*

Trackers (MIL), Laser-3475 — *See Vol. D*

Tracking Systems (MIL)-3475 — *See Vol. D*

Trainers (MIL), ECM-3475 — *See Vol. D*

Trainers (MIL), Elint-3475 — *See Vol. D*

Trainers (MIL), EW-3475 — *See Vol. D*

Trainers (MIL), Maritime-3475 — *See Vol. D*

Training Systems (MIL)-3475 — *See Vol. D*

Transceivers-1900 — *See Vol. D*

Transceivers (MIL)-2440

† Aydin Corp., 700 Dresher Rd., Horsham, PA 19044 215-657-7510
† Aydin Vector Div., Aydin Corp., Box 328, Newtown, PA 18940-0328 215-968-4271
† ILC Data Device Corp., 105 Wilbur Pl., Bohemia, NY 11716 516-567-5600

Transducer Elements-5500

Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... **B•1900**
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... **B•1932**
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171

† General Microwave Corporation, 5500 New Horizons Blvd., Amityville, NY 11701 516-226-8900
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† Lectrohm Div. of Capco, Inc., Box 1028, Grand Junction, CO 81502 303-243-8480
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
§ Rye Industries, Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 818-964-6565
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Transducers, Acceleration — See Accelerometers (Vol. B)

Transducers, Audio-5500

Bell, Floyd, Inc., 897 Higgs Ave., Columbus, OH 43212, 614-294-4000 ... D•1024
† Blatek, Inc., Box 574, Bellefonte, PA 16823, 814-355-4910 ..... B•1882
§ Golden Pacific Electronics, Inc, 560 S. Melrose St., Placentia, CA 92670, 714-993-6970 ..... D•1029
§ International Components Corp., 105 Maxess Rd., Melville, NY 11747, 516-293-1500 ..... D•1031
LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... D•1033
§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... D•1036-1037
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788, 516-582-3400 ... D•1039
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... B•1899, D•1040-1042
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... B•1901, D•1044-1045
Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168
† Shogyo International Corp., 287 Northern Blvd., Great Neck, NY 11021, 516-466-0911 ..... D•1050
§ Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, 201-572-9512 ..... D•1054-1058
Tauber Elctrns. Inc., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, 619-274-7242 ..... D•1493
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... D•1060
§ AKG Acoustics, Inc., 77 Selleck St., Stamford, CT 06902 203-348-2121
§ Atlas/Soundolier, 1859 Intertech Dr., Fenton, MO 63026 800-362-5673
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
§† Projects Unlimited, 3680 Wyse Rd., Dayton, OH 45414 513-890-1918
§ Rye Industries, Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
§ Shure Bros., 222 Hartrey Ave., Evanston, IL 60202-3696 312-866-2200
Stanton Magnetics, Inc., Terminal Dr., Plainview, NY 11803 516-349-0235
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
§ Wheelock, Inc., 273 Branchport Ave., Long Branch, NJ 07740 201-222-6880

Transducers, Ceramic-5500

LZR Electronics, Inc., 8174 Beechcraft Ave., Gaithersburg, MD 20879, 301-921-9440 ..... D•1033
§ MG Electronics, 32 Ranick Rd., Hauppauge, NY 11788, 516-582-3400 ... D•1039
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... B•1901
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† International Transducer Corp., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111 805-683-2575
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196 312-576-4850
§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208

Transducers, Displacement-5500

† Maurey Instrument Corp., 4555 W. 60th St., Chicago, IL 60629, 312-581-4555 ..... A•2078-2080
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... B•1900
Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
§ AEMC, 99 Chauncy, Boston, MA 02111 ..... 617-451-0227;800-343-1391
† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
§ Automatic Timing & Controls Co., 201 So. Gulph Rd., King of Prussia, PA 19406 ..... 215-337-5500;800-441-8245
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Bristol Babcock Inc., 1100 Buckingham St., Watertown, CT 06795 ..... 203-575-3000; 800-243-3576
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
Celesco Transducer Prods., Inc., 7800 Deering Ave., Canoga Pk., CA 91304 818-884-6860
§ Ceramic Magnetics, Inc., 87 Fairfield Rd., Fairfield, NJ 07006 201-227-4222
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
Computer Instruments, 100 Madison Ave., Hempstead, NY 11550 516-483-8200
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
Disc Instruments, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626 714-433-0343
Electro-Craft, 1600 2nd St. S., Hopkins, MN 55343 612-931-2700
EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
Giddings & Lewis Electronics, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
Gould Inc., Test and Measurement, 3631 Perkins Avenue, Cleveland, OH 44114 216-361-3315
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
§ Gunther, W., GmbH, Virnsberger Strasse 51, D 8500 Nurnberg 82, WEST GERMANY ..... (0)911/65521 or 65520
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§† Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
LEL Co., 5 Burns Pl., Cresskill, NJ 07626 201-569-8641
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Magnetoelastic Devices, Box 625, Pittsfield, MA 01201 413-445-5608
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Modern Controls Corp., 2233 Indl. Blvd., Sarasota, FL 33580 813-355-5183
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
MTS Systems, Box 24012, Minneapolis, MN 55424 612-937-4000
Northern Precision Labs., 11 Madison Rd., Fairfield, NJ 07006 201-227-4800
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081 201-376-6070
Omutec, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802 714-758-0200
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
Precision Level Vial Co., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925 ..... 215-794-0800;800-345-7517
§† Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
Stoelting Co., 1350 S. Kostner Ave., Chicago, IL 60623 312-522-4500
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., 7055 N.W. Grandview Dr., Corvallis, OR 97330 503-757-3158
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201
Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Transducers, Flow-5500

Blatek, Inc., Box 574, Bellefonte, PA 16823, 814-355-4910 ..... B•1882
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 .. B•1932-1933
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
Accusonic Division, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541 .. 617-548-5800
§† Bailey Controls Co., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092 216-585-8500
† Bristol Babcock Inc., 1100 Buckingham St., Watertown, CT 06795 ..... 203-575-3000; 800-243-3576
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346

† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
Computer Instruments, 100 Madison Ave., Hempstead, NY 11550 516-483-8200
Controls Division, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900
EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255
† Flow Technology, Inc., Box 52103, Phoenix, AZ 85072 602-437-1315
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
Kurz Instruments Inc., 2411 Garden Rd., Monterey, CA 93940 800-424-7356
Micronel U.S., 2142F Industrial Ct., Sycamore Research Center, Vista, CA 92083 619-727-7400
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443 616-777-2602
§† MKS Instruments, Inc., Six Shattuck Road, Andover, MA 01810 617-975-2350
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
Motorola Inc., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196 312-576-4850
Panametrics, 221 Cresent St., Waltham, MA 02254 617-899-2740
Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
Sensym, Inc., 1255 Reamwood Ave., Sunnyvale, CA 94089 408-744-1500
Validyne Engineering Corporation, 8626 Wilbur Ave., Northridge, CA 91324 818-886-2057
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Transducers, Force-5500

Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... B•1932
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, 203-481-5721 ..... B•1927
Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
† A. L. Design, Inc., 4232 Ridge Lea Rd., Amherst, NY 14226 716-833-6272
BLH Elctrns., 75 Shawmut Road, Canton, MA 02021 617-821-2000
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
§ Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720 617-264-9550
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§ Dillon, W. C., & Co., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031 507-238-4461
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
§ GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024 313-476-7875
§ Helm Instrument Co., Inc., 1387 Dussel Drive, Maumee, OH 43537 419-893-4356
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
§† Interface, Inc., 7401 E. Butherus Dr., Scottsdale, AZ 85260 602-948-5555
§ Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084 313-643-0220
Magnetoelastic Devices, Box 625, Pittsfield, MA 01201 413-445-5608
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
PPM, Inc., 5385 Harper Rd., Cleveland, OH 44139 216-349-2300
§† Revere Corporation of America, 845 N. Colony Rd., Wallingford, CT 06492 203-269-7701
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Stoelting Co., 1350 S. Kostner Ave., Chicago, IL 60623 312-522-4500
Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347
Tedea Inc., 8606 Wilbur Ave., Northridge, CA 91324 818-349-6116
Unimeasure, Inc., 7055 N.W. Grandview Dr., Corvallis, OR 97330 503-757-3158
Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
Wilcoxon Research, 2096 Gaither Rd., Rockville, MD 20850 301-330-8811

Transducers, Frequency — See Transducers, Volt, Watt, Current, etc. (Vol. B)

Transducers, Humidity-5500

† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
§† Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
§† Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
Marcon America Corp., 310 Era Drive, Northbrook, IL 60062 312-564-2820
† Thunder Scientific Corp., 623 Wyoming S.E., Albuquerque, NM 87123 ..... 505-265-8701; 800-872-7728
§ Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277

Transducers, Incremental Digital Position, Rotary — See Encoders, Shaft Angle (Vol. B)

Transducers, Magnetic Pickup-5500

† Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, 516-694-6700 ..... B•1184-1185
Airpax Corp., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, 203-272-0301 ..... B•1877
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735, 516-694-5100 ..... B•1878
Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 407-678-6900 ..... D•1223
Dixson, Inc., Box 1449, Grand Junction, CO 81502, 303-242-8863 (ext 223) ..... D•1367
Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1891
† International Electro Magnetics, Inc., 350 N. Eric Dr., Palatine, IL 60067, 312-358-4622 ..... D•1032
† Magnetic Shield Corporation, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, 312-766-7800 ..... C•1753
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1898
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1917, D•1306-1307
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1925
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1799
Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410 203-272-0301
§ AKG Acoustics, Inc., 77 Selleck St., Stamford, CT 06902 203-348-2121
§ ALTEK Corp., 2150 Industrial Pkwy., Silver Spring, MD 20904 301-622-3906
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
§ C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§ Dynapar, 1675 Delany Rd., Gurnee, IL 60031 312-662-2666
§† Electro Corporation, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578 813-355-8411
Giddings & Lewis Electronics, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935 414-921-7100
§ Grado Laboratories, 4614 Seventh Ave., Brooklyn, NY 11220 718-435-5340
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
§ Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
§ Rye Industries, Inc., 125 Spencer Pl., P.O. Box M, Mamaroneck, NY 10543 914-698-0080
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
§ Veeder-Root, 70 Sargeant St., Hartford, CT 06102 203-527-7201

Transducers, Magnetostrictive-5500

Unimeasure, Inc., 7055 N.W. Grandview Dr., Corvallis, OR 97330 503-757-3158

Transducers, Piezoelectric-5500

§ Mallory Capacitor Co., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, 317-636-5353 ..... D•1036-1037
§ Murata Erie North America, Inc., 2200 Lake Park Dr., Smyrna, GA 30080, 404-436-1300 ..... B•1899, D•1040-1042
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... D•1044-1045
§ Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854, 201-572-9512 ..... D•1054,1056,1058
TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku,, Tokyo, JAPAN 103, (03) 278-5111 ..... D•1060
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... B•1926
Vernitron Piezoelectric Div., 232 Forbes Rd., Bedford, OH 44146-5478, 216-232-8600 ..... A•1487
§ Atlas/Soundolier, 1859 Intertech Dr., Fenton, MO 63026 800-362-5673
§ Atomergic Chemetals Corp., 91 Carolyn Blvd., Farmingdale, NY 11735-1527 516-694-9000
† Blatek, Inc., Box 574, Bellefonte, PA 16823 814-355-4910
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† Dunegan Corporation, Physical Acoustics Corp., 19-B Thomas, Irvine, CA 92718 714-380-1544
Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
† International Transducer Corp., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111 805-683-2575
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
§† Projects Unlimited, 3680 Wyse Rd., Dayton, OH 45414 513-890-1918

† Savoy Electronics, P.O. Box 5727, Ft. Lauderdale, FL 33310 ..... 305-563-1333; 800-327-1282
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208
Stetron International, Inc., 90 Broadway, Buffalo, NY 14203 716-854-3443
Taiyo Yuden (USA) Inc., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493 312-364-6104
Teledyne Microwave, 1290 Terra Bella Ave., Mountain View, CA 94043 415-968-2211
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322

Transducers, Position, Linear-5500

† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... B•1900
Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778, 617-358-2777 ..... A•2110
§ AEMC, 99 Chauncy, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
Burleigh Instruments, Burleigh Pk., Fishers, NY 14453 716-924-9355
Celesco Transducer Prods., Inc., 7800 Deering Ave., Canoga Pk., CA 91304 818-884-6860
† Component Specialties Corp., 9143 E. La Rosa Dr., Temple City, CA 91780 213-283-0015
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§ Dova Controls, 4052 148th Ave. N.E., Redmond, WA 98052 206-881-7414
§ Electro Corporation, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578 813-355-8411
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593 805-499-7779
§† Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Modern Controls Corp., 2233 Indl. Blvd., Sarasota, FL 33580 813-355-5183
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081 201-376-6070
Omutec, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802 714-758-0200
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 213-393-1497
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 818-964-6565
† Sunshine Scientific Instruments, 1810 Grant Ave., Philadelphia, PA 19115 215-673-5600
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
TRW Technar, Inc., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706 818-334-0250
Unimeasure, Inc., 7055 N.W. Grandview Dr., Corvallis, OR 97330 503-757-3158
Validyne Engineering Corporation, 8626 Wilbur Ave., Northridge, CA 91324 818-886-2057
Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777

Transducers, Position, Rotary-5500

BEI Motion Systems Co., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, 501-851-4000 ..... B•1880
BEI Motion Systems Co., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, 619-931-0200 ..... B•1880
† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701, 813-822-2529 ..... B•1898
Novotechnik U.S., Inc., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, 617-485-2244 ..... B•1900
Sharp, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, 201-529-8757 ..... B•1925
Transmagnetics, 210 Adams Blvd., Farmingdale, NY 11735, 516-293-3100 ..... D•1184
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Astrosystems, 6 Nevada Dr., Lake Success, NY 11042 516-328-1600
BEI Motion Systems Co., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069 619-471-2600
BEI Motion Systems Co., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117 805-968-0782
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Clifton Precision, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018 215-622-1000
† Computer Conversions Corp., 6 Dunton Ct., E. Northport, NY 11731 516-261-3300
† Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910 818-882-0424
C-Tek Inc., 4 Railroad Ave., Wakefield, MA 01880 617-246-1720
Datametrics Inc., 340 Fordham Road, Wilmington, MA 01887 617-658-5410
§ Dova Controls, 4052 148th Ave. N.E., Redmond, WA 98052 206-881-7414
§ Dynapar, 1675 Delany Rd., Gurnee, IL 60031 312-662-2666
† Farrand Controls, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595 914-761-2600
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
† JDK Controls, Inc., 2630 Lavery Ct., Suite F, Newbury Park, CA 91320-1593 805-499-7779
† Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 914-664-7733
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
Omutec, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802 714-758-0200
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 213-393-1497
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
† Sequential Information Systems Inc., 249 N. Saw Mill River Rd., Elmsford, NY 10523 914-592-5930
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
Spectrol Electronics, 17070 East Gale Ave., City of Industry, CA 91745 818-964-6565
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
Tocos America, Inc., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005 312-364-7277
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729 516-586-5100
† Vernitron Controls, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073 619-428-5581
Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
† Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778 617-358-2777

Transducers, Power — See Transducers, Volt, Watt, Currents, etc. (Vol. B)

Transducers, Pressure-5500

§ Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720, 617-264-9550 ..... B•1884
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006, 201-227-1002;800-635-0650 ..... B•1888
Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... B•1932-1933
§† Pres-Air-Trol Corp., 1009 Boston Post Rd., Mamaroneck, NY 10543, 914-698-2026;800-431-2625 (outside NY) ..... B•1787
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1918,1920
Setra Systems, Inc., 45 Nagog Park, Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1922-1923
† Vernitech, 300 Marcus Blvd., Deer Pk., NY 11729, 516-586-5100 ..... A•2103, B•1030
Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
† A. L. Design, Inc., 4232 Ridge Lea Rd., Amherst, NY 14226 716-833-6272
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
Analogic Corp., 8 Centennial Dr., Peabody, MA 01961 617-246-0300
§† Bailey Controls Co., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092 216-585-8500
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
§ Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
§ Bellofram Corporation, Pulpit Rock Rd., Pelham, NH 03076 ..... 603-635-2103; 800-343-0039
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Bristol Babcock Inc., 1100 Buckingham St., Watertown, CT 06795 ..... 203-575-3000; 800-243-3576
Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346
Celesco Transducer Prods., Inc., 7800 Deering Ave., Canoga Pk., CA 91304 818-884-6860
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
† Computer Instruments, 100 Madison Ave., Hempstead, NY 11550 516-483-8200
† Consolidated Controls, 15 Durant Ave., Bethel, CT 06801 203-743-6721
§† Controls Division, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§ Dynisco, 10 Oceana Way, Norwood, MA 02062 617-769-6600
† Edcliff Div., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016 818-358-4571
§ Electromatic Controls Corp., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010 312-882-5757
§ Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Essex Group, 9933 13th St., Ft. Wayne, IN. 46809 219-478-1521
§ Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440

† Faria, Thomas G., Corp., P.O. Box 983, Uncasville, CT 06382-0983 203-848-9271
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
† Giannini Petro Marine, 9474 Chesapeake Dr., San Diego, CA 92123 619-569-1668
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
Gould Inc., Test and Measurement, 3631 Perkins Avenue, Cleveland, OH 44114 216-361-3315
§ GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024 313-476-7875
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855 203-866-2573
Honeywell Inc., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408 612-870-5186
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
† IMO Delaval Inc., 325 Halstead St., Pasadena, CA 91109-7087 818-351-4241
§ International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714 602-748-7900
§† Jumo Process Control, Inc., 410 Garibaldi Ave., Lodi, NJ 07644 201-779-7744
§ Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
† Kollsman Instr., 220 Daniel Webster Hwy., Merrimack, NH 03054 603-889-2500
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Lebow Products, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084 313-643-0220
LEL Co., 5 Burns Pl., Cresskill, NJ 07626 201-569-8641
Leybold Inficon, Inc., 6500 Fly Rd, E. Syracuse, NY 13057 315-437-0377
† Litton Potentiometer Div., 750 So. Fulton Ave., Mt. Vernon, NY 10551 ... 914-664-7733
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443 ... 616-777-2602
§† MKS Instruments, Inc., Six Shattuck Road, Andover, MA 01810 617-975-2350
Motorola Inc., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196 312-576-4850
§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
Optimum Applied Systems, 145 Palisade St., Dobbs Ferry, NY 10522-1696 914-693-9001
† Paine Corporation, 2401 S. Bayview St., Seattle, WA 98144 ..... 206-329-8600; 800-426-0366
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
Pressure Systems, Inc., 34 Research Dr., Hampton, VA 23666 804-865-1243
§† Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§† Sensym, Inc., 1255 Reamwood Ave., Sunnyvale, CA 94089 408-744-1500
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
Stoelting Co., 1350 S. Kostner Ave., Chicago, IL 60623 312-522-4500
Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
§† Trans Metrics, Inc., P. O. Box 178, Chagrin Falls, OH 44022 216-248-2229
Unimeasure, Inc., 7055 N.W. Grandview Dr., Corvallis, OR 97330 503-757-3158
Validyne Engineering Corporation, 8626 Wilbur Ave., Northridge, CA 91324 818-886-2057
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
§ Yellow Springs Instrument Co., Box 279, Yellow Springs, OH 45387 513-767-7241
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Transducers, Proximity-5500

§ Hamlin, Lake & Grove Sts., Lake Mills, WI 53551, 414-648-2361 ..... B•1891
Instrumentation & Control Sys., 520 Interstate Rd, Addison, IL 60101, 312-543-6200 ..... B•1499
Kessler-Ellis Prods., 120 1st Ave., Atlantic Highlands, NJ 07716, 201-291-0500;800-631-2165 ..... D•1134
Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, 513-871-3777 ..... B•1799
§† STI, Control Components Div., 9520 Black Mountain Rd., San Diego, CA 92126-4507, 619-566-7680;800-826-5053 ..... B•1590
Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803 516-694-6700
§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926 915-592-3253
§ Eaton Corp, Durant Products, 901 S. 12th St., Watertown, WI 53094 414-261-4070
§ Electro Corporation, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578 813-355-8411
EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
Epsilon-Lambda Elctrns. Corp., 427 Stevens St., Geneva, IL 60134 312-232-9611
FSI/Fork Standards, Inc., 666 Western Ave., Lombard, IL 60148 ..... 312-231-3511; 312-932-9380
General Numeric Corporation, 390 Kent Avenue, Elk Grove Village, IL 60007 312-640-1595
† GIC Thermodynamics, 2611 Parmenter, Royal Oak, MI 48073 313-280-1648
§ Gordon Products, 67 Del Mar Dr., Brookfield, CT 06804 203-775-4501
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300
Metrix Instrument Co., 1711 Townhurst, Houston, TX 77043 713-461-2131
§† Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
Modern Controls Corp., 2233 Indl. Blvd., Sarasota, FL 33580 813-355-5183
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081 201-376-6070
§ Redington Counters, 130 Addison Rd., Windsor, CT 06095 203-688-6205
Rehlander Assocs., 118A Bridge St., Beverly, MA 01915 617-922-5961
Relay Specialties, 17 Raritan Rd., Oakland, NJ 07436 201-337-1000
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§ Spanta, Inc., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417 201-848-0033
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600
§ Tenor Company, 17020 W. Rogers Dr., New Berlin, WI 53151 414-782-3800
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322

Transducers, Sonic-5500

Bell, Floyd, Inc., 897 Higgs Ave., Columbus, OH 43212, 614-294-4000 ... D•1024
§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... B•1901, D•1044-1045
† Blatek, Inc., Box 574, Bellefonte, PA 16823 814-355-4910
† Hazeltine Corp., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740 516-261-7000
† International Transducer Corp., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111 805-683-2575
Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000
§† Kyocera Northwest, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542 619-576-2600
Motorola Ceramic Products, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113 505-822-8801
† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
§ Stetco, Inc., 3344 Schierhorn Ct., Franklin Pk., IL 60131 312-671-4208

Transducers, Strain Gauge-5500

Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 .. B•1932-1933
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1918-1920
Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
Acurex-Autodata, 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039 415-967-9100
A. L. Design, Inc., 4232 Ridge Lea Rd., Amherst, NY 14226 716-833-6272
Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241
BLH Elctrns., 75 Shawmut Road, Canton, MA 02021 617-821-2000
† Bourns Instruments Inc., 6135 Magnolia Ave., Riverside, CA 92506 714-781-5148
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
† Consolidated Controls, 15 Durant Ave., Bethel, CT 06801 203-743-6721
§ Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720 617-264-9550
Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300
§† Dillon, W. C., & Co., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031 507-238-4461
§ Dynisco, 10 Oceana Way, Norwood, MA 02062 617-769-6600
† Edcliff Div., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016 818-358-4571
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650
EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
§ GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024 313-476-7875
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
§ Helm Instrument Co., Inc., 1387 Dussel Drive, Maumee, OH 43537 419-893-4356
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† IMO Delaval Inc., 325 Halstead St., Pasadena, CA 91109-7087 818-351-4241
§ Interface, Inc., 7401 E. Butherus Dr., Scottsdale, AZ 85260 602-948-5555
§† Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900
Lebow Products, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084 313-643-0220
Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
† Paine Corporation, 2401 S. Bayview St., Seattle, WA 98144 ..... 206-329-8600; 800-426-0366
Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800
§† Revere Corporation of America, 845 N. Colony Rd., Wallingford, CT 06492 203-269-7701
Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
Tedea Inc., 8606 Wilbur Ave., Northridge, CA 91324 818-349-6116
§† Trans Metrics, Inc., P. O. Box 178, Chagrin Falls, OH 44022 216-248-2229

§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322

Transducers, Temperature-5500

§† Ametek/Rodan Div., 2905 Blue Star St., Anaheim, CA 92806, 714-630-0081 ..... B•1837-1838

§ Dale Electronics, Inc., El Paso Div., P.O. Box 26728, El Paso, TX 79926, 915-592-3253 ..... B•1840-1841

† Harrel, Inc., 16 Fitch St., E. Norwalk, CT 06855, 203-866-2573 ..... D•1130

Keystone Carbon, Thermistor Div., 1935 State Street, St. Marys, PA 15857, 814-781-1591 ..... B•1847-1849

§ Midwest Components, Inc., 1981 Port City Blvd., Muskegon, MI 49443, 616-777-2602 ..... B•1853,1855,1857-1858

Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 .. B•1932-1933

§ Quality Thermistor, 2147 Centurion Pl., Boise, ID 83709, 208-377-3373 ..... B•1864-1865

Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1170

RCL-Shallcross, 195 McGregor St., Manchester, NH 03102, 603-627-3831 ..... A•2017

Techno, Inc., 7803 Lemona Ave., Van Nuys, CA 91405, 818-781-1642 ..... B•1870-1871

Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726

Advanced Techn. Research Labs., 5645 K General Washington Dr., Alexandria, VA 22312 703-750-2920

† Advanced Thermal Products, Inc., P.O. Box 249, St. Marys, PA 15857 ... 814-772-0278

§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397

§ Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000

§† Amprobe Instrument, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563 516-593-5600

† Analog Devices, Inc., One Technology Way, P.O. Box 9106, Norwood, MA 02062-9106 617-329-4700

§ Atkins Technical Inc., 3401 S.W. 40th Blvd., Gainesville, FL 32608 904-378-5555

§† Bailey Controls Co., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092 216-585-8500

Barber-Colman Co., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132 815-877-0241

Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611

Betatherm Corp., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545 617-842-0516

† Bristol Babcock Inc., 1100 Buckingham St., Watertown, CT 06795 ..... 203-575-3000; 800-243-3576

† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000

Burling Instruments, P.O. Box 298, Chatham, NJ 07928 201-635-9481

Cambridge Aeroflo Instruments, Inc., 900 Mount Laurel Circle, Shirley, MA 01464 617-425-2346

§ Capintec Instruments, 6 Arrow Rd., Ramsey, NJ 07446 201-825-9500

† Consolidated Controls, 15 Durant Ave., Bethel, CT 06801 203-743-6721

Controls Division, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900

Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107

Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107

Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300

Degussa Corp., 104 New Era Drive, So. Plainfield, NJ 07080 201-757-6500

Digital Dynamics, Inc., 275 Technology Circle, Scotts Valley, CA 95066 408-438-6823

§ Dowty Electronics Co., Thermocontrol Div., Prospect St., P.O. Box 250, Brandon, VT 05733 802-247-6811

ECO Instrs. Div., Sea Data Corp., 1 Bridge St., Newton, MA 02158 617-964-8360

§ EDL, Inc., 385 Oser Ave., Hauppauge, NY 11788 ..... 516-435-2808;1-800-DIAL EDL

Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650

EOTec Corp., 420 Frontage Road, W. Haven, CT 06516 203-934-7961

§ E-Squared Technology Corp., 4475 Dupont Ct # 9, Ventura, CA 93003 805-644-9544

§ Everest Interscience, Inc., P. O. Box 3640, Fullerton, CA 92634-3640 714-992-4461

† Faria, Thomas G., Corp., P.O. Box 983, Uncasville, CT 06382-0983 203-848-9271

§† Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255

General Resistance, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721

§ Hades Manufacturing Corp., 151 Verdi St., Farmingdale, NY 11735 516-249-4244

† Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000

§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179

Instrulab, P.O. B. 98, Dayton, OH 45404 513-223-2241

International Resistive Company, P.O. Box 1860, Boone, NC 28607 704-264-8861

Kearney/Wabash Electrical Components, 1375 Swan Street, Huntington, IN 46750 219-356-8300

† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900

† Lake Shore Cryotronics, Inc., 64 E. Walnut St., Westerville, OH 43081 ... 614-891-2243

Larson Instrument, Greenbush Rd., Orangeburg, NY 10962 914-359-3800

§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232

Mag-Con, 1626 Terrace Dr., St. Paul, MN 55113 612-633-8820

Meissner Industries, 551 Rte. 10, Dover, NJ 07801 201-366-1700

Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600

§† Mikron Instr., 445 W. Main St., Wyckoff, NJ 07481 201-891-7330

Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121

§ Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900

§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705 714-540-4914

† Piezo Electric Products, Inc., 212 Durham Ave., Metuchen, NJ 08840 201-548-2800

PPM, Inc., 5385 Harper Rd., Cleveland, OH 44139 216-349-2300

§† Precision Monolithics, Inc., 1500 Space Park Dr., Santa Clara, CA 95054-3499 408-727-9222

Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121

Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966

† PSG Inds., 1225 Tunnel Road, Perkasie, PA 18944 215-257-3621

§† RCD Components, Inc., 520 E. Industrial Pk. Dr., Manchester, NH 03103 603-669-0054

RCL-Shallcross, Inc., U.S. Hwy. 70 East, Smithfield, NC 27577 919-934-5181

† RdF Corporation, 23 Elm Ave., Hudson, NH 03051 603-882-5195

† Relco Products, 5594 E. Jefferson Ave., Denver, CO 80237 303-756-1143

Rochester Instrument Systems, 255 N. Union St., Rochester, NY 14605 716-263-7700

§ S. F. Products Corporation, P. O. Box 369, Southport, CT 06490 203-929-6180

§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100

Stow Labs., Inc., Kane Ind'l. Dr., Hudson, MA 01749 617-562-9347

† Syscon Intl., Inc., 1108 So. High St., So. Bend, IN 46618-1096 219-232-3900

§ TDK Corporation, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku., Tokyo, JAPAN 103 ..... (03) 278-5111

Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433

† Thermo Electric, 109 Fifth St., Saddle Brook, NJ 07662 201-843-5800

§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020

§ Wahl Instruments, Inc., 5750 Hannum Ave., Culver City, CA 90231 800-421-2853

§† Weed Instrument Co., Inc., 707 Jeffrey Way, P.O. Box 300, Round Rock, TX 78664-0300 512-255-7043

§ Yellow Springs Instrument Co., Box 279, Yellow Springs, OH 45387 513-767-7241

Transducers, Thermoelectric — See Transducers, Temperature (Vol. B)

Transducers, Tilt - Also see Inclinometers-5500

§† Dova Controls, 4052 148th Ave. N.E., Redmond, WA 98052 206-881-7414

† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497

† Precision Level Vial Co., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925 ..... 215-794-0800;800-345-7517

† Spectron Glass & Electronics, Inc., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788 516-582-5600

Transducers, Torque-5500

Computer Optical Products, Inc., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, 818-882-0424 ..... B•1883

Omega Engineering, Box 4047, Stamford, CT 06907, 203-359-1660 ..... B•1932

Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920

Waters Manufacturing, Inc., Talley Industries, Longfellow Ctr., Wayland, MA 01778, 617-358-2777 ..... A•2111

Acurex-Autodata, 555 Clyde Ave., P.O. Box 7042, Mountain View, CA 94039 415-967-9100

† A. L. Design, Inc., 4232 Ridge Lea Rd., Amherst, NY 14226 716-833-6272

Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611

Daytronic Corp., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342 513-866-3300

ESSCO Inds., P.O. Box 515, Sierra Madre, CA 91024-0515 818-355-8315

§ GSE, Core Inds., 23640 Research Dr., Farmington Hills, MI 48024 313-476-7875

§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282

§ Interface, Inc., 7401 E. Butherus Dr., Scottsdale, AZ 85260 602-948-5555

Lebow Products, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084 313-643-0220

Magnetoelastic Devices, Box 625, Pittsfield, MA 01201 413-445-5608

† Penny & Giles, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401 ... 213-393-1497

Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000

Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611

Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777

§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322

Transducers, Ultrasonic-5500

† Blatek, Inc., Box 574, Bellefonte, PA 16823, 814-355-4910 ..... B•1882

§ NTK Technical Ceramics, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, 201-376-6070 ..... B•1901, D•2171

Radio Materials Corp., P. O. Box 339, Attica, IN 47918, 317-762-2491;1-800-356-9956 ..... A•1168,1170

Accusonic Division, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541 .. 617-548-5800

§ Amerace Corporation, Newburgh Rd., Hackettstown, NJ 07840 201-852-1122

Anders, Inc., 77 Wolcott Rd., Simsbury, CT 06070 203-658-7666

† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171

† Dukane Corp., Communications Sys. Div., 2900 Dukane Dr., St. Charles, IL 60174-9984 312-584-2300

† EDO Western Corp., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115 ..... 801-486-7481/3846

§ Electro Corporation, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578 813-355-8411

§ GC-Thorsen, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209 815-968-9661

† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066

† International Transducer Corp., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111 805-683-2575

JTM Systems & Consulting, Inc., Terrace Hill, Ithaca, NY 14850 607-272-0808

Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000

Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600

§ Murata Manufacturing Co., Ltd., 26-10-2-chome-Tenjin, Nagaoka-Kyo-Shi, Kyoto, JAPAN 617 075-951-9111

Panametrics, 221 Cresent St., Waltham, MA 02254 617-899-2740

† Piezo Kinetics Inc., Box 756, Pine and Mill Streets, Bellefonte, PA 16823 ..... 814-355-1593;814-355-1594
Polaroid Corp., Powercard Div., 391 Totten Pond Rd., Waltham, MA 02159 617-890-6789
Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
§† Rosemount Corp., Sensall/National Sonics, 250 Marcus Blvd., Hauppauge, NY 11788 516-273-6600
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
Sonicor Instrument Corp., 1365 Marconi Blvd., Copiague, NY 11726 516-842-3344
§ Sonobond Ultrasonics Inc., Inductotherm Industries, 200 E. Rosedale Ave., West Chester, PA 19380 ..... 215-696-4710;800-323-1269
Stetco, Inc., 3344 Schierhorn Ct, Franklin Pk., IL 60131 312-671-4208
§ Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131 408-432-8020
§ Valpey-Fisher, 75 South St, Hopkinton, MA 01748 617-435-6831

Transducers, Velocity-5500

Blatek, Inc., Box 574, Bellefonte, PA 16823, 814-355-4910 ..... B•1882
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920
§ Vibra-Metrics, Inc., 1014 Sherman Ave., Hamden, CT 06514, 203-288-6158;1-800-352-2001 ..... B•1930
Airpax Co., Sensor Div., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410 203-272-0301
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
Celesco Transducer Prods., Inc., 7800 Deering Ave., Canoga Pk., CA 91304 818-884-6860
† Computer Instruments, 100 Madison Ave., Hempstead, NY 11550 516-483-8200
Disc Instruments, Honeywell, 102 E. Baker St, Costa Mesa, CA 92626 714-433-0343
Electro Physics Co., Inc., 3009 Central Ave., Waukegan, IL 60085 312-249-5801
§ Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255
† Genisco Technology Corp., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065 805-581-3985
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
† Humphrey, Inc., 9212 Balboa Ave., San Diego, CA 92123 619-565-6631
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
§ Kavlico Corp., 14501 Los Angeles Ave., Moorpark, CA 93021 805-523-2000
Kinemetrics/Systems, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107 818-795-2220
Kurz Instruments Inc., 2411 Garden Rd., Monterey, CA 93940 800-424-7356
Metrix Instrument Co., 1711 Townhurst, Houston, TX 77043 713-461-2131
§† Micro Mo Electronics, Inc., 742 2nd Ave. S., St. Petersburg, FL 33701 813-822-2529
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
§† Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§† Systron-Donner Inertial Div., 2700 Systron Dr., Concord, CA 94518 415-671-6400
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
† Teledyne Gurley, 514 Fulton St. P.O. Box 88, Troy, NY 12181 518-272-6300
§ Temposonics, MTS Sys. Corp., 111 East Ames Ct., Plainview, NY 11803 516-349-1950
Transducers and Systems, A Prime Technology Company, Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471 203-481-5721
Transducer Systems, Inc., 1510 Delp Dr., Kulpsville, PA 19443 215-256-4611
† Transicoil, Inc., Trooper Rd., P.O. Box 99, Worcester, PA 19490-9990 215-277-1300
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
Vibrac, 1 Columbia Dr., Amherst, NH 03031 603-882-6777
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322

Transducers, Vibration-5500

Chatsworth Data Corporation, 20710 Lassen St., Chatsworth, CA 91311, 818-341-9200 ..... D•1227
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006, 201-227-1002;800-635-0650 ..... B•1889
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1920
§ Vibra-Metrics, Inc., 1014 Sherman Ave., Hamden, CT 06514, 203-288-6158;1-800-352-2001 ..... B•1930
Alpha-M Corp., 913 Highland Dr., Euless, TX 76040 817-267-7022
Bently Nevada Corp., P.O. Box 157, Minden, NV 89423 702-782-3611
† Bruel & Kjaer Instrs. Inc., 185 Forest St., Marlboro, MA 01752-3093 617-481-7000
† Channel Industries, 839 Ward Dr., Santa Barbara, CA 93111 805-967-0171
† Columbia Resch. Labs., Macdade Blvd. & Bullens La., Woodlyn, PA 19094 215-872-3882
§ Dova Controls, 4052 148th Ave. N.E., Redmond, WA 98052 206-881-7414
Electro Physics Co., Inc., 3009 Central Ave., Waukegan, IL 60085 312-249-5801
§ Endevco, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675 714-493-8181
† Gulton Industries, Inc., Servonic Div., 1644 Whittier Ave., Costa Mesa, CA 92627 ..... 714-642-2400;800-854-4066
§ Helm Instrument Co., Inc., 1387 Dussel Drive, Maumee, OH 43537 419-893-4356
† HH Controls Co., Inc., 16 Frost St., Arlington, MA 02174 617-646-2626
§ Hottinger Baldwin Measurements, 139 Newbury St., Framingham, MA 01701 617-875-8282
§ IC Sensors, Inc., 1701 McCarthy Blvd., Milpitas, CA 95035 408-472-1800
† IMO Delaval Inc., 325 Halstead St., Pasadena, CA 91109-7087 818-351-4241
Kinemetrics/Systems, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107 818-795-2220
† Knowles Electronics, Inc., 3100 N. Mannheim Rd., Franklin Park, IL 60131 312-455-3600
Metrix Instrument Co., 1711 Townhurst, Houston, TX 77043 713-461-2131
Modern Controls Corp., 2233 Indl. Blvd., Sarasota, FL 33580 813-355-5183
Motion Sensors, Inc., 12 Park Street, Cranford, NJ 07701 201-925-3553
† PCB Piezotronics, 3425 Walden Ave., Depew, NY 14043-2495 716-684-0001
Primo Company Limited, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, JAPAN 181 0422-43-3121
§ Projects Unlimited, 3680 Wyse Rd., Dayton, OH 45414 513-890-1918
† Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§ Spectral Dynamics Division, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575 619-268-7100
§† Systron-Donner Inertial Div., 2700 Systron Dr., Concord, CA 94518 415-671-6400
Teledyne/Geotech, 3401 Shiloh Rd., Garland, TX 75041 214-271-2561
Trans-Tek, P.O. Box 338, Rte. 83, Ellington, CT 06029 203-872-8351
Unholtz-Dickie Corp., 6 Brookside Dr., Wallingford, CT 06492 203-265-3929
§ Vibro-Meter Corp., 1 Progress Rd., Billerica, MA 01822-5058 617-663-7322
† Wilcoxon Research, 2096 Gaither Rd., Rockville, MD 20850 301-330-8811

Transducers, Volt, Watt, Current VAR, Power Factor, Frequency-5500

Active Control Instrumentation, P.O. Box 243-Wildwood Circle, Key Largo, FL 33037, 305-451-1000 ..... D•1119
Aeroflex Laboratories Inc., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, 516-694-6700 ..... B•1184-1185
† American Aerospace Controls, 570 Smith St., Farmingdale, NY 11735, 516-694-5100 ..... B•1878-1879
Bell, F. W., Inc., 6120 Hanging Moss Rd., Orlando, FL 32807, 407-678-6900 ..... D•1222
Dynapower Corporation, Box 3180, Farmington Hills, MI 48333, 313-553-4300 ..... D•1703,1706
Flex-Core Div., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, 614-889-6152 ..... A•2229
Ohio Semitronics, Inc., 1205 Chesapeake Ave., Columbus, OH 43212, 614-486-9561 ..... B•1902-1915, D•1306-1307
Rekco, Inc., N. 114 W. 19225 Clinton Dr., Germantown, WI 53022, 414-784-3430 ..... D•1141
Tokin America, Inc., 155 Nicholson Ln., 95134, CA 95131, 408-432-8020 ..... B•1926
§ AEMC, 99 Chauncy, Boston, MA 02111 ..... 617-451-0227;800-343-1391
§† Amprobe Instrument, Core Industries, Inc, 630 Merrick Rd., Lynbrook, NY 11563 516-593-5600
§ ARGA Controls, 35 E. Glenarm St., Pasadena, CA 91105 213-682-3314
Best Technology Inc., 400 Boren Ave. North, Seattle, WA 98109 206-382-1300
† Bristol Babcock Inc., 1100 Buckingham St., Watertown, CT 06795 ..... 203-575-3000; 800-243-3576
† C & C Jetronic, Inc., Research Pk. 318 Wall St., Princeton, NJ 08540 609-921-8540
Crompton Instruments, 2763 Higgins Road, Elk Grove Village, IL 60007 312-593-1107
Crompton Instrs., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007 312-593-1107
Cross Electronics, 100 Commonwealth Dr., Warrendale, PA 15086 412-776-1591
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
Dowty RFL Inds. Inc./Communications Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
Dowty RFL Inds. Inc./Instrumentation Div., The Dowty Grp. PLC, Powerville Rd., Boonton, NJ 07005-0239 201-334-3100
† Electro National, Matthews Ave., Canton, MS 39046 601-859-5511
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033 ..... 201-245-3200;800-526-4048
§ Fenwal Electronics/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757 617-478-5255
§ Halmar Electronics, Inc., 900 N. Hague Ave., Columbus, OH 43204 614-275-0530
§ Micro Switch, A Honeywell Div., 11 W. Spring St., Freeport, IL 61032 815-235-6600
North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542 516-671-5700
† Pulsar Products Div., Physics International, 2700 Merced St., San Leandro, CA 94577 415-577-7236
Rochester Instrument Systems, 255 N. Union St., Rochester, NY 14605 716-263-7700
§ Rotek Instrument Corp., 390 Main St., Waltham, MA 02254 617-899-4611
Scientific Columbus, Inc., Esterline Corporation, 1900 Arlingate Lane, Columbus, OH 43223 614-274-0400
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§ Square D Co., Executive Plaza, Palatine, IL 60067 312-397-2600
Star Micronics, Inc., OEM Division, 70-D Ethel Rd. W., Piscataway, NJ 08854 201-572-9512
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
U.S. Instr. Rentals, 2988 Campus Dr., San Mateo, CA 94403 800-824-2873
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Transformers, Audio-5600 — *See Vol. A*

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Transformers (MIL), Audio, Power, RF-2440

† Abbott Technologies, Inc., Burbank Division, Transformers, 639 So. Glenwood Pl., Burbank, CA 91506, 818-841-3630 ..... A•2157-2159,2161,2163-2166

Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197

Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2209

Dynage/Power & Magnetics, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, 605-296-3462/3487 ..... A•2212-2213

EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2228

† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239

Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251

Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253

Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742, 516-654-1166 ..... A•2262

MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265

§† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2288-2289,2295

† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301

PC Transformer Corp., 64 D Nancy St., West Babylon, NY 11704, 516-491-3300 ..... A•2308-2309

† Perkin-Elmer Corp., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, 203-762-4786 ..... A•2317

† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319-2339,2342-2343,2346-2347, D•1863,1874-1876

† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351

† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352

† Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2398-2399, D•1983

† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•2407, B•1022-1025

Todd Systems, Inc., 50 Ash St., Yonkers, NY 10701, 914-963-3400 .. A•2409-2410

† Torotel Prods. Inc., 13402 S. 71 Hwy., Grandview, MO 64030-3199, 816-761-6314 ..... A•2418-2420,2422-2423

† Torwico Elctrns. Inc., 410 Oberlin Ave. South, Lakewood, NJ 08701, 201-364-1800 ..... A•2424-2425

† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426

Ulveco, Inc., 323 Vintage Park Drive, Foster City, CA 94404, 415-574-1100 ..... A•2430

United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428

Voltampere Corp., 146 Horton Ave., Lynbrook, NY 11563, 516-887-9443 ..... D•2038

Wayne Transformer Co., Inc., 666 Pacific St., Brooklyn, NY 11217, 718-783-9007 ..... A•2440

§† Adams-Russell, Anzac Div., 80 Cambridge St, Burlington, MA 01803 671-273-3333

AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024

† Automatic Coil Corp., Sub. Designatronics, Inc., 3545 N.W. 71st St, Dept. E, Miami, FL 33147 305-696-6660

Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541

† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376

† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798

Electronic Transformer Corp., P.O. Box 188, Totowa, NJ 07511 201-942-2222

† Elnetic Electronics, Inc., P.O. Box 88232, Los Angeles, CA 90009-8232 .. 213-515-1546
, Endicott Coil, 24 Charlotte St., Binghamton, NY 13905 607-797-1263
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
Genco Precision Corp., 247 Skidmore Road, Deer Park, NY 11729 516-242-3006
† Hadley, Robert M. Co., Inc., 750 West 51st St., Los Angeles, CA 90037 .. 213-234-9091
† Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Magnetic Circuit Elements, 1540 Moffett St., Salinas, CA 93905 408-757-8752
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Milwaukee Transformer Co., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223 414-358-5300
Mouser Electronics, 2401 Hwy. 287 North, Mansfield, TX 76063 817-483-4422
MTE Corp., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223 414-358-5300
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
Onan Power/Electronics, 4801 W. 81st St., Minneapolis, MN 55437 612-921-5600
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Pacific Electro Dynamics, Inc., 11465 Willows Rd. N.E., Redmond, WA 98073-9745 206-881-1700
† Power Sys. Grp., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311 818-885-8223
§ QPL Magnetics, Inc., P.O.BOX C, Lake Grove, NY 11755 516-589-3331
† Sigma Electronics Inc., 10830 Kinghurst Dr., Houston, TX 77099 713-933-4700
§† Skyway Magnetics, 35372 Hwy 79, Warner Springs, CA 92086 619-782-3342
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
† Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
§† Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
Torema U.S.A., Inc., 6699 Portwest Dr., No. 130, Houston, TX 77024 713-861-6643
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100

Transformers (MIL), Pulse & Variable-2440

Bey Electric, Inc., 362 Main St., Box 548, Lincoln Park, NJ 07035, 201-694-5000 ..... A•2197
Dale Electronics, Inc., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, 605-665-9301 ..... A•2205,2209
† ESC Electronics Corp., 534 Bergen Blvd., Palisades Pk., NJ 07650, 201-947-0400 ..... A•1558,2215
EWC, Inc., 725 Federal Ave., Kenilworth, NJ 07033, 201-245-3200;800-526-4048 ..... A•2216,2228
† Hisonic, Inc., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, 913-782-0012 ..... A•2239
Magnetek Corp., 7315 Red Deer Dr., Boulder, CO 80301-4696, 303-442-6700 ..... A•2250-2251
Magnetek Triad, 1124 E. Franklin St., Huntington, IN 46750, 219-356-6500 ..... A•2252-2253
MCI Transformer Corporation, 411 Manhattan Ave., Babylon, NY 11704, 516-587-0510 ..... A•2265
† Microtran Co. Inc., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, 516-561-6050 ..... A•2282,2288-2289,2295
† North Hills Electronics, 1 Alexander Pl., Glen Cove, NY 11542, 516-671-5700 ..... A•2301
† Pico Electronics, Inc., 453 North MacQuesten Pkwy., Mt. Vernon, NY 10552, 914-699-5514;800-431-1064 ..... A•2319,2322-2323,2340-2341,2344-2345,2348, D•1863,1874-1875
† Polyphase Instrument, 175 Commerce Dr., Ft. Washington, PA 19034, 215-643-6950 ..... A•2350-2351
† Power Magne-Tech Corporation, 441 High Street, Perth Amboy, NJ 08861, 201-826-4700 ..... A•2352-2353
Tamura Corporation of America, 1150 Dominguez St., Carson, CA 90746-3518, 213-638-1790 ..... A•1291,1695,2395,2398-2399, D•1983
† Technitrol, 1952 E. Allegheny Ave., Philadelphia, PA 19134, 215-426-9105 ..... A•1628,2407, B•1022-1025
† Trans American Transformer, 142 Peconic Ave., Medford, NY 11763, 516-654-1880 ..... A•2426
United Transformer Corporation, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, 201-454-2600 ..... A•2428
§† Vitec Electronic Corporation, 1525A East Acequia, Visalia, CA 93291, 209-739-1077 ..... A•2435
† AIE Magnetics, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210 615-244-9024
§† Aydin Radar & EW Division, Div. of Aydin Corporation, 32 Great Oaks Boulevard, San Jose, CA 95119-1371 408-629-1100
Berkshire Transformer Corp., Route 341, P.O. Box 129, Kent, CT 06757 203-927-3541
† B. G. Laboratories, Inc., 75 Travis Ave., Binghamton, NY 13904 607-722-2376
† BH Electronics, Inc., 12219 Wood Lk. Dr., Burnsville, MN 55337 612-894-9590
† Bicron Electronics, 100 Barlow Street, Canaan, CT 06018 203-824-5125
† Coiltronics Inc., 984 S.W. 13th Court, Pompana Beach, FL 33069 305-781-8900
† DeYoung Manufacturing, Inc., 12920 N.E. 125th Way, Kirkland, WA 98034 206-823-4798
† Freed Transformer, 1718 Weirfield St., Ridgewood, NY 11385 212-386-1300
† Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225 716-894-5710
† Magnetic Component Engineering, Inc., 11379 Playa Street, Culver City, CA 90230 213-398-4761
† Magnetico Inc., 182 Morris Ave., Holtsville, NY 11742 516-654-1166
Neshaminy Transformer, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925 215-794-7411
† OPT Industries Inc., 300 Red School La., Phillipsburg, NJ 08865 201-454-2600
† Power Sys. Grp., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311 818-885-8223
† Standex Electronics, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209 513-871-3777
† Stangenes Industries, Inc., 1052 East Meadow Circle, Palo Alto, CA 94303 415-493-0814
Sterling Transformer Corp., 510 Driggs Ave., Brooklyn, NY 11211 718-782-4200
Tele-Tech Corporation, P.O. Box 790, Bozeman, MT 59715 406-586-0291
† Texas Transformer Corp., P.O. Box 220, Plano, TX 75074 214-424-1581
Thordarson Meissner, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863 618-262-5121
§† Toko America, Inc., 1250 Feehanville Dr., Mt. Prospect,, IL 60056 312-297-0070
† Vanguard Electronics Co., 1480 W. 178th St., Gardena, CA 90248 213-323-4100
† Wirebenders, Inc., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021 ... 602-861-1856

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§ Clairex Electronics, Clairex Corporation, 560 S. 3rd Ave., Mt. Vernon, NY 10550, 914-664-6602 ..... B•1270
§ EG & G Vactec, 10900 Page Blvd., St. Louis, MO 63132, 314-423-4900 ... B•1271
† NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... A•1749, B•1280-1281
§† Optek Technology, Inc., 345 Industrial Blvd., McKinney, TX 75069, 214-542-9461 ..... B•1278
Philips ECG, Amperex Electronics Corp., A North American Philips Co., 100 First Ave., Waltham, MA 02254, 617-890-6107 ..... A•2135
Raytheon/TAG Semiconductors Ltd., 43 Third Ave., Burlington, MA. 01803, 617-272-3704 (3705) ..... A•2139-2141
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
EG&G Rotron, Industrial Division, Saugerties, NY 12477 914-246-3401
Ferranti Elec., 87 Modula Ave., Commack, NY 11725 516-543-0200
General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
† Gilway Technical Lamp, 800 W. Cummings Pk., Woburn, MA 01801 617-935-4442
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
§ Lite-On Corp., Sub. Taiwan Liton Elctrn. Co. Ltd., 4951 Airport Pkwy., Ste. 570, Dallas, TX 75248 214-239-3565
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§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
§ NTE Electronics, Inc., 44 Farrand St., Bloomfield, NJ 07003 201-748-5089
Opto Technology, Inc., 562 Chaddick Dr., Wheeling, IL 60090 312-537-4277
Philips Electronics Ltd., Elcoma Division, 601 Milner Avenue, Scarborough, ONTARIO, CAN. M1B 1M8 416-292-5161
§ Rohm Corp., 8 Whatney, Irvine, CA 92718 714-855-2131
§ Sanyo Semiconductor Corp., 7 Pearl Ct., Allendale, NJ 07401 201-825-8080
Sensor Techn., 21012 Lassen St., Chatsworth, CA 91311 213-882-4100
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Optoelectronics Division, 19000 Homestead Rd., Cupertino, CA 95014 408-257-7910
† Silicon Sensors, Hwy. 18 East, Dodgeville, WI 53533 608-935-2707
† Silonex Inc., 331 Cornelia St., Plattsburgh, NY 12901 518-561-3160
§† Teledyne Crystalonics, Teledyne Industries, Inc., 147 Sherman St., Cambridge, MA 02140 617-491-1670
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200

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Transistors, Unijunction, Surface Mount-4800 — *See Vol. A*

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† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
§† Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
§† General Electric Solid State Div., G.E. Corporation, Route 202, Somerville, NJ 08876 201-685-6530
§† Germanium Power Devices, Box 3065, Shawsheen Village Sta., Andover, MA 01810 617-475-5982
† International Rectifier Corp., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245 213-772-2000
§† Motorola Semiconductor Prods. Sector, 3102 North 56th Street, Phoenix, AZ 85018-6606 602-244-6900
† Powertech, Inc., 0-02 Fairlawn Ave., Fairlawn, NJ 07410 201-791-5050
§† RCA Solid State Div., Transistors, Rte. 202, Somerville, NJ 08876 201-685-6000
§† Siliconix, Inc., 2201 Laurelwood Rd., Santa Clara, CA 95054 408-988-8000
§† Solitron Devices, Inc., Semiconductor Group, 1177 Blue Heron Blvd., Riviera Beach, FL 33404 305-848-4311
Sprague Electric Company, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102 617-339-8900
§† Supertex, Inc., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607 408-744-0100
Texas Instrs., Data Sys. Group, P. O. Box 809063, Dallas, TX 75380-9063 1-800-527-3500
§† TRW Optoelectronics Div., 1215 W. Crosby Rd., Carrollton, TX 75006 ... 214-323-2200
§† TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260 213-536-0888

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Transmission Lines (MIL), RF-2440

† Amphenol RF Operations, Amphenol Corporation, One Kennedy Avenue, Danbury, CT 06810 203-743-9272

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Transmitters, Fiber Optic-2475

Interoptics, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, 415-347-7727 ..... B•1169
Litton Poly-Scientific, 1213 N. Main St., Blacksburg, VA 24060-3100, 703-953-4751 ..... B•1171,1221,1230
† **MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172**
§† **NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1173-1174**
§ **Potter & Brumfield, A Siemens Co., 200 S. Richland Creek Dr., Princeton, IN 47671-0001, 812-386-1000 ..... B•1571**
† **Ross Engineering Corp., 540 Westchester Dr., Campbell, CA 95008, 408-377-4621 ..... B•1577**
Aborn Electronics Inc., 2108 D Bering Dr., San Jose, CA 95131 408-436-5444
§† Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
§ Artel Communications Corp., 22 Kane Industrial Dr., Hudson, MA 01749 617-562-2100
Avantek, Inc., 3175 Bowers Ave., Santa Clara, CA 95054 408-727-0700
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
§ Dymec, Inc., 8 Lowell Ave., Winchester, MA 01890 ..... 617-729-7870;800-225-1151
† Farinon Div., Harris Corp., 1691 Bayport, San Carlos, CA 94070 415-594-3000
† Fibronics International Inc., Communications Way, Independence Park, Hyannis, MA 02601-1892 617-778-0700
† Foundation Instruments Inc., 24 Colonnade Rd., Nepean, ON, CANADA K2E 7J6 613-226-4000
§ Fuji Electric Corp. of America, 727 W. 7 St., Ste. 235, Los Angeles, CA 90017 213-622-4490
General Fiber Optics, Inc., 98 Commerce Rd., Cedar Grove, NJ 07009 .. 201-239-3400
§ General Optronics Corp., 2 Olsen Ave., Edison, NJ 08820 201-549-9000
GTE SUPPLY, GTE Communications Systems, 5225 Wiley Post Way, Salt Lake City, UT 84116 800-433-4837
Hewlett-Packard Co., 19310 Pruneridge Ave. CIC, IFD, Cupertino, CA 95014 ..... Call Local Sls. Off.
§† Honeywell Optoelectronics, 830 E. Arapaho Dr., Richardson, TX 75081 214-470-4271
IPAC Grp., 3047 Indl. Blvd., Bethel Pk., PA 15102 412-831-9200
§† ITT Electro-Optical Prods., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019 703-563-0371
§† Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
LeCroy Corp., 700 S. Main St., Spring Vly., NY 10977 914-425-2000
† Manage, Inc., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014 413-592-9123
† Math Assocs., 2200 Shames Dr., Westbury, NY 11590 516-334-6800
§† Mikron Instr., 445 W. Main St., Wyckoff, NJ 07481 201-891-7330
† Optelecom, Inc., 15930 Luanne Dr., Gaithersburg, MD 20877 301-840-2121
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
Photodyne Inc., 3760 Calle Tecate, Camarillo, CA 93010 805-388-8378
Poulin Associates, Inc., 302 North Rd., Sudbury, MA 01776 617-443-7333
Rockwell International Telecommunications, 1200 N. Alma Rd., Richardson, TX 75081 214-996-5000
§† SpecTran Corp., 50 Hall Road, Sturbridge, MA 01566 617-765-0851
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200

Transmitters, Fixed Frequency-1900 — *See Vol. D*

Transmitters, Infrared remote control transmitters for satellite T.V. receivers-1900 — *See Vol. D*

Transmitters, Laser-3700

Analog Modules, Inc., 126 Baywood Avenue, Longwood, FL 32750, 305-339-4356/4355 ..... D•1006
MERET, Inc., 1815 24th St., Santa Monica, CA 90404-4998, 213-828-7496 ..... B•1172
§ American Laser Systems, Inc., 106 Fowler Rd., Goleta, CA 93117 805-967-0423
CATEL Telecommunications, 4050 Technology Pl., Fremont, CA 94537 415-659-8988
§† Codenoll Technology Corp., 1086 N. Bwy., Yonkers, NY 10701 914-965-6300
§† Laser Diode, Inc., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901 201-249-7000
Ortel Corp., 2015 W. Chestnut St., Alhambra, CA 91803 818-281-3636
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433

Transmitters, Position-1900 — *See Vol. D*

Transmitters, Process Control (Temperature, Pressure, Flow, etc.)-5500

§ Data Instruments, Inc., 100 Discovery Way, Acton, MA 01720, 617-264-9550 ..... B•1884
E-T-A Circuit Breakers, 7400 N. Croname Rd., Chicago, IL 60648, 312-647-8303 ..... B•1890
§ International Microtronics Corp., 4016 E. Tennessee St., Tucson, AZ 85714, 602-748-7900 ..... D•1377-1379
§† NES, Inc. (Nationwide Electronic Systems), 3003 Wakefield, Carpentersville, IL 60110, 312-426-5900 ..... D•1137
§ Newport Electronics, 630 E. Young St., Santa Ana, CA 92705, 714-540-4914 ..... D•1388-1389
Sensotec, Inc., 1200 Chesapeake Ave., Columbus, OH 43212, 614-486-7723 ..... B•1918
Setra Systems, Inc., 45 Nagog Park, Acton, MA 01720, 508-263-1400;1-800-25-SETRA ..... B•1922-1923
§ Action Instruments, 8601 Aero Dr., San Diego, CA 92123 619-279-5726
Anasco Corporation, 42A Cherry Hill Dr., Commerce Ctr. Bldg., Danvers, MA 01923 ..... 617-777-8888;800-826-2726
§† Bailey Controls Co., Div. of Babcox & Wilcox, 29801 Euclid Ave., Wickliffe, OH 44092 216-585-8500
§ Beckman Industrial Corp., Emerson Electric Co., 3883 Ruffin Road, San Diego, CA 92123 619-495-3200
Brooks Instrument Div., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440 215-362-3500
Celesco Transducer Prods., Inc., 7800 Deering Ave., Canoga Pk., CA 91304 818-884-6860
§ Chessell Corp., 1 Pheasant Run, Newtown, PA 18940 215-968-0660
Computer Instruments, 100 Madison Ave., Hempstead, NY 11550 516-483-8200
† Controls Division, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047 215-355-6900
Degussa Corp., 104 New Era Drive, So. Plainfield, NJ 07080 201-757-6500
DGH Corporation, P. O. Box 5638, Manchester, NH 03108 603-622-0452
† Dresser Inds., 1505 Elm St., Dallas, TX 75201 214-746-6000
Entran Devices, 10 Washington Ave., Fairfield, NJ 07006 .. 201-227-1002;800-635-0650
§ Extech Instruments Corp., 150 Bear Hill Rd., Waltham, MA 02154 617-890-7440
§ Fuji Electric Corp. of America, 727 W. 7 St., Ste. 235, Los Angeles, CA 90017 213-622-4490
§† Gould Inc., Meas. Sys. Div., 2230 Statham Blvd., Oxnard, CA 93030 805-487-8511
§ Hy-Cal Engineering, 9650 Telstar Ave., El Monte, CA 91731 818-444-4000
Kistler-Morse, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073 206-881-8000
† Kulite Semiconductor Prods., Inc., One Willow Tree Rd., Leonia, NJ 07605 201-461-0900

Leeds & Northrup, General Signal, Sumneytown Pike, North Wales, PA 19454 215-643-2000
§ Love Controls Corp., 1475 S. Wheeling Rd., Wheeling, IL 60090 312-541-3232
§† Mikron Instr., 445 W. Main St., Wyckoff, NJ 07481 201-891-7330
Minco Products, 7300 Commerce La., Minneapolis, MN 55432 612-571-3121
§† MKS Instruments, Inc., Six Shattuck Road, Andover, MA 01810 617-975-2350
Omega Engineering, Box 4047, Stamford, CT 06907 203-359-1660
† Paine Corporation, 2401 S. Bayview St., Seattle, WA 98144 ..... 206-329-8600; 800-426-0366
Princo Instruments, Inc., 1020 Industrial Hwy., Southampton, PA 18966
Richard-Lee Co., Box 724, New Providence, NJ 07974 201-276-0710
§† Robinson-Halpern, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248 215-825-9200
Schaevitz Engineering, U.S. 130, Union Ave., Pennsauken, NJ 08110 609-662-8000
§† Seaboard Electronics, 70 Church St., New Rochelle, NY 10805 914-235-8073
Trans Metrics, Inc., P. O. Box 178, Chagrin Falls, OH 44022 216-248-2229
Validyne Engineering Corporation, 8626 Wilbur Ave., Northridge, CA 91324 818-886-2057
§ Wahl Instruments, Inc., 5750 Hannum Ave., Culver City, CA 90231 800-421-2853
Yokogawa Corp. of America, 200 West Park Drive, Peachtree City, GA 30269 404-487-1471

Transmitters, Radar — See Radar System Components (Vol. A)

Transmitters, Telemetry-1900 — *See Vol. D*

Transmitters, Tone-1900 — *See Vol. D*

Transmitters (MIL), ECM-3475 — *See Vol. D*

Transmitters (MIL), Shipboard Jamming-3475 — *See Vol. D*

Transmitters (MIL), TWTs-3475 — *See Vol. D*

Transponders-1900 — *See Vol. D*

Transports, Tape (all kinds)-2000 — *See Vol. D*

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Trimmers, Capacitor — See Capacitors, Variable, Padders & Trimmers (Vol. A)

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Trimmers, Surface Mount, Potentiometer-4750 — *See Vol. A*

Tube Heat Dissipators-2600 — *See Vol. C*

Tubes, Ballast — See Resistors, Ballast (Vol. A)

Tubes, Cathode Ray, General Purpose-2450

§ A.C. Interface Inc., 15560 Rockfield, Unit 1E, Irvine, CA 92718 714-472-9524
Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
Ball Electronic, Systems Div., P. O. Box 589, Broomfield, CO 80020 303-460-5260
Data Ray Corp., 452 Burbank Street, Broomfield, CO 80020 303-469-5173
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
§† Rank Brimar Inc., 227 Technology Circle, Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-450-8992
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Display Devices Operation, P. O. Box 500, Beaverton, OR 97077 ..... 503 627 6868
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Cathode Ray, Special Purpose-2450

Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
Ball Electronic, Systems Div., P. O. Box 589, Broomfield, CO 80020 303-460-5260
Data Ray Corp., 452 Burbank Street, Broomfield, CO 80020 303-469-5173
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
Hughes Aircraft Co., Industrial Products Division, 6155 El Camino Real, Carlsbad, CA 92009 619-931-3000
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
§† Rank Brimar Inc., 227 Technology Circle, Scotts Valley, CA 95066 408-438-6440
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-450-8992
† Raytheon Co., Microwave & Power Tube Div., 190 Willow St., Waltham, MA 02154 617-899-8400
Tektronix, Inc., P.O. Box 500, 76/260, Beaverton, OR 97077 800-835-9433
Tektronix, Inc., Display Devices Operation, P. O. Box 500, Beaverton, OR 97077 ..... 503 627 6868
Thomas Electronics, Inc., 100 Riverview Dr., Wayne, NJ 07470 201-696-5200
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271
† Zenith CRT & Components Operations, 1000 Milwaukee Ave., Glenview, IL 60025 312-391-7733

Tubes, Counting-2200 — *See Vol. D*

Tubes, Flash-3700

† Amglo, 5265 Michigan Ave., Rosemont, IL 60018 312-671-4321
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
EG&G, Inc., Electro-Optics Div., 35 Congress St., Salem, MA 01970 617-745-3200
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Siemens Components, Inc., Special Products Div., 186 Wood Ave., South, Iselin, NJ 08830 201-321-3400
§ Xenon Corp., 20 Commerce Way, Woburn, MA 01801 617-938-3594

Tubes, Ignitron-2200 — *See Vol. D*

Tubes, Image Converter-2450

§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
ElectroPhysics Corp., 48 Spruce St., Nutley, NJ 07110 201-667-2262
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ IR Scientific, Box 110, Carlisle, MA 01741 617-667-7110
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
§† Varo, Inc., Electron Devices Div., 2203 W. Walnut St., Garland, TX 75046 214-487-4129
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Tubes, Indicator — See Tubes, Readout (Vol. B)

Tubes, Magnetron — See Tubes, Microwave (Vol. A)

Tubes, Microwave-3400 — *See Vol. D*

Tubes, Photomultiplier-3700

§ Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† Centronic, Inc., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702 805-499-5902
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
Ealing Electro-Optics, New Englander Industrial Park, Holliston, MA 01746 ..... 617-429-8370;1-800-343-4912
EG&G Gamma Scientific, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Gamma Scientific Inc., 3777 Ruffin Rd., San Diego, CA 92123 619-279-8034
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Microscience, Inc., 182 Forbes Rd., Braintree, MA 02184 617-849-1952
§ Shokai Far East, Ltd., 280 North Central Ave., Hartsdale, NY 10530 914-681-0700
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
§† THORN EMI Gencom Inc., 23 Madison Rd., Fairfield, NJ 07006 201-575-5586
Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Tubes, Readout (CRT, Cold-Cathode, Vacuum Fluorescent, Incandescent, etc.)-2450

§ NEC Electronics, Inc., 401 Ellis Street, Mountain View, CA 94039-7241, 415-960-6000 ..... B•1080-1081
ACI Data Products, 17921 Sampson Ln., Huntington Beach, CA 92647 .. 714-842-2945
§ A E G Corporation, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269 201-231-8300
Ball Electronic, Systems Div., P. O. Box 589, Broomfield, CO 80020 303-460-5260
† Displays, Inc., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044 717-242-2541
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
† ERA/REFAC Electronics, Inc., West Hill Rd., Winsted, CT 06098 203-379-2731
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§ Industrial Electronic Engineers, 7740 Lemona Ave., Van Nuys, CA 91405 818-787-0311
Infodex, Inc., 10 Venus Dr., Wolcott, CT 06716 203-757-9291
§ Mitsubishi Electronics, 991 Knox Street, Torrance, CA 90502 213-515-3993
Plasmarc Technologies, Inc., 180 Passaic Avenue, Fairfield, NJ 07006 .. 201-575-0870
Rauland-Zenith Electronics Corp., 2407 W. North Ave., Melrose Pk., IL 60160 312-450-8992
Tektronix, Inc., Display Devices Operation, P. O. Box 500, Beaverton, OR 97077 ..... 503 627 6868
§† Teltron, Inc., 2 Riga Lane, Birdsboro, PA 19508 215-582-2711
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400

Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Tubes, Strobe — See Lamps, Stroboscopic Source (Vol. B)

Tubes, TV Camera Pickup-3700

§ Amperex Electronic Company, A Div. of North American Philips Corporation, Providence Pike, Slatersville, RI 02876 401-762-3800
ATV Research, Inc., 1301 Broadway, Dakota City, NE 68731 402-987-3771
Centronic, Inc., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E, Newbury Park, CA 91320-1702 805-499-5902
§ Distributor & Special Products, Thomson Consumer Electronics, Inc., 2000 Clements Bridge Rd., Deptford, NJ 08096 609-541-3636
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hamamatsu Photonics K.K., 325-6 Sunayama-Cho, Hamamatsu City, Shizuoka Pref, JAPAN 0534-52-2141
Hitachi America, Ltd., 2210 O'Toole Ave., San Jose, CA 95131 408-435-8300
§† Teltron, Inc., 2 Riga Lane, Birdsboro, PA 19508 215-582-2711
§ Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
§† Vicon Industries, Inc., 525 Broad Hollow Rd., Melville, NY 11747 516-293-2200
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Tubes, Transmitting-1900 — ***See Vol. D***

Tubes, X-ray-2200 — ***See Vol. D***

Tubes (MIL), Indicator & Pickup-2440

† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Teltron, Inc., 2 Riga Lane, Birdsboro, PA 19508 215-582-2711

Tubes (MIL), Microwave-2440

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
Hughes Aircraft Co., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999 213-517-6000
† Litton Systems, Inc., Electron Dvcs. Div., 960 Industrial Rd., San Carlos, CA 94070 415-591-8411
Thomson Electron Tubes & Devices Corp., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801 201-328-1400
§† Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† VTM Microwaves, Inc., 4975 W. 80 Ave., Westminster, CO 80030 303-426-6866

Tubes (MIL), Power & Gas, Planar-2440

§† Amperex Electronic Corp., Hicksville Div., Box 418 - 230 Duffy Ave., Hicksville, NY 11802 516-931-6200
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050
§† Varian Associates, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
† Westinghouse Electric Corp., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845 607-796-3271

Tubes (MIL), Receiving, & Tube Shields-2440

Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198
† EEV Inc., 4 Westchester Plaza, Elmsford, NY 10523 914-592-6050

Tubing, Ceramic-2500 — ***See Vol. C***

Tubing, Fiberglass-2800 — ***See Vol. C***

Tubing, Glass-2500 — ***See Vol. C***

Tubing, Heat Shrinkable-Also See Caps, Forms & Tapes, Heat Shrinkable-2800 — ***See Vol. C***

Tubing, Metal-2500 — ***See Vol. C***

Tubing, Paper-2800 — ***See Vol. C***

Tubing, Plastic-Also See Tubing, Spaghetti-2800 — ***See Vol. C***

Tubing, Spaghetti-2800 — ***See Vol. C***

Tubing, Spiral Wrap-2800 — ***See Vol. C***

Tubing, Waveguide-3450 — ***See Vol. A***

Tubing, Zipper-2800 — ***See Vol. C***

Tuners, AM/FM-1300 — ***See Vol. D***

Tuners, Microwave-3450 — ***See Vol. A***

Tuning Forks-2300 — ***See Vol. A***

Tweezers, Manual & Vacuum-5400 — ***See Vol. C***

Ultraviolet Inspection Lighting-Also See Microscopes, Ultraviolet-4100 — ***See Vol. D***

Urea Formaldehyde — See Plastic Raw Materials (Vol. C)

Valve Position Indicators/Transmitters-5500

ETI Systems, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, 619-757-7770 ..... A•2074, B•1205
§ Allied Precision Electronics Corp., 1702-D Ponderosa, College Station, TX 77840 409-693-5397
§ Jamesbury Corp., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605 617-852-0200
§ Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
§ Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513 312-485-5152

Valve Positioners & Actuators-4750 — ***See Vol. A***

Valves, Solenoid-4550

§ Deltrol Controls, 2745 S. 19th St., Milwaukee, WI 53215, 414-671-6800 ..... B•1615-1616
† Electronic Specialty Corp., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, 206-574-5000 ..... B•1624-1625
Regdon Solenoid, Inc., 3713 Grand Blvd., Brookfield, IL 60513, 312-485-5152 ..... B•1634
§ Airmatic-Allied, 185 Park Dr., Wilmington, OH 45177 513-382-1691
§† Automatic Switch Co., 50-60 Hanover Road, Florham Park, NJ 07932 1-201-966-2000
§† Barksdale Controls Div., Imo Delaval Inc., 3211 Fruitland Ave., P.O. Box 58843, Los Angeles, CA 90058 213-589-6181
† Bendix Corp., Electrodynamics Div., 11600 Sherman Way, N. Hollywood, CA 91605 818-765-1010
§ Crouzet Controls, Inc., 1083 State Pkwy., Schaumburg, IL 60173 312-843-2200
Delta Products Corporation, 3823 Spinnaker Ct., Fremont, CA 94538 415-770-0660
† EEMCO Div., Datron Systems Inc., 4585 Electronics Pl., Los Angeles, CA 90039 818-247-7060
§ Industrial Computer Designs, Inc., 31264 La Baya Drive, Westlake Village, CA 91362 818-889-3179
§ ITT General Controls Div., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201 213-842-6131
§ Jamesbury Corp., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605 617-852-0200
§ H. Kuhnke, Inc., 26 W. Highland Ave., Atlantic Highlands, NJ 07716 ..... 201-291-3334; 800-221-0714
† Lisk, G. W., Co., 2 South St., Clifton Springs, NY 14432 315-462-2611
§ Magnatrol Valve Corp., 67 Fifth Ave., Hawthorne, NJ 07507 201-427-4341
Norgren, 5400 South Delaware, Littleton, CO 80120-1663 303-794-2611
Parker Hannifin Corp., 17325 Euclid Ave., Cleveland, OH 44112 216-531-3000
† SR Engineering, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643 714-554-4200
Varian Assocs., Indl. Equip. Grp., 611 Hansen Way, Palo Alto, CA 94303 415-493-4000
Veeco Instruments Inc., Terminal Dr., Plainview, NY 11803 516-349-8300

Valves, Vacuum-4100 — ***See Vol. D***

Varactors — See Diodes, Varactor (Vol. A)

Varistors — See Resistors, Voltage Sensitive (Vol. A)

VCXO — See Oscillators, Voltage Controlled Crystal

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Wall Plates — See Boxes, Junction, Outlet & Wall Plates (Vol. C)

Warning Systems, Lightning-4300
Avex Electronics, 1683 Winchester Rd, P.O. Box 1026, Bensalem, PA 19020 ..... 215-638-1515;800-345-1295
Mauell Corp., 31 Old Cabin Hollow Rd, P.O. Box 339, Dillsburg, PA 17019 717-432-8686

Warning Systems (MIL), Computerized-3475 — *See Vol. D*

Warning Systems (MIL), EW-3475 — *See Vol. D*

Warning Systems (MIL), IR-3475 — *See Vol. D*

Warning Systems (MIL), Laser-3475 — *See Vol. D*

Warning Systems (MIL), SAM Launch-3475 — *See Vol. D*

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Washers, Plain-2825 — *See Vol. C*

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Waveguides (MIL)-2440
Alpha Inds., Inc. - TRG Millimeter Comp., 651 Lowell St, Methuen, MA 01844 617-682-4661
† Ark Elctrns. Corp., 1325 Industrial Hwy., Southampton, PA 18966 215-322-6510
§† Dielectric Communications, General Signal, Tower Hill Rd., Raymond, ME 04071 ..... 207-655-4555;800-341-9678
Lectronic Research Labs., Inc., 1423 Ferry Ave., Camden, NJ 08104 609-541-4200
† Mitec Electronics, 104 Gun Avenue, Pointe Claire, QUEBEC, CANADA H9R 3X3 514-694-6666
Telephonics Corporation/PRD Instruments, 770 Park Avenue, Huntington, NY 11743 ..... 516-549-6415/6102

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Windows, Shielded — See Shields, RF (Vol. C)

Wire & Cable Ties-2825 — *See Vol. C*

Wire, Airframe-2440
§† Belden Wire and Cable, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, 317-983-5200;800-BELDEN-1 ..... C•1772,1813
§† Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410, 201-796-2886 ... C•1816
§† Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400 ..... C•1838
§† Judd Wire, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, 413-863-4357 ..... C•1857
MWS Wire Industries, 31200 Cedar Valley Dr., Westlake Village, CA 91362, 818-991-8553 ..... C•1872
† Barcel Wire & Cable Corp., Electronics Div., 2851 Aton Ave., Irvine, CA 92714 714-863-0300
† BRintec Corp., Brand-Rex Cable Systems Division, 1600 W. Main St, Willimantic, CT 06226-1128 203-456-8000
§† Consolidated Electronic Wire & Cable, 11044 King St, Franklin Park, IL 60131-1412 312-455-8830
§ Custom Cable Corp., 242 Butler St, Westbury, NY 11590 516-334-3600
§† Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198
Delco Wire & Cable, Inc., 257 Rittenhouse Cir., Bristol, PA 19007 215-785-0511
† Electro Weave, 425 Shrewsbury St, Worcester, MA 01604 617-752-8932
§† FL Surprenant Div., 172 Sterling St, Clinton, MA 01510 617-368-1401
† Galite, 2 Tower Dr., Wallingford, CT 06492 203-265-7126
† General Wire Products, Inc., 425 Shrewsbury Street, Worcester, MA 01604 617-752-8260
† W. L. Gore & Assocs., 555 Paper Mill Rd., Newark, DE 19714 302-738-4880
† GSI Corp., 1917 Greenspring Dr., Timonium, MD 21093 301-252-1768
Judd Wire, High Voltage Engrg., 870 Los Vallecitos Blvd, San Marcos, CA 92069 619-744-7720
§† King Wire & Cable Corp., 179-45 110 Ave., Jamaica, NY 11433 718-657-4422
§† Olympic Wire & Cable, 1 Madison Rd., Fairfield, NJ 07006 201-227-7996
§† Philadelphia Insulated Wire Co. Inc., 333 New Albany Rd., Moorestown, NJ 08057 609-235-6700
† Plastoid Corporation, 45 Gingerbread Castle Rd., Hamburg, NJ 07419 .. 201-827-7141
§† Specialty Cable Corporation, P.O. Box 50, Wallingford, CT 06492 ..... 203-265-7126; 800-243-3959
§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276
Storm Products Co., 116 Shore Drive, Hinsdale, IL 60521 312-323-9121
§† Tensolite Company, Subsidiary of Carlisle Corp., Old Post Rd., Rte. 9A, Buchanan, NY 10511 914-737-5600
† Thermax Wire Corp., 32-02 Linden Pl, Flushing, NY 11354-2897 718-939-8300
† United Wire & Cable Corp., 425 Shrewsbury St, Worcester, MA 01604 .. 617-757-3872
§† Vertex Computer Cable & Products, 61 Executive Blvd, Farmingdale, NY 11735 516-293-1610
† Victor Wire & Cable Corp., 3601 Holdrege Ave., Los Angeles, CA 90016 213-870-9933

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ABL Electronics Supply, Inc., 1736 Front St., Yorktown Hgts., NY 10598, 914-962-2253 ..... **C•1768**

§† **American Insulated Wire Corp., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, 401-726-0700** ..... **C•1770**

§† **American Wire & Electronics, 3198K Airport Loop Drive, Costa Mesa, CA 92626, 714-957-6905** ..... **C•1771**

§† **Brim Electronics, P.O. Box 336 E, Fair Lawn, NJ 07410, 201-796-2886** ..... **C•1816-1819**

Carol Cable Co. Inc., 249 Roosevelt Ave., Pawtucket, RI 02862, 401-724-9605 ..... **C•1827**

Caton Connector Corp., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, 617-585-4315 ..... **C•1300**

§† **Daburn Electronics & Cable Corp., 70 Oak St., Norwood, NJ 07648, 201-768-5400** ..... **C•1838**

§† **Judd Wire, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, 413-863-4357** ..... **B•1012, C•1857**

† **Molecu-Wire, P.O. Box 495, Farmingdale, NJ 07727, 201-938-9473** .. **C•1865,1869**

MWS Wire Industries, 31200 Cedar Valley Dr., Westlake Village, CA 91362, 818-991-8553 ..... **C•1872**

National Wire & Cable Corp., 136 San Fernando Rd., Los Angeles, CA 90031-1780, 213-225-5611 ..... **C•1874-1876**

§† Alpha Wire Corp., 711 Lidgerwood Ave., P.O. Box 711, Elizabeth, NJ 07207-0711 201-925-8000

§† Amphenol Products, 4300 Commerce Ct., Lisle, IL 60532 312-983-3500

Apex Microtechnology Corp., 5980 N. Shannon Rd., Tucson, AZ 85741 602-742-8600

§† Consolidated Electronic Wire & Cable, 11044 King St., Franklin Park, IL 60131-1412 312-455-8830

§ Cooner Wire Co., 9186 Independence Ave., Chatsworth, CA 91311 818-882-8311

Dearborn Wire & Cable, Inc., 250 W. Carpenter, Wheeling, IL 60090 ..... 312-459-1000; 800-323-0198

† Gavitt Wire & Cable, Brookfield, MA 01506 617-867-6476

General Electric Co., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602 203-382-2000

§ International Wire Products Co., 500 W. Main St., Wyckoff, NJ 07481 201-891-5800

§† Judd Wire, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069 619-744-7720

Lynn Electronics, 915 Pennsylvania Blvd., Feasterville, PA 19047 ..... 215-677-6700; 800-523-6075

† Markel Corp., P.O. Box 752, Norristown, PA 19404 215-272-8960

Raychem Corp., Elctrns. Grp., 300 Constitution Dr., Menlo Park, CA 94025 415-361-3860

§† Specialty Cable Corporation, P.O. Box 50, Wallingford, CT 06492 ..... 203-265-7126; 800-243-3959

§† Standard Wire & Cable Co., 2345 Alaska Ave., El Segundo, CA 90245 ... 213-536-0006; (800)-447-0006/821-5276

† Vertex Computer Cable & Products, 61 Executive Blvd., Farmingdale, NY 11735 516-293-1610

§† Whitmor Wire & Cable, 27737 Ave. Hopkins, Valencia, CA 91355 805-257-2400

§† Wilco Wire & Cable Co., Inc., 1921 Las Plumas Ave., San Jose, CA 95133 408-926-8880

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PRODUCT SELECTION GUIDES
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

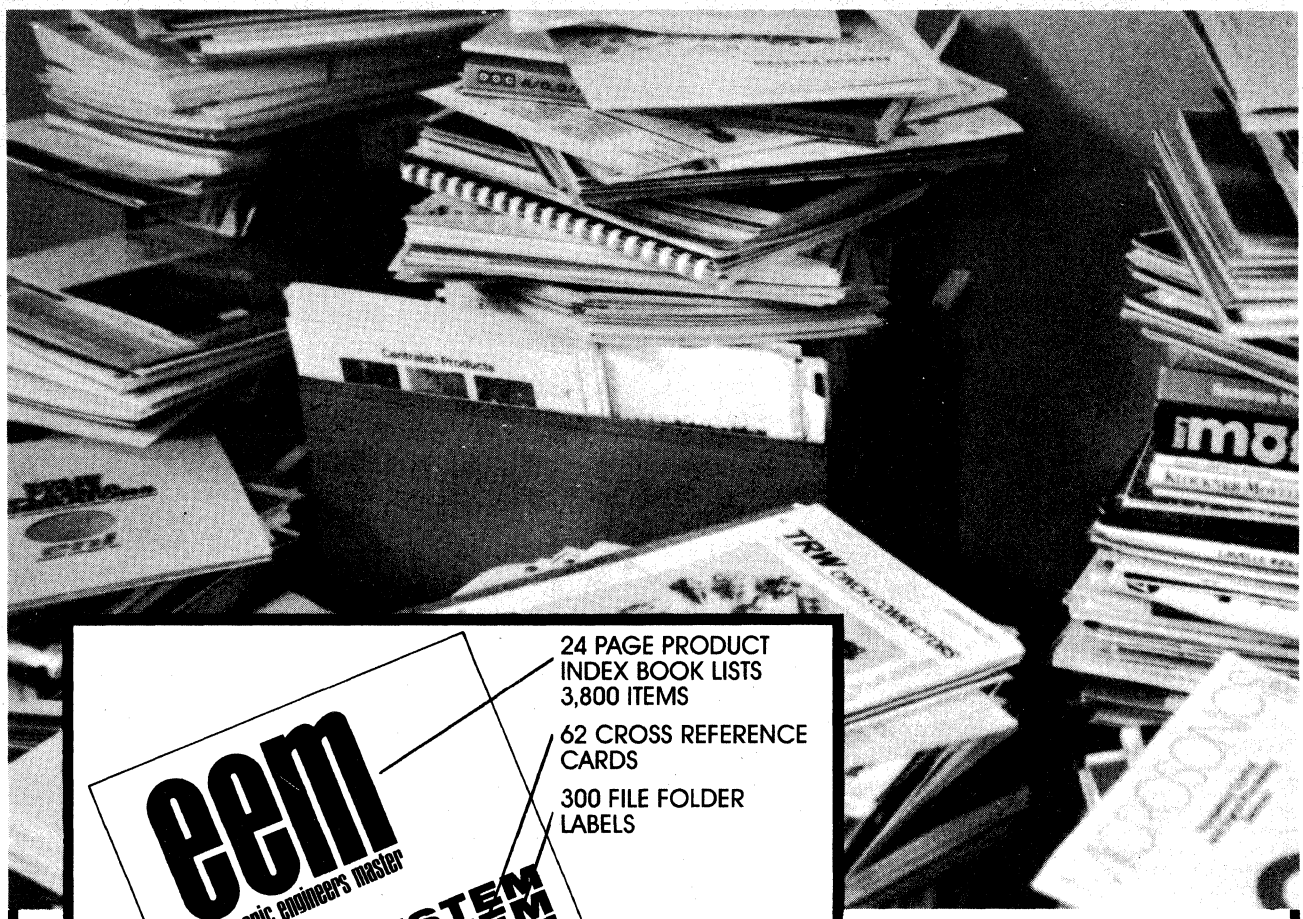
U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

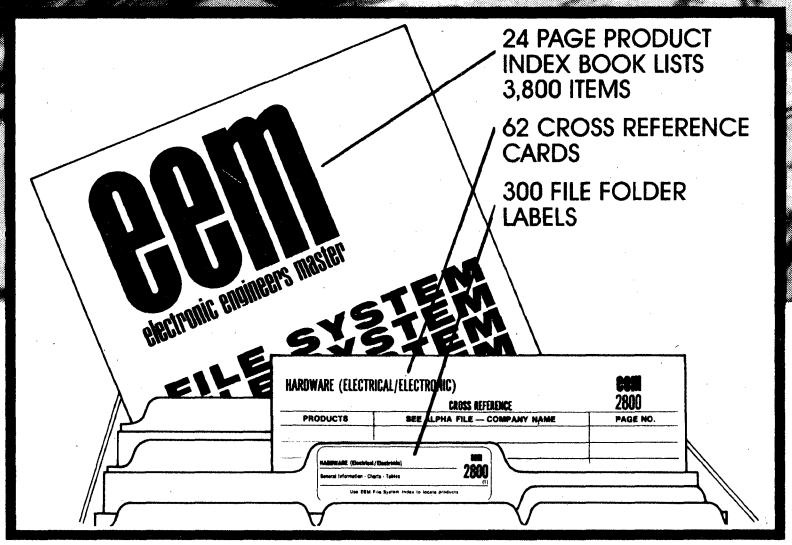
V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force





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MINIGLOSSARY
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				b6	0	0	1	1	0	0	1	1
				b5	0	1	0	1	0	1	0	1
b4	b3	b2	b1		0	1	2	3	4	5	6	7
0	0	0	0	0	NUL	DLE	SP	0	@	P	`	p
0	0	0	1	1	SOH	DC1	!	1	A	Q	a	q
0	0	1	0	2	STX	DC2	"	2	B	R	b	r
0	0	1	1	3	ETX	DC3	#	3	C	S	c	s
0	1	0	0	4	EOT	DC4	$	4	D	T	d	t
0	1	0	1	5	ENQ	NAK	%	5	E	U	e	u
0	1	1	0	6	ACK	SYN	&	6	F	V	f	v
0	1	1	1	7	BEL	ETB	'	7	G	W	g	w
1	0	0	0	8	BS	CAN	(	8	H	X	h	x
1	0	0	1	9	HT	EM	)	9	I	Y	i	y
1	0	1	0	10	LF	SUB	*	:	J	Z	j	z
1	0	1	1	11	VT	ESC	+	;	K	[	k	{
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1	1	1	1	15	SI	US	/	?	O	_	o	DEL

Control Character Representations

NUL	Null
SOH	Start of Heading (CC)
STX	Start of Text (CC)
ETX	End of Text (CC)
EOT	End of Transmission (CC)
ENQ	Enquiry (CC)
ACK	Acknowledge (CC)
BEL	Bell
BS	Backspace (FE)
HT	Horizontal Tabulation (FE)
LF	Line Feed (FE)
VT	Vertical Tabulation (FE)
FF	Form Feed (FE)
CR	Carriage Return (FE)
SO	Shift Out
SI	Shift In
DLE	Data Link Escape (CC)
DC1	Device Control 1
DC2	Device Control 2
DC3	Device Control 3
DC4	Device Control 4
NAK	Negative Acknowledge (CC)
SYN	Synchronous Idle (CC)
ETB	End of Transmission Block (CC)
CAN	Cancel
EM	End of Medium
SUB	Substitute
ESC	Escape
FS	File Separator (IS)
GS	Group Separator (IS)
RS	Record Separator (IS)
US	Unit Separator (IS)
DEL	Delete

(CC) Communication Control
(FE) Format Effector
(IS) Information Separator

Special Graphic Characters

SP	Space
!	Exclamation Point
|	Logical OR
"	Quotation Marks
#	Number Sign
$	Dollar Sign
%	Percent
&	Ampersand
'	Apostrophe
(	Opening Parenthesis
)	Closing Parenthesis
*	Asterisk
+	Plus
,	Comma
-	Hyphen (Minus)
.	Period (Decimal Point)
/	Slant
:	Colon
;	Semicolon
<	Less Than
=	Equals
>	Greater Than
?	Question Mark
@	Commercial At
[	Opening Bracket
\	Reverse Slant
]	Closing Bracket
^	Circumflex
¬	Logical NOT
_	Underline
`	Grave Accent
{	Opening Brace
¦	Vertical Line (This graphic is stylized to distinguish it from Logical OR)
}	Closing Brace
~	Tilde

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-temperature	NA	S	2.1	685	1.8	200	[h]
	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	−1
Brown	1	10	±0.1pF	±1%		−33		−10
Red	2	100		±2%		−75	1.0	−100
Orange	3	1000		±3%		−150	1.5	−1000
Yellow	4	10000			+100% −0%	−220	2.0	−10000
Green	5		±0.5pF	±5%	±5%	−330	3.3	+1
Blue	6					−470	4.7	+10
Violet	7					−750	7.5	+100
Gray	8	0.01	±0.25pF		+80% −20%	+150 to −1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to −750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\,K\,A}{t_D}$

Metric: $C = \frac{.0884\,K\,A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$$E = \tfrac{1}{2}\,CV^2$$

III. Linear charge of a capacitor (Amperes)

$$I = C\frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$$X_C = \frac{1}{2\pi fC}$$

VI. Inductive Reactance (ohms)

$$X_L = 2\pi fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$$DF = \tan\delta \text{ (loss angle)} = \frac{ESR}{X_c} = (2\pi fC)\,(ESR)$$

IX. Power Factor

PF = Sine δ (loss angle) = Cos φ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$$Q = \text{Cotan } \delta \text{ (loss angle)} = \frac{1}{DF}$$

XI. Equivalent Series Resistance (ohms)

$$ESR = (DF)\,(Xc) = (DF)\,(\tfrac{1}{2}\pi fC)$$

XII. Power Loss (watts)

$$\text{Power loss} = (2\pi fCV^2)\,(DF)$$

XIII. KVA (Kilowatts)

$$KVA = 2\pi fCV^2 \times 10^{-3}$$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\,(T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \times 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_o}{L_t} = \left[\frac{V_t}{V_o}\right]^x \quad \left[\frac{T_t}{T_o}\right]^\tau$$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{ --- } + \frac{1}{C_N}$

Two: $C_T = \frac{C_1\,C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 \text{ --- } + C_N$$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

$$db = 20 \log \frac{V_1}{V_2}$$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^{3}
Mega	X 10^{6}
Giga	X 10^{9}
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_s = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
φ = Phase angle
x + y = Exponent effect of voltage and temp
L_o = Operating life
L_t = Test life
V_t = Test voltage
V_o = Operating voltage
T_t = Test temperature
T_o = Operating temperature

MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MAXIMUM CURRENT CAPACITY—CONDUCTORS

Size, AWG	MIL-W-5088				National Electrical Code	Underwriters Laboratory		American Insurance Association	500 c mils/A
	Copper		Aluminum			60°C	80°C		
	Single-wire	Wire-bundled	Single-wire	Wire-bundled					
30	...	...	...	...	...	0.2	0.4	...	0.20
28	...	...	...	...	...	0.4	0.6	...	0.32
26	...	...	...	...	...	0.6	1.0	...	0.51
24	...	...	...	...	...	1.0	1.6	...	0.81
22	9	5	...	...	...	1.6	2.5	...	1.28
20	11	7.5	...	...	...	2.5	4.0	3	2.04
18	16	10	...	...	6	4.0	6.0	5	3.24
16	22	13	...	...	10	6.0	10.0	7	5.16
14	32	17	...	...	20	10.0	16.0	15	8.22
12	41	23	...	...	30	16.0	26.0	20	13.05
10	55	33	...	...	35	...	...	25	20.8
8	73	46	58	36	50	...	...	35	33.0
6	101	60	86	51	70	...	...	50	52.6
4	135	80	108	64	90	...	...	70	83.4
2	181	100	149	82	125	...	...	90	132.8
1	211	125	177	105	150	...	...	100	167.5
0	245	150	204	125	200	...	...	125	212.0
00	283	175	237	146	225	...	...	150	266.0
000	328	200	...	...	275	...	...	175	336.0
0000	380	225	...	...	325	...	...	225	424.0

MINIGLOSSARY
BASIC
EBCDIC CODE

Bit Positions 4, 5, 6, 7	Second Hexadecimal Digit	Digit Punches	00				01				10				11				
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 0, 1
			00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11	Bit Positions 2, 3
			0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F	First Hexadecimal Digit
			12				12	12		12	12	12		12	12				Zone Punches
				11				11	11	11		11	11	11		11			
					0		0		0	0	0		0	0			0		
			9	9	9	9	9	9	9	9									Digit Punches
			①	②	③	④	⑤	⑥	⑦	⑧					⑨	⑩	⑪	⑫	
0000	0	8-1	NUL	DLE	DS		SP	&	-									0	8-1
0001	1	1	SOH	DC1	SOS				⑬		a	j			A	J	⑭	1	1
0010	2	2	STX	DC2	FS	SYN					b	k	s		B	K	S	2	2
0011	3	3	ETX	TM							c	l	t		C	L	T	3	3
0100	4	4	PF	RES	BYP	PN					d	m	u		D	M	U	4	4
0101	5	5	HT	NL	LF	RS					e	n	v		E	N	V	5	5
0110	6	6	LC	BS	ETB	UC					f	o	w		F	O	W	6	6
0111	7	7	DEL	IL	ESC	EOT					g	p	x		G	P	X	7	7
1000	8	8		CAN							h	q	y		H	Q	Y	8	8
1001	9	8-1		EM							;	r	z	`	I	R	Z	9	9
1010	A	8-2	SMM	CC	SM		¢	!	⑮	:									8-2
1011	B	8-3	VT	CU1	CU2	CU3	.	$	,	#									8-3
1100	C	8-4	FF	IFS		DC4	<	*	%	@									8-4
1101	D	8-5	CR	IGS	ENQ	NAK	(	)	_	'									8-5
1110	E	8-6	SO	IRS	ACK		+	;	>	=									8-6
1111	F	8-7	SI	IUS	BEL	SUB		¬	?	"									8-7
			12				12				12	12		12	12	12		12	Zone Punches
				11				11				11	11	11		11	11	11	
					0				0		0		0	0	0		0	0	
			9	9	9	9									9	9	9	9	

Card Hole Patterns

①	12-0-9-8-1	⑤	No-Punches	⑨	12-0
②	12-11-9-8-1	⑥	12	⑩	11-0
③	11-0-9-8-1	⑦	11	⑪	0-8-2
④	12-11-0-9-8-1	⑧	12-11-0	⑫	0
⑬	0-1				
⑭	11-0-9-1				
⑮	12-11				

Control Character Representations

ACK	Acknowledge	EOT	End of Transmission	PF	Punch Off
BEL	Bell	ESC	Escape	PN	Punch On
BS	Backspace	ETB	End of Transmission Block	RES	Restore
BYP	Bypass	ETX	End of Text	RS	Reader Stop
CAN	Cancel	FF	Form Feed	SI	Shift In
CC	Cursar Control	FS	Field Separator	SM	Set Mode
CR	Carriage Return	HT	Horizontal Tab	SMM	Start of Manual Message
CU1	Customer Use 1	IFS	Interchange File Separator	SO	Shift Out
CU2	Customer Use 2	IGS	Interchange Group Separator	SOH	Start of Heading
CU3	Customer Use 3	IL	Idle	SOS	Start of Significance
DC1	Device Control 1	IRS	Interchange Record Separator	SP	Space
DC2	Device Control 2	IUS	Interchange Unit Separator	STX	Start of Text
DC4	Device Control 4	LC	Lower Case	SUB	Substitute
DEL	Delete	LF	Line Feed	SYN	Synchronous Idle
DLE	Data Link Escape	NAK	Negative Acknowledge	TM	Tape Mark
DS	Digit Select	NL	New Line	UC	Upper Case
EM	End of Medium	NUL	Null	VT	Vertical Tab
ENQ	Enquiry				

Special Graphic Characters

¢	Cent Sign
.	Period, Decimal Point
<	Less-than Sign
(	Left Parenthesis
+	Plus Sign
|	Logical OR
&	Ampersand
!	Exclamation Point
$	Dollar Sign
*	Asterisk
)	Right Parenthesis
;	Semicolon
¬	Logical NOT
-	Minus Sign, Hyphen
/	Slash
,	Comma
%	Percent
_	Underscore
>	Greater-than Sign
?	Question Mark
:	Colon
#	Number Sign
@	At Sign
'	Prime, Apostrophe
=	Equal Sign
"	Quotation Mark

MINIGLOSSARY ENCAPSULATION

MATERIALS/HANDLING

Catalyst: A substance which changes the *rate* of chemical reaction. Very small quantities can cause fast change.

Conformal coating Sprayed or dipped. A thin conformal jacket which protects an assembly from moisture or other degrading environments.

Curing agent: See catalyst.

Hardener: See catalyst.

Hermetic: A permanent gas-tight seal.

RTV: Room Temperature Vulcanizing. Associated with silicone rubber sealants which vulcanize at room temperature.

Thermoplastic: Plastic materials which can be made to flow *repeatedly* with the application of heat.

Thermosetting: Plastics which once cured cannot be made to flow again.

Thixotropy: The property of a coating compound which has low viscosity when agitated, but which thickens when the agitation ceases.

Viscosity: Measured in units of *poise* or *centipoise*. The property of a liquid which resists internal flow. Low viscosity equates with thin and vice-versa.

PROCESSING

Casting: Parts or assemblies are placed in a mold. Encapsulating material is added and cured. Part is then removed from the mold.

Dip coating: Part or assembly is dipped into the encapsulating material. Final thickness is determined by number of dips, viscosity, rate of withdrawal, and temperature.

Embedding: Wherein an encapsulant substantially fills all voids in and about an assembly.

Impregnation: A process of encapsulation involving evacuating all air and then allowing the encapsulating material to flow in and fill all voids.

Molding: Similar to casting except this process usually implies multicavity molds and costly machines.

Potting: Wherein the part or assembly is immersed in an encapsulating material contained in a shell which becomes a permanent outer surface after curing.

DIELECTRIC

Arc resistance: An encapsulant's resistance to the formation of a conductive path or track. Measured in time.

Breakdown voltage: The voltage at which an encapsulant fails electrically.

Capacitance: The property of conductors and dielectrics which allows the storage of an electrical charge when the voltage is applied.

Corona: A luminous discharge of electricity due to air ionization when a certain voltage is reached. Can be internal or external. The formation of ozone can cause rapid deterioration of certain materials.

Dielectric: Insulator (Nonconductor.)

Dielectric constant: The property of a material that determines its ability to store electrostatic energy.

Dielectric strength: The ratio of dielectric breakdown to the thickness of insulating material.

Dissipation factor: The ratio of a dielectric material's energy losses.

Flashover: Point at which an electric discharge occurs around an edge or across a surface. Can result in a carbon track and permanent degradation.

Insulation resistance: (IR) An insulating material's total DC leakage.

Surface resistivity: The resistance of the surface of an insulating material to the flow of direct current.

Voltage endurance: Sometimes called corona resistance. The ability of a material to withstand the application of sustained high voltage.

Volume resistivity: The resistance of a material to direct current flow as a measure of volume. Expressed as ohm-centimeters.

EEM

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

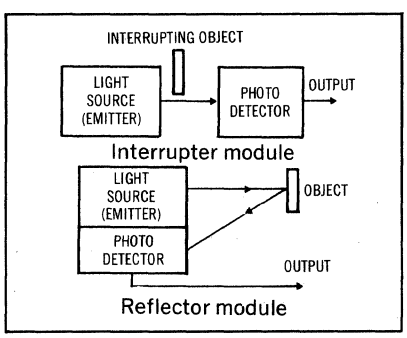
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

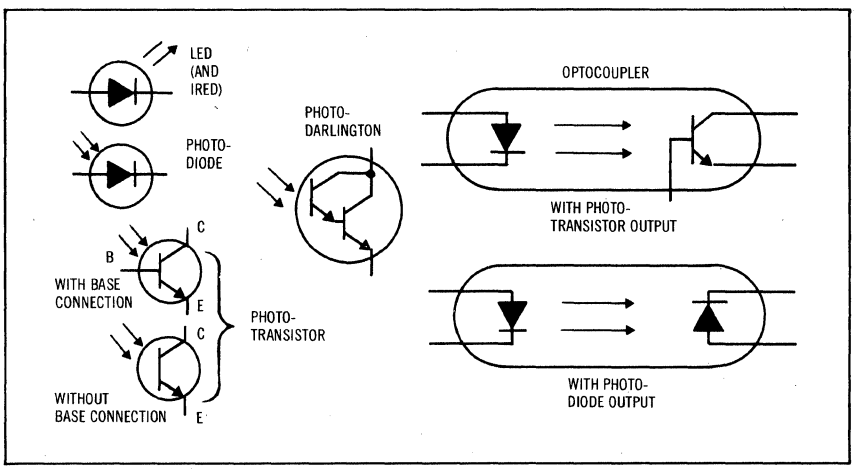
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

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Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

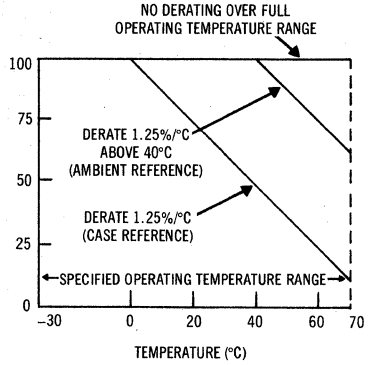

Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

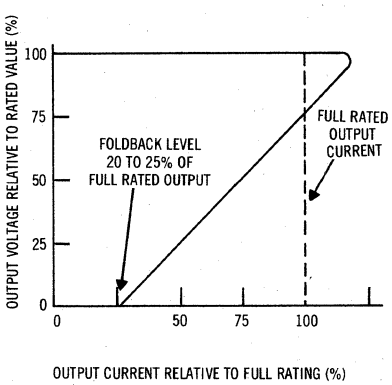

Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

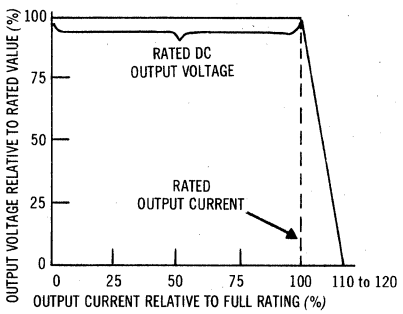

Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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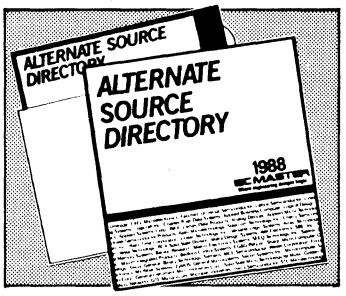

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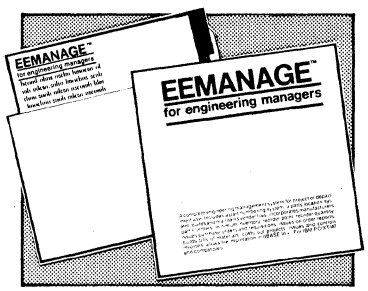

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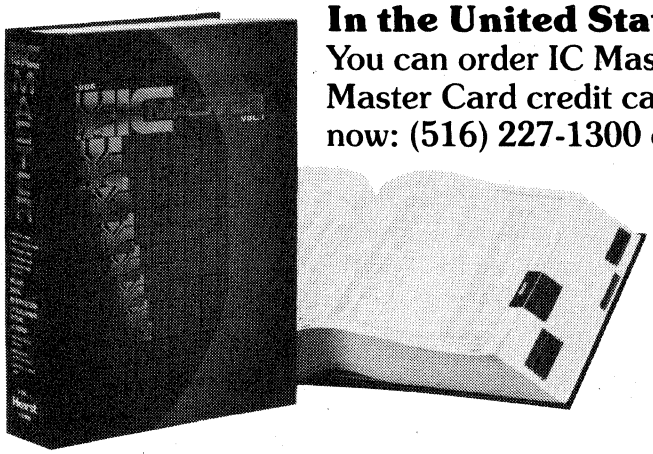

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IL Elgin, Allied Elctrns. 312-697-8200
IL Lisle, Comps. Inc. 312-852-7707
IL Rosemont, Advent Elctrns. Inc. 312-297-6200
IL Schaumburg, Future Elctrns. Inc. 312-882-1255
IN Indianapolis, Bell Inds. 317-634-8202
IN Indianapolis, Bell Inds.;Jit Div. 317-299-5487
IN Indianapolis, Mar Elctrns. Inc. 317-633-6699
IA Cedar Rapids, Advent Elctrns. Inc. 319-363-0221
MD Columbia, Future Elctrns. Inc. 301-995-1222
MD Jessup, Treeko Sls. Inc. 301-470-3300
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA Canton, E P C Elctrns. 617-821-2111
MA Marlborough, Hardware Specialty Co. Inc. 617-481-8622
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Westborough, Future Elctrns. Inc. 617-366-2400
MA Wilmington, Allied Elctrns. 617-942-0150
MA Woburn, Macbearing Co. 617-933-2110
MI Farmington Hills, Advent Elctrns. Inc. .. 313-477-1650
MN Bloomington, Bergquist Co. 612-835-2322
MN Minneapolis, Aero-Space Computer Supp. 612-884-4725
MN St. Paul, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
MO St. Louis, Ric-Tronics 314-576-9816
NH Hampstead, A E I 603-329-5656
NH Salem, Cronin Elctrns., Inc. 603-898-4440
NJ Frenchtown, Sintec Co. 201-996-4093
NJ Mt. Laurel, Future Elctrns. Inc. 609-778-7600
NJ Springfield, Route Elctrns. 201-379-7710
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Distrs. inc. 716-887-2800
NY Elmhurst, Century Fasteners Corp. 718-446-5000
NY Holtsville, Tower Fasteners 516-289-8800
NY Liverpool, Future Elctrns. Inc. 315-451-2371
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, Q A R Indl. Elec. 914-699-2224
NY Rochester, Masline Elctrns. Inc. 716-546-5373
NY Rochester, Summit Elctrns. Inc. 716-334-8110
NC Charlotte, Century Fasteners Corp. ... 704-554-0444
NC Greensboro, Golden Elctrns. 919-294-4653
NC Greensboro, Hammond Elctrns. Inc. ... 919-275-6391
NC Raleigh, Century Elctrn. Comps. 919-782-2116
NC Raleigh, Century Fasteners Corp. 919-787-1800
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Twinsburg, Schuster Elctrns. 216-425-8134
OH Warren, REM Elctrns. 216-373-1300
OK Tulsa, Carlton-Bates Co. Inc. 918-250-1626
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Future Elctrns. Inc. 503-626-2977
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Portland, Dunn Elctrns. 503-285-0214
PA Carisle, Cumberland Elctrns. 717-243-8006
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-232-5999
PA Lancaster, Cumberland Elctrns. 717-393-8304
PA Lewistown, Cumberland Elctrns. 717-249-9631
PA Norristown, Century Elctrn. Comp. 215-631-5400
PA Philadelphia, P E I-Genesis 800-523-0727
PA Philadelphia, Shap Elctrns. 215-969-3300
PA York, Cumberland Elctrns. 717-845-8791
SC Greenville, Hammond Elctrns. Inc. 803-233-4121
SC W. Columbia, Century Fasteners Corp. 803-791-1800
TN Memphis, Carlton-Bates Co. Inc. 901-365-3539
TN Nashville, Carlton-Bates Co. Inc. 615-244-3562
TX Austin, Wofford Elctrns., Inc. 512-339-1131
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Richardson, Comps. Cen. Inc. 214-664-3444
TX Texarkana, Carlton-Bates Co. Inc. 214-792-6923
UT Salt Lake City, Future Elctrns. Inc. 801-972-8489
VA Richmond, Century Fasteners Corp. .. 804-262-8671
WA Bellevue, Future Elctrns. Inc. 206-881-8199
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Comp. Resources 800-547-6523
WA Redmond, Energy Sls. Inc. 206-883-2342
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Allied Elctrns. 206-547-2827
WI New Berlin, N E P Elctrns. Inc. 414-785-9100
Can Calgary, Alberta, Future Elctrns. Inc. ... 403-259-6408
Can Downview, Ont., Future Elctrns. Inc. ... 416-638-4771
Can Edmonton, Alberta, Future Elctrns. Inc. 403-438-2858
Can Mississauga, Ont., Prelco 416-678-0401
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Montreal, Que., Prelco 514-389-8051
Can Nepean, Ont., Carsten Elctrns. Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. Inc. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Carsten Elctrns. 514-334-8321
Can Vancouver, BC, Future Elctrns. Inc. ... 604-294-1166
Can Victoria, BC, Queale Elctrns. Ltd. 604-388-6111
Can Winnipeg, Manitoba, Future Elctrns. Inc. 204-339-0554

FAX: 201-526-6866

ABACUS CONTROLS INC., 89 Readington Rd., Somerville, NJ 08876, Tel: 201-526-6010, TELEX: 888186 ABACUS CONT UD; FSC No.: 54241; Empl.: 45; *Sls. Mgr.:* L. Albrecht ..... **D•2063-2065**

Local Sales Offices & Reps

AL Huntsville, Scientific Dvcs. 205-536-1969
CA Los Angeles, Power Partners 800-468-5400
CA San Diego, Power Partners 800-468-5400
CA Santa Clara, Source Tronics 408-988-8801,
CT New London, Elctrn. Sls. of New England 203-443-2646
FL Ft. Walton Beach, Scientific Dvcs. 904-651-4407
FL Orlando, Scientific Dvcs. 305-841-8180
GA Atlanta, Scientific Dvcs. 205-536-1969
GA Savannah, Scientific Dvcs. 904-651-4407
MA Wareham, Elctrn. Sls. of New England 617-295-7634
MO St. Louis, AME Sls. 314-962-9771,
NC Winston-Salem, Scientific Dvcs. 919-765-5776
TX Dallas, True Techn. 214-691-7870
EXP New York, NY, XPort Trading Co. 212-466-4204,

ABALON PRECISION MFG., 1040 Home Street, Bronx, NY 10459, Tel: 212-589-5682, FAX: 212-589-0300; Empl.: 25; *Sls. Mgr.:* Norman C. Orent

Abbott TECHNOLOGIES, INC.

FAX: 818-954-9305

ABBOTT TECHNOLOGIES, INC., Burbank Division, Transformers, 639 So. Glenwood Pl, Burbank, CA 91506, Tel: 818-841-3630, TELEX: 69-6282; FSC No.: 58910; Empl.: 50; *Sls. Mgr.:* P. Ferrari ..... **A•2157-2166**

Local Sales Offices & Reps

AZ Scottsdale, SMS & Assocs. 602-998-0831
FL Altamonte Springs, Gugel Assocs. Inc. 305-788-0845
IL Hinsdale, Palatine Engrg. & Sls. (CKC) 312-655-0668
IN Indianapolis, JFCO, Inc. 317-576-9363
IA Cedar Rapids, Palatine Engrg. & Sls., Inc. 319-365-8071
KS Wichita, Palatine Engrg. & Sls., Inc. 316-262-1020
MI Grand Rapids, JFCO, Inc. 616-949-1020
MN Minneapolis, Holmgren Assocs., Inc. .. 612-786-7641
MO Hazelwood, Palatine Engrg. & Sls., Inc. 314-839-0800
NJ Ft. Lee, Abbott Transistor Labs. 201-461-4411
OH Vandalia, JFCO, Inc. 513-890-8322
PA Pittsburgh, JFCO, Inc. 412-823-5400
TN Nashville, Mil-Spec Sls. Co. 615-367-2427
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
Can Rexdale, Ontario, Source Elctrns., Ltd. 416-676-0830

abbott

FAX: 213-939-1995

ABBOTT TRANSISTOR LABS, Power Supplies, 2727 S. La Cienega Blvd., Los Angeles, CA 90034, Tel: 213-936-8185, TELEX: 69-1398; FSC No.: 15755; Empl.: 500; *Sls. Mgr.:* Mike Brown ..... **D•1505-1520**

Local Sales Offices & Reps

AZ Scottsdale, SMS & Assocs. 602-998-0831
CA Mtn. View, Martinez & Assocs. 415-966-1012
FL Altamonte Springs, Gugel-Tuttle Assocs. Inc. 305-788-0845
NJ Ft. Lee, Abbott Transistor Labs. 201-461-4411
NY Liverpool, R&D Assocs., Inc. 305-688-0845
OK Tulsa, General Sls. & Assocs. 918-622-7744
TX Richardson, Abbott Transistor Labs. .. 214-437-0697
UT Bountiful, Anderson & Assocs. 801-292-8991
WA Bellevue, Comtec 206-453-1188
Can Ottawa, Subtec Ltd. 613-738-1470

ABBOTT TECHNOLOGIES, INC., Sun Valley Division, Power Supplies, 8203 Vineland Ave., Sun Valley, CA 91352, Tel: 818-504-0644, TELEX: 75-2972, FAX: 818-768-0395; Empl.: 30; *Sls. Mgr.:* Frank Goitz ..... **D•1521-1529, 2066-2067**

Local Sales Offices & Reps

IN Indianapolis, John Sukup Inc. 317-253-5501
MN Minneapolis, Holmgren Assocs. 612-786-7641
MO Kansas City, Abrams & Assocs. 314-569-0447

ABL ELECTRONICS SUPPLY, INC., 1736 Front St., Yorktown Hgts., NY 10598, Tel: 914-962-2253, FAX: 914-962-2296; Empl.: 18; *Sls. Mgr.:* George Wiesel ..... **C•1768-1769**

ABLE POWER AND ENGINEERING INC., 1222 N. Delta St., S. San Gabriel, CA 91770, Tel: 818-571-6260, TELEX: 287020 SCS UR; Empl.: 25; *Sls. Mgr.:* Joe Chou; *Dist. Mgr.:* Bob Thomas

ABLESTIK LABORATORIES, 833 W. 182nd St., Gardena, CA 90248, Tel: 213-532-9341, TWX: 910-346-7606, FAX: 213-516-9417; FSC No.: 21109; Empl.: 150; *Sls. Mgr.:* D. W. Lefever

ABORN ELECTRONICS INC., 2108 D Bering Dr., San Jose, CA 95131, Tel: 408-436-5444, TELEX: 184817 MSGSNDR, FAX: 408-287-4535; FSC No.: 8Z441; Empl.: K. Bomin; *Sls. Mgr.:* V. Lumba

ABRAMS INSTRUMENT CORP., 2859 W. Jolly Rd., Okemos, MI 48864, Tel: 517-332-6405, TWX: 810-251-0785; FSC No.: 00048; *Sls. Mgr.:* Merlyn Gates

A B TOOL & MFG., INC., Engineered Automation Div., 152 Cregar Road, High Bridge, NJ 08829, Tel: 201-638-8555, TELEX: 847-340; Empl.: 25; *Sls. Mgr.:* David F. Mowen

ACC ELECTRONICS COMPANY, Echlin Inc., 1300 W. Oak, Independence, KS 67301, Tel: 316-331-1000, TELEX: 436483, FAX: 316-331-1000 (ext. 440); Empl.: 1000; *Sls. Mgr.:* Leon Allen

ACCESSORIES FOR ELCTRNS., INC., 800 Merrick Rd., Baldwin, NY 11510-3593, Tel: 516-546-1751, FAX: 516 867-1922; FSC No.: 54355; Empl.: 20; *Sls. Mgr.:* Bill Harris

ACCUDYNE CORP., P.O. Box 1429, Janesville, WI 53547, Tel: 608-752-9081; FSC No.: 18356; Empl.: 540; *Sls. Mgr.:* R. E. Mowris; *Dist. Mgr.:* R. E. Mowris

ACCUGRAPH CORP., 50 Gervais Drive, Suite 204, Don Mills, ONT, Canada M3C 1Z3, Tel: 416-441-2211, TELEX: 06-986973, FAX: 416 441-2228; Empl.: 155; *Sls. Mgr.:* Dennis Kukulsky; *Dist. Mgr.:* Dennis Kukulsky

ACCULEX CORPORATION, MetraByte, 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 617-880-3660, TELEX: 240713; *Sls. Mgr.:* Ben Bailey ..... **D•1352**

ACCUMET ENGINEERING, 518 Main St., Hudson, MA 01749, Tel: 617-568-8311, FAX: 617-562-4384; *Sls. Mgr.:* C. T. Haering

Local Sales Offices & Reps

MD Pasadena, Spectro-Lambda 301-437-7633
NJ Clarksburg, Micro-Lambda 609-259-0400
NY Huntington, Compar New York 516-423-5660
TX Dallas, C & J Assocs. 214-450-5872

ACCUPROBE, INC., 1 Harrison Ave, Box 1044, Salem, MA 01970, Tel: 617-745-7878, TELEX: 882194 Accuprobe UD, FAX: 617-745-7922; Empl.: 26; *Sls. Mgr.:* Thomas H. Murphy; *Dist. Mgr.:* T. H. Murphy

ACCURATE ELECTRONICS, 169 S. Abbe Rd., P.O. Box 1287, Elyria, OH 44036, Tel: 216-366-6330, TELEX: 469705; FSC No.: 11375; Empl.: 35; *Sls. Mgr.:* J. F. Seybold

Accuride

FAX: 213-903-0208

ACCURIDE, 12311 Shoemaker, Santa Fe Springs, CA 90670, Tel: 213-944-0921, TWX: 910-586-1632; *Sls. Mgr.:* Jackie Pinto; *Dist. Mgr.:* Bill Kniegge ..... **C•1006-1009**

Local Sales Offices & Reps

CA Belmont, Accuride 415-594-2830
CA Diamond Bar, Accuride 213-944-0921
CA Santa Fe Springs, Accuride 213-944-0921
GA Dunwoody, Accuride 404-449-3350
IL Wood Dale, Accuride 312-843-2585
MA Holliston, Accuride 617-429-2474
MA Leominster, Accuride 617-537-8985
NY Rochester, Accuride 717-227-5835
TX Dallas, Accuride 214-492-4633

ACCUSONIC DIVISION, Ferranti O.R.E. Inc., Box 709, Falmouth, MA 02541, Tel: 617-548-5800, TELEX: 6817399 OREFAL UW; Empl.: 125; *Sls. Mgr.:* Robert Beede

ACCUSONIC SYSTEMS CORP., Designatronics, Inc., 2101 Jericho Turnpike, New Hyde Park, NY 11040, Tel: 516-328-3300; Empl.: 15 (This Subsidiary); *Sls. Mgr.:* Dennis Goodman

ACCUTRONICS/CONNOR-WINFIELD, See Connor-Winfield

acdc electronics

FAX: 619-439-4243

ACDC ELECTRONICS, Div. of Emerson, 401 Jones Rd., Oceanside, CA 92054, Tel: 619-757-1880, TWX: 910-322-1470; Empl.: 750; *Sls. Mgr.:* Mike Kirkowski; *Dist. Mgr.:* Ray Brown ..... **D•1195, 1530-1533**

Local Sales Offices & Reps

CA Burbank, ACDC 818-848-9252
CA Orange City, ACDC 619-439-4200
CA San Diego, ACDC 619-942-7230
CA Santa Clara, ACDC Elctrns. 408-727-1626
CO Englewood, Omega Ltd. 203-265-2972
CT Walllingford, ACDC 203-265-2972
FL Sanford, ACDC Elctrns. 305-321-8121
IL Elk Grove Vl., Tri Star Grp. 312-593-0200
IL Naperville, ACDC Elctrns. 312-355-8444
IN Indianapolis, EMCI 317-253-1668
KS Kansas City, Rush & West 913-764-2700
MA Sudbury, ACDC Elctrns. 617-443-9903
MN Minneapolis, Components 612-374-1250
MO Ballwin, Rush & West 314-965-3322
NY Binghamton, Tri-Tech 510-252-0891
NY Hudson Valley, Tri-Tech 914-897-5611
NY Islip, ACDC 516-348-7710
NY Rochester, Tri-Tech 716-385-6500
NY Syracuse, Tri-Tech 315-446-2881
OH Cleveland, Lyons Corp. 216-659-9224
OH Columbus, Lyons Corp. 614-890-2743
OH Dayton, Lyons Corp. 513-278-0714
OK Bixby, MGR Elctrns. 918-369-5186
OR Beaverton, Earl & Brown 503-644-9230
PA Philadelphia, Tech. Sls. 215-675-8600
TX Austin, ACDC Elctrns. 512-250-1011
TX Austin, MGR Elctrns. 512-250-0926
TX Dallas, MGR ELctrns. 214-238-5246
TX Houston, MGR Elctrns. 713-497-8306
WA Redmond, Earl & Brown 206-875-5064
Can Burnaby, BC, Webster Instrs. 604-434-2611
Can Montreal, Que., Webster Instrs. 514-744-5829
Can Toronto, Webster 416-625-0600

Local Distributors

CA Chatsworth, Time Elctrns. 714-937-0911
CA San Carlos, Lo-Dan 415-592-4600
CA Torrance, Time Elctrns. 818-998-7200
CO Englewood, Displays Elctrns. 303-779-8053
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Largo, Lo-Dan 813-586-2851
GA Norcross, Applied Power Inc. 404-263-0421
ID Mt. Prospect, Magnuson Elctrns. 800-323-9773
IL Arlington Hgts., Lo-Dan 312-398-5311
IL Chicago, Newark Elctrns. 312-784-5100
IN Indianapolis, Mar Elctrns. 317-633-6699
MD Baltimore, PEI Genesis 301-296-9333
MD Columbia, Time Elctrns. 301-964-3090
MD Edina, Time Elctrns. 612-835-1250
MA Boston, Time Elctrns. 617-935-8080
MA Needham, Cronin Elctrns. 617-449-5000
MI Madison Hgts., McNaughton-McKay 313-399-7500
MO St. Louis, Time Elctrns. 314-391-6444
NJ Pinebrook, Time Elctrns. 201-882-4611
NY Hauppauge, Time Elctrns. 516-273-0100
NY Syracuse, Time Elctrns. 315-432-0355
OH Cincinnati, Hughes Peters, Inc. 513-351-2000
OH Columbus, Hughes Peters, Inc. 614-294-5351
OR Portland, Time Elctrns. 503-684-3780
PA Philadelphia, Philadelphia Elctrns. 607-365-6704
TX Dallas, Norvell Elctrns. 214-233-0020
WA Redmond, Priebe Elctrns. 206-881-2363
WA Redmond, Time Elctrns. 206-641-3640

ACD-ELCOR PRODUCTS, P.O. Box 244, Bethel, CT 06801, Tel: 203-743-3510; Empl.: 3

ACHESON COLLOIDS, Div. of Acheson Industries, Inc., P.O. Box 611747, Port Huron, MI 48061-1747, Tel: 313-984-5581, TWX: 810-231-5265; Empl.: 200

ACI DATA PRODUCTS, 17921 Sampson Ln., Huntington Beach, CA 92647, Tel: 714-842-2945, TELEX: 655328; Empl.: 10; *Sls. Mgr.:* J. Rogers

A.C. INTERFACE INC., 15560 Rockfield, Unit 1E, Irvine, CA 92718, Tel: 714-472-9524, TELEX: 655-328; FSC No.: OAP 78; Empl.: 23; *Sls. Mgr.:* Bill Roth; *Dist. Mgr.:* Ray Ponkey

ACL INC., 1960 E. Devon Ave., Elk Grove, IL 60007, Tel: 312-981-9212, 800-STATIC-0, TELEX: 4330251; Empl.: 8; *Sls. Mgr.:* Ralph D. Considine

ACME DIVISION, Allied Products Corporation, P.O. Box 1404, New Haven, CT 06505, Tel: 203-562-2171, TELEX: 295503 Acme UR; Empl.: 75; *Sls. Mgr.:* Marvin Leonard

Acme Electric Electronic Distribution

FAX: 716-968-3948

ACME ELECTRIC CORPORATION, 20 Water Street, Cuba, NY 14727, Tel: 716-968-2400; *Sls. Mgr.:* Dale Guilford; *Dist. Mgr.:* Donald Chesner ..... **D•1534-1536**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
AZ Phoenix, O'Donnell Assocs. S.W. 602-944-9542
CA San Jose, O'Donnell Assocs., North 408-432-1940
CO Englewood, Harthun Assocs. 303-792-5050
FL Deerfield Bch., Cartwright & Bean 305-429-3400
FL Orlando, Cartwright & Bean 305-422-4531
GA Norcross, Cartwright & Bean 404-368-0160
IL Des Plaines, Electron Mktg. 312-298-2330
IN Ft. Wayne, Needler Sls. Co., Inc. 219-447-2123
IN Indianapolis, Luebbe Sls. 317-845-7389
IN Indianapolis, Needler Sls. Co., Inc. 317-255-8056
KS Shawnee Mission, Lowell Kangas & Assocs. 913-631-3515
LA Covington, Cartwright & Bean 504-892-1780
MD Gaithersburg, Naudain Assocs. 301-258-5040
MA Framingham, Marathon Sls. 617-875-3566
MI Jackson, Cartwright & Bean 601-981-1170
MI Livonia, Luebbe Sls. 313-477-3131
MN Minneapolis, Boerger & Assocs. 612-560-3435
MO St. Louis, Lowell Kangas & Assocs. 314-821-4050
NJ Matawan, Shepard & Assocs. 201-566-0095
NM Albuquerque, O'Donnell Assocs. S.W. 505-883-1030
NY E. Syracuse, Ossmann & Assocs. 315-437-7052
NY Henrietta, Ossmann & Assocs. 716-359-1200
NC Charlotte, Cartwright & Bean 704-536-0303
NC Lumberton, Acme Elec. Corp. 919-738-9202
NC Raleigh, Cartwright & Bean 919-876-4130
OH Cincinnati, Luebbe Sls. 513-530-0600
OH Cleveland, Luebbe Sls. 216-333-0425
OH Cleveland, Marlow Assocs. 216-991-6500
OH Columbus, Luebbe Sls. 614-431-0474
OH Dayton, Luebbe Sls. 513-294-0426
OH Dayton, Marlow Assocs. 513-274-9666
OK Tulsa, Milco Mktg. 918-664-2277
OR Beaverton, Pacific Specialists 503-641-9373
PA Pittsburgh, Luebbe Sls. 412-364-0490
PA Pittsburgh, Marlow Assocs. 412-343-5050
PA Prospect Pk., Elf Sls. Co. 215-534-3340
TN Memphis, Cartwright & Bean 901-362-8345
TX Austin, Milco Mktg. 512-251-9918
TX Houston, Milco Mktg. 713-723-5037
TX Richardson, Milco Mktg. 214-783-2716
UT Salt Lake City, Acme Elec. Corp. 801-539-0227
WA Redmond, Pacific Mktg. Specialists 206-882-3144
WI Waukesha, Electron Mktg. 414-547-1505

Local Distributors

AL Decatur, Forbes Distbg. 205-353-4762
AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Arrow Elctrns. 205-837-6955
AL Huntsville, Forbes Distbg. 205-837-1579
AL Mobile, Forbes Distbg. 205-479-4535
AZ Phoenix, Arrow Elctrns. 602-437-0750
AZ Phoenix, Cetec/Future 602-272-7951
CA Chatsworth, Allied Elctrns. 818-701-7500
CA Chatsworth, Cetec/Future 818-700-0914
CA Fremont, Allied Elctrns. 415-770-0590
CA Irvine, Cetec/Future 714-250-4141
CA Menlo Pk., Casey Johnston 415-328-6892
CA San Diego, Allied Elctrns. 619-565-4800
CA San Diego, Cetec/Future 619-278-5020
CA San Jose, Cetec/Future 408-434-1114
CA San Jose, ITT Multicomp. 408-279-0685
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Ana, ITT Multicomp. 714-835-9019
CA Santa Monica, Transworld Trade 213-476-8406
CA Sunnyvale, Allied Elctrns. 408-745-6600
CA Tustin, Allied Elctrns. 714-669-4190
CO Denver, Allied Elctrns. 303-790-1664
CO Englewood, Arrow Elctrns. 303-790-4444
CO Englewood, NEP Elctrns. 303-799-9898
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Altamonte Springs, Arrow Elctrns. 305-682-6923
FL Clearwater, Allied Elctrns. 813-539-0369
FL Deerfield Bch., Arrow Elctrns. 305-429-8200
FL Ft. Lauderdale, American Battery 305-583-2470
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Jacksonville, Hammond/EMSCO 904-356-4851
FL Lantana, Sylvia Prods. 305-482-5295
FL Orlando, EMSCO 305-849-6362
FL Orlando, Hammond Elctrns. 305-849-6060
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Tampa, Hammond/EMSCO 813-253-2684
GA Doraville, Voltex Batteries 404-448-6021
GA Marietta, Americom 404-428-8400
GA Norcross, Allied Elctrns. 404-446-8585
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Hammond Elctrns. 404-449-1996
IL Addison, LComp Elctrns. 312-628-1400
IL Chicago, NEP Elctrns. 312-625-8400
IL Elgin, Allied Elctrns. 312-697-8200
IL Itasca, Arrow Elctrns. 312-250-0500
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Advent Elctrns. 317-872-4910
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Bell Inds. 317-875-8200
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Iowa Radio Supp. 319-393-4510
KS Lenexa, Arrow Elctrns. 913-541-9542
KS Wichita, Radio, Inc. 316-264-2798
KY Florence, URI Elctrns. 606-371-4423
KY Lexington, Radio Elctrn. 606-255-6661
KY Louisville, Peerless Elctrns. 502-637-7674
LA New Orleans, Radio Parts 504-581-5959
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, Arrow Elctrns. 301-995-6002
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ADTRON CORPORATION, 745 N. Gilbert Rd., Ste. 124-361, Gilbert, AZ 85234, Tel: 602-926-1461, TWX: 910-240-3012; Empl.: 3; *Sls. Mgr.:* Douglas Lonngren

ADVANCE, A Unit of Zero Corporation, 6900 Beck Avenue, N. Hollywood, CA 91605, Tel: 818-983-0333 ..... **C•1101**

ADVANCE CONVERSION DEVICES CO., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-989-0095; FSC No.: 52298; Empl.: 24; *Sls. Mgr.:* D. J. Fedderly ..... **D•2068-2069**

ADVANCED ANALOG, Intech, 2270 Martin Ave., Santa Clara, CA 95050, Tel: 408-988-4930, TWX: 910-338-2213; FSC No.: 33967; Empl.: 150; *Sls. Mgr.:* David Timm

ADVANCED CIRCUIT TECHNOLOGY, 118 Northeastern Blvd., Nashua, NH 03062, Tel: 603-880-6000, 800-234-FLEX, TWX: 710-228-8961, FAX: 603-880-1785; FSC No.: 57034; Empl.: 185; *Sls. Mgr.:* David Bouley

ADVANCED COMPONENTS INDS., INC., Spitznagel GmbH, 120 Center Street, El Segundo, CA 90245, Tel: 213-322-4249, TELEX: 5106000379 ACI LSA CA; *Sls. Mgr.:* Irma Spreitzer

ADVANCED CONTROL SYS., 205 Oak Street, Pembroke, MA 02359, Tel: 617-826-4477, FAX: 617-826-9987; Empl.: 8; *Sls. Mgr.:* Leopold Bric ..... **D•1120**

ADVANCED DETECTOR CORP., Applied Solar Energy Corp., 15251 E. Don Julian Rd., Industry, CA 91746, Tel: 818-369-6886, TWX: 910-584-4890, FAX: 818-336-8694; Empl.: 297

ADVANCED ELECTRONIC PACKAGING, 21562 Surveyor Circle, Huntington Beach, CA 92646, Tel: 714-969-1150; *Sls. Mgr.:* Douglas A. Hill

ADVANCED FILTER DEVICES, INC., 6241 Yarrow Dr., Ste. D, Carlsbad, CA 92009, Tel: 619-438-2074, FAX: 619-438-5937; FSC No.: 56620; Empl.: 45; *Sls. Mgr.:* Herbert Johnson

ADVANCED HIGH VOLTAGE CO., P.O. Box 2136, Lancaster, CA 93539, Tel: 818-997-7222; *Sls. Mgr.:* John Richardson ..... **D•1577**

ADVANCED INPUT DEVICES, W. 250 A.I.D. Dr., Coeur d'Alene, ID 83814, Tel: 208-765-8000, TWX: 510-776-0584; FSC No.: 95666; Empl.: 550; *Sls. Mgr.:* John Overby

ADVANCED INTERCONNECTIONS CORP., 5 Energy Way, West Warwick, RI 02893, Tel: 401-823-5200, TWX: 910-240-3454, FAX: 401 823-8723; FSC No.: 05-0394638; *Sls. Mgr.:* Max E. Rice

ADVANCED KINETICS, 1239 Victoria St., Costa Mesa, CA 92627, Tel: 714-646-7165, TELEX: 18-2714, FAX: 714-722-9039; Empl.: 32; *Sls. Mgr.:* Mitch Barker

ADVANCED LINEAR DEVICES, INC., 1030 West Maude Ave., Bldg. 501, Sunnyvale, CA 94086-2810, Tel: 408-720-8737, TWX: 510-100-6588, FAX: 408-720-8297; Empl.: 10; *Sls. Mgr.:* G. M. O'Neal; *Dist. Mgr.:* G. M. O'Neal

ADVANCED MATERIALS SYSTEMS, See Handy & Harman Electronic Materials Corp.

ADVANCED MICRO DEVICES, P.O. Box 3453, 901 Thompson Pl., Sunnyvale, CA 94088, Tel: 408-732-2400, TELEX: 34-6306, TWX: 910-339-9280, FAX: 408-982-7447; Empl.: 17,000; *Sls. Mgr.:* Steve Zelencik; *Dist. Mgr.:* Al Frugaletti

ADVANCED MICRO SYSTEMS, INC., 31 Flagstone Drive, Hudson, NH 03051, Tel: 603-882-1447, FAX: 603-889-0425; Empl.: 50

ADVANCED PRECISION CONTROLS, 409 Calle San Pablo, No. 100, Camarillo, CA 93010, Tel: 805-388-1344, FAX: 805-388-1270; Empl.: 20; *Sls. Mgr.:* Judy Williams; *Dist. Mgr.:* Judy Williams

ASCI SWITCH

FAX: 818-791-8347

ADVANCED SYSTEMS CONCEPTS, 2333 N. Lake Ave., Altadena, CA 91001, Tel: 818-791-0983, TELEX: 701 215 ASCI; FSC No.: 6U785; Empl.: 15; *Sls. Mgr.:* Maria Reddix; *Dist. Mgr.:* B. Lee ..... **D•1143**

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IA Des Moines, Beams Co. 515-255-1148
MN Edina, Integrated Peripheral Sys. 612-831-0349
OH Dayton, Ashby Assocs. 513-252-5627
VA Vienna, Advanced Technlg. Assocs. .. 703-556-0500

ADVANCED TECHN. RESEARCH LABS., 5645 K General Washington Dr., Alexandria, VA 22312, Tel: 703-750-2920; FSC No.: 91375; Empl.: 12; *Sls. Mgr.:* Bob Palma, Sr.; *Dist. Mgr.:* Bob Palma, Sr.

ADVANCED THERMAL PRODUCTS, INC., P.O. Box 249, St. Marys, PA 15857, Tel: 814-772-0278; *Sls. Mgr.:* John M. Sidoni

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MA Norwood, The MacInnis Co. 617-762-8090,
NY Syracuse, The Martin Assocs. 315-422-6943
NC Raleigh, DHR Mktg. 919-781-1961
SC Greenville, DHR Mktg. 803-235-3594
WI New Berlin, Thomas Labant 414-425-7157

AD-VANCE MAGNETICS, INC., 625 Monroe St., Rochester, IN 46975, Tel: 219-223-3158, TWX: 810-290-0294, FAX: 214-223-2524; FSC No.: 50788; Empl.: 30; *Sls. Mgr.:* Kay Nixon ..... **C•1743**

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CA El Cajon, ATronix Technlg. 619-444-1501
CA Los Altos, Frauman Assoc. 415-941-0660
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CO Englewood, Component Sls. Inc. 303-779-8060
CT Branford, Abbott-Allison 203-481-0405
IL Westchester, W. G. Brouillette 312-345-6500
NJ Flanders, K & R Engrg. Sls. Corp. 201-584-5235, 800-631-9362
PA Stewartstown, Eastern Comps. Sls. Corp. 717-993-6261
PA W. Conshohocken, Eastern Comps. ... 215-825-8610
TX Dallas, J. M. Spell Co. Inc. 214-620-0040
UT Salt Lake City, Component Sls. Inc. ... 801-268-8440
VA Herndon, Eastern Comps. 703-444-1089
VA Vinton, Eastern Comps. Sls. Corp. 703-344-4756
WA Bellevue, Caruso & Co. 206-455-8811

ADVANCE WIRE & CABLE, The Advange Group, 1661 Industrial Way, Belmont, CA 94002, Tel: 415-592-4550, TELEX: 334475, FAX: 415-593-8859; FSC No.: 57775; Empl.: 158; *Sls. Mgr.:* Ed Mittelbusher; *Dist. Mgr.:* Ed Mittelbusher

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CA Anaheim, The Advance Grp. 714-870-0300
CA Belmont, The Advance Grp. 415-592-4550
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CO Denver, The Advance Grp. 303-388-0923
FL Orlando, Gillum Sls. 305-857-2110
FL Tampa, Gillum Sls. 813-531-2248
GA Marietta, GWC 404-992-5931
IL Deerfield, Flaherty-Haines, Inc. 312-948-7800
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NY Commack, JL Sls. Assocs. 516-462-5666
NY E. Rochester, L-Mar Assocs. 716-381-9100
OH Dayton, JFCO 513-890-7251
SC Greer, Advance Wire & Cable 803-877-9600
TX Plano, K & H Sls. 214-423-6520
WA Redmond, The Advance Grp. 206-867-0416

ADVANTEST®

FAX: 312-634-2872

ADVANTEST AMERICA, INC., 300 Knightsbridge Parkway, Lincolnshire, IL 60069, Tel: 312-634-2552; Empl.: 130; *Sls. Mgr.:* Steve Langerock ..... **D•1196-1204**

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CA Santa Clara, Advantest America, Inc. .. 408-970-9922
CA Santa Monica, Advantest America, Inc. 213-392-0088,
CA Sunnyvale, Amasco 408-733-8690,
CT Wallingford, Pat Jenks Assocs. 203-265-9939,
FL Longwood, Southern Mktg. Assocs. ... 305-682-7317,
FL Orlando, Advantest America, Inc. 305-859-0722
GA Marietta, Southern Mktg. Assocs. 404-565-0603,
IL Lincolnshire, Advantest America, Inc. 312-634-2552
MD Rockville, Creative Mktg. Assocs. 301-251-4100,
MA Danvers, Pat Jenks Assocs. 617-777-5600,
MA Marlboro, Advantest America, Inc. 617-481-0184,
NJ Fort Lee, Advantest America, Inc. 201-886-0300
NC Greensboro, Southern Mktg. Assocs., Inc. 919-282-6001,
PA Allentown, Advantest America, Inc. 215-264-7680
PA Northampton, AEGIS 215-837-8400,
PA Southampton, Eastern Instrmn. of Phila. 215-355-7700,
PA Stroudsburg, AEGIS 717-421-8660
TX Austin, Advantest America, Inc. 512-451-3936
TX Farmers Branch, Advantest America, Inc. 214-239-7834
VT Williston, Advantest America, Inc. 802-879-8974,
Can Mississauga, Ont., Allan Crawford Assocs., Ltd. 416-890-2010,
Can N. Vancouver, B.C., Allan Crawford Assocs., Ltd. 604-988-2195,
Can Ottawa, Ont., Allan Crawford Assocs., Ltd. 613-596-9300,

ADVANTEST CORPORATION, NS Bldg. 14th,4-1,Nishi-Shinjuku 2-Chome,Shinjuku-ku, Tokyo 160, Tokyo 176, Japan, Tel: 03-342-7500, TELEX: 232-4914 ADVAN J; Empl.: 1300; *Sls. Mgr.:* Keishi Kaetsu

A E CORP., 65 Wellesley Ave., Needham, MA 02194, Tel: 617-449-3142; Empl.: 10; *Sls. Mgr.:* H. Harrison

A E G CORPORATION, Route 22-Orr Drive, P.O. Box 3800, Somerville, NJ 08876-1269, Tel: 201-231-8300, TELEX: 833409 ..... **B•1105**

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CA Woodland Hills, Technlg. Solutions ... 818-704-1693
CT Farmington, Ray Perron & Co., Inc. 203-673-4825
FL Clearwater, Sigma Tech. Assocs., Inc. 813-791-0271
GA Norcross, Electramark 404-446-7915
IL Chicago, Janus Ins. 312-250-9650
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IL Schaumburg, AEG Gen. Region 312-303-6460
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IA Cedar Rapids, J.P. & Assocs. 313-393-9790
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MA Needham, Ray Perron & Co., Inc. 617-449-6162
MA New Bedford, AEG Eastern Region ... 617-990-1057
MI St. Claire Shores, DEM Sls. 313-777-1750
MN Minnetonka, J.P. & Assocs., Inc. 612-935-7930
NH Dover, Ray Perron & Co., Inc. 603-742-2321
NJ Haddonfield, Sunday O'Brien 609-429-4013
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NY Long Island City, M. H. Lynn 718-352-9233
NY Syracuse, Micro-Tech Mktg. 315-458-5242
NY Syracuse, Pi Tronics Inc. 315-455-7346
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Cleveland, Arthur H. Baier Co. 216-461-6161
OH Columbus, Arthur H. Baier Co. 614-764-1144
OR Tigard, Elctrn. Comp. Sls. 503-245-2342
PA Camp Hill, Quick Response 717-938-9696
PA Pittsburgh, Arthur H. Baier Co. 412-367-7799
TX Garland, Pro Comp Sls. 214-276-1948
TX Hurst, Pro Comp Sls. 817-589-0336
VA Lynchburg, Paragem 804-528-0681
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Janus Inc. 414-542-7575
WI Milwaukee, Phase II Mktg. 414-272-1171
Can Brampton, Ont., Cantec Reps., Inc. 416-791-5922
Can Dollard des Ormeaux, Que., Cantec Reps. 514-683-6131
Can Ottawa, Ont., Cantec Reps., Inc. 613-725-3704

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AZ Phoenix, Cetec/Future 602-272-7851
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CA Chatsworth, Cetec/Future 818-700-0914
CA Irvine, Cetec/Future 714-250-4141,818-446-5733
CA Irvine, Integrated Elctrns. 714-837-9960
CA Milpitas, Cable Conn 408-943-6655
CA Orange, Elctrn. Connexions Corp. 714-998-9241
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Diego, Cetec/Future, Inc. 619-278-5020
CA San Jose, Future Elctrns. 408-435-9100
CA San Jose, Integrated Elctrns. 408-435-1000
CA Santa Clara, Cetec/Future, Inc. 408-748-8550
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, SAI 408-720-0760
CO Denver, Integrated Elctrns. 303-292-6121
CO Westminster, Future Elctrns. 303-650-0123
CT Danbury, Future Elctrns. 203-743-9594
CT Wallingford, Midstoth Elctrns. 203-265-9900
FL Altemonte Springs, SAI 305-831-6201
FL Boca Raton, Plainview Elctrns. 305-997-7705
FL Clearwater, Future Elctrns. 813-578-1770
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Orlando, Future Elctrns. 305-767-8414
FL Tampa, Reptron Elctrns. 813-855-4656
GA Norcross, Future Elctrns. 404-441-7676
GA Norcross, Reptron Elctrns. 404-446-1300
IL Des Plaines, Rod Graham 312-299-8799
IL Hoffman Estates, Integrated Elctrns. .. 312-843-2040
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IL Schaumberg, Reptron Elctrns. 312-882-1700
IN Indianapolis, Mar Elctrns. 317-633-6699
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MD Columbia, Future Elctrns. 301-995-1222
MD Columbia, Gen. Radio Supply Co. 301-995-6744
MA Westboro, Future Elctrns. 617-366-2400
MA Wilmington, SAI 617-657-5700
MI Livonia, Reptron Elctrns. 313-525-2700
MN Minnetonka, Reptron Elctrns. 612-938-0000
NJ Camden, General Radio 609-964-8560
NJ Cherry Hill, Exact Inc. 609-429-6586
NJ Mount Laurel, Future Elctrns. 609-778-7600
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NY Melville, SAI 516-293-2710
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OH Worthington, Reptro Elctrns. 614-436-6675
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OR Beaverton, Integrated Elctrns. 503-641-1690
TX Ft. Worth, Swieco, Inc. 817-335-6521
TX San Antonio, Sherman Elctrns. 512-224-1004
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Future Elctrns. 801-972-8489
VT Rutland, SAI 802-775-7126
WA Bellevue, Future Elctrns. 206-881-8199
WA Bellevue, Integrated Elctrns. 206-455-2727
Can Calgary, Alb., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Future Elctrns. 403-438-2858
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns., Inc. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-294-1166

A E G TELEFUNKEN, High Power Grp., Rte. 22, Orr Dr., Somerville, NJ 08876, Tel: 201-722-9800, TELEX: 833409; *Sls. Mgr.:* John Szafranski

AEG TELEFUNKEN, SEMICONDUCTOR GRP., See AEG Corp.

AEL, INC, See American Electronic Labs

AEMC, 99 Chauncy, Boston, MA 02111, Tel: 617-451-0227, 800-343-1391, TELEX: 95-1073, FAX: 617-423-2952; *Sls. Mgr.:* Jon Henderson

AEROCOM, 3090 S.W. 37th Ave., Miami, FL 33133, Tel: 305-448-6503, TELEX: 6812020; FSC No.: 81535; Empl.: 100; *Sls. Mgr.:* Thomas A. Coleman

AEROFLEX LABS., INTEGRATED MICROSYSTEMS DIV., See Aeroflex Labs., Microelectronics Div.

MAGNETIC PRODUCTS DIVISION
AEROFLEX LABORATORIES INC.

FAX: 516-694-6771

AEROFLEX LABORATORIES INC., Magnetic Products Div., 35 South Service Road, Plainview, NY 11803, Tel: 516-694-6700, TWX: 510-224-6417; Empl.: 490; *Sls. Mgr.:* Robert M. Slatkin ..... **B•1184-1185**

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CT S. Windsor, C.S.I. Interconnect Prods. 203-644-1276
FL Clearwater, Brennan Assocs., Inc. 813-446-5006
IL Northfield, Feller Assocs., Inc. 312-446-8065
KS Wichita, Avionic Engrg. Sls. Co. 316-264-6201
NY Cazenovia, DOL Engrg. 315-334-0722
OH Novelty, Feller Assocs., Inc. 216-338-3774
OK Tulsa, Milko Mktg. 918-582-9411
TX Houston, Milko Mktg. 713-723-5003
TX Richardson, Milko Mktg. 214-783-2785
WA Mercer Island, Eagle Entprs., Inc. 206-232-7401
EXP NJ/Montvale, Henley Elctrns. 201-307-0422

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CA	San Diego, The Knight Co.	619-743-5136
CO	Englewood, Westernn Sls. Inc.	303-798-0945
CT	Southbury, Dynamic Technlgs.	203-262-6220
FL	Palm Bay, Star Tech Data Sys.	305-727-2247
IL	Northfield, Feller Assocs., Inc.	312-446-8065
IA	Cedar Rapids, Feller Assocs., Inc.	319-364-0566
MA	Burlington, MASS Mktg., Inc.	617-272-6265
MN	Minneapolis, International Elctrns, Inc.	612-571-0000
NJ	Ft. Lee, Nexus Technlg.	201-942-0151
NY	Smithtown, L.I., Nexus Technlg.	516-864-2263
NY	Cazanovia, DOL Engrg.	315-655-8602
OH	Novelty, Feller Assocs.	216-338-3774
OH	Solon, J. R. Thornberry Co., Inc.	216-248-4995
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VA	Front Royal, Eltron Sls. Ltd.	703-635-7201
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EXP	NY, Plainview, Aeroflex Labs.	516-694-6700
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AEROSPACE OPTICS, INC., 3201 Sandy La., Fort Worth, TX 76112, Tel: 817-451-1141, TELEX: 75-8461; Empl.: 83; *Sls. Mgr.:* Ben L. Fryrear

AEROTECH, INC., 101 Zeta Dr., Pittsburgh, PA 15238, Tel: 412-963-7470, TWX: 710-795-3125; Empl.: 150; *Sls. Mgr.:* F. Armstrong; *Dist. Mgr.:* K. Ross

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CA	Cupertino, Aerotech Northwest	408-257-1102
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IL	Dundee, Aerotech Midwest	312-428-5440
NC	Raleigh, Aerotech S. Atlantic	919-848-1965
PA	Pittsburgh, Aerotech Central	412-963-7493,
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AEROTRONIC, General Signal, Riverside Dr., Contoocook, NH 03229, Tel: 603-746-4631, TWX: 710-366-1684, FAX: 603-746-4679; FSC No.: 67272; Empl.: 100

AERTECH INDS., See TRW Microwave

AES CORP., 285 Newbury St., Peabody, MA 01960, Tel: 617-535-7310, TELEX: 387852 AES CORP INTL, FAX: 617-535-7313; Empl.: 25; *Sls. Mgr.:* Philip G. Huntley

AETNA ENGINEERING, P.O. Box 7749, Van Nuys, CA 91409-7749, Tel: 818-341-9409; Empl.: 6; *Sls. Mgr.:* T. W. Collins

AFFILIATED MANUFACTURERS, INC., U.S. Highway 22, P.O. Box 5049, North Branch, NJ 08876, Tel: 201-722-7100, TELEX: 264712, FAX: 201-722-5082; Empl.: 150; *Sls. Mgr.:* Craig Brown

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MA	Amesbury, Affiliated Mfrs., Inc.	617-388-5770
MN	Minnetonka, Process Technlg. Inc.	612-934-7624
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WI	Hales Corners, Process Technlg.	414-425-2940

AFI/DATATROL, See Datatrol, Div. of Data Card Corp.

AIE MAGNETICS, Div. of Vernitron, 701 Murfreesboro Rd., Nashville, TN 37210, Tel: 615-244-9024, TELEX: 554466; FSC No.: 06978; Empl.: 300; *Sls. Mgr.:* J. Holeman

AIKEN ADVANCED SYSTEMS, INC., Amstar Electronics Group, 5901 Edsall Rd., Alexandria, VA 22304-4197, Tel: 703-370-0900, TWX: 710-832-0612; FSC No.: 60590; Empl.: 190; *Sls. Mgr.:* C. G. Gilmer

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AILTEC DIV. CUTLER-HAMMER, See Eaton Corp., Elctrn. Instrmn. Div.

AIMSCO INC., Cheler Corp., 4024 22nd Ave. W., Seattle, WA 98199-0056, Tel: 206-284-5563, 800-426-0244, TWX: 910-444-1333; Empl.: 30; *Sls. Mgr.:* C. Ernst; *Dist. Mgr.:* Carl Teichman

AIPHONE, 1700 130th Ave. NE, Bellevue, WA 98005, Tel: 206-455-0510, FAX: 206-455-0071; Empl.: 44; *Sls. Mgr.:* Hiko Shinoda

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CO	Wheatridge, Silver Peak Mktg. Ltd.	303-467-3021
FL	Maitland, Hutto-Hawkins-Pergoy, Inc.	305-831-2474
GA	Atlanta, Murphy-Cota, Inc.	404-875-2525
IL	Chicago, G. Duvall Co.	312-774-5115
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IN	Indianapolis, Elmarcon, Inc.	317-846-0221
KS	Mission, B.C. Elctrn. Sls., Inc.	913-262-1720
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MA	W. Boylston, Givan Assocs.	617-835-3161
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NJ	Upper Montclair, Pusecker Sls.	201-744-1834
NY	Pittsford, Alby Currant Sls.	716-586-1110
NC	Burlington, Murphy & Cota, Inc.	919-584-6450
OH	North Olmsted, Avcom, Inc.	216-777-2060
OR	Portland, Earl & Brown Co., Inc.	503-245-2283
PA	Hazelton, Forti Assocs., Inc.	717-455-2003
TX	Houston, Graham/Davis Inc.	713-558-8662
TX	Irving, Graham/Davis Inc.	214-554-6535
UT	Sandy, Silver Peak Mktg. Ltd.	801-942-6694
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064

AirBorn

FAX: 214-931-9305

AIRBORN, INC., 4321 AirBorn Dr., Addison, TX 75001-0519, Tel: 214-931-3200, TELEX: 79-4200, TWX: 910-860-5230; FSC No.: 10400;Multiple; Empl.: 548; *Sls. Mgr.:* T. V. Lee, Sls. Mgr. **C•1132-1157**

Local Sales Offices & Reps

AZ	Tempe, Piper Sls. Co.	602-949-0048
CA	Downey, Buffa Co., Inc.	213-923-4618
CA	Mountain View, Serra Assocs.	415-964-4300
CO	Boulder, Front Range	303-443-4780
CT	Roxbury, Kimble Assocs.	203-354-1954
FL	Ft. Lauderdale, Southland Comps.	305-491-6110
IL	Des Plaines, ESCO Assoc.	312-298-5310
IA	Cedar Rapids, Dytronix	319-377-8275
KS	Wichita, Dytronix	316-838-0884
MD	Hunt Valley, Eagle Sls. Corp.	301-666-3930
MN	Bloomington, PWC	612-831-5999
MO	Bridgeton, Dytronics, Inc.	314-291-4777
MO	Raytown, Dytronix	816-356-6340
NH	Nashua, Solla - Tronics	603-882-7146
NJ	Manville, Dynorep	201-685-0135
NM	Albuquerque, Piper Sls. Co.	505-883-9090
NY	Penfield, Upstate Comps.	716-381-6070
OH	Dayton, Electro-Com	513-898-5140
TX	Austin, Pro-Mark	214-644-0467
TX	Richardson, Pro-Mark	214-644-0467
WA	Seattle, Eltech Inc.	206-643-4330
Can	Mississauga, Ont., Source Elctrns. Ltd.	416-676-0830
Can	Ottawa, Ont., Source Elctrns. Ltd.	613-737-7580

Local Distributors

TX	Addison, AirBorn Distribution Service	214-931-3200

AIR ELECTRO SUPPLY, INC., 7700 Gloria Ave., Van Nuys, CA 91406, Tel: 213-873-6400, 818-988-4400, TELEX: 66-2459, TWX: 910-495-1794 **C•1384**

AIR/FLEX INDS. INC., 2422 Merced Ave., S. El Monte, CA 91733, Tel: 818-579-7060; FSC No.: 22782; *Sls. Mgr.:* Karl Thorp

Airflyte ELECTRONICS CO.

FAX: 201-436-6024

AIRFLYTE ELCTRNS. CO., 56 New Hook Rd., P. O. Box 231, Bayonne, NJ 07002, Tel: 201-436-2230; Empl.: 75; *Sls. Mgr.:* John Piret **B•1186-1191**

Local Sales Offices & Reps

CA	Los Altos, Poltronics	415-941-3020
CA	Signal Hill, Thorson Co.	213-595-0361
CT	No. Haven, Kitchen & Kutchin	203-239-0212
IL	Park Ridge, Probe Elctrns.	312-698-2044
MA	Lexington, Kitchen & Kutchin	617-862-8230
NJ	Kinnelon, Avionics Equip.	201-838-8105
NY	Rochester, R. P. Kennedy Co.	716-271-6322
PA	Dowing, Budd Elctrns. Corp.	215-458-8258
TX	Austin, Electra Reps., Inc.	512-339-1163
TX	Dallas, Electra Reps., Inc.	214-248-3852

AIR LAND SYSTEMS CORPORATION, 2710 Prosperity Ave., Fairfax, VA 22031, Tel: 703-573-1100, TELEX: 710-833-1174, TWX: Airland Frax; Empl.: 50

AIRMATIC-ALLIED, 185 Park Dr., Wilmington, OH 45177, Tel: 513-382-1691; Empl.: 150

AIR MAZE CORP., 25000 Miles Rd., Cleveland, OH 44128, Tel: 216-292-6800, TELEX: 98-5413; Empl.: 300; *Sls. Mgr.:* Jim Ernster; *Dist. Mgr.:* Gary Yoho

AIR-O-TRONICS, Trush Group, Route 20 E., Cazenovia, NY 13035, Tel: 315-655-2387, TWX: 710-541-1530, FAX: 315-655-3862; FSC No.: 16663; Empl.: 15

AIRPAX CORP., Woods Rd., Cambridge, MD 21613, Tel: 301-228-4600, TELEX: 8-7715, TWX: 710-865-9655; FSC No.: 81541; Empl.: 550; *Sls. Mgr.:* Bob Phillips **A•1717; B•1298**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	714-566-6580
CA	Santa Ana, Airpax Co.	408-980-0470
CO	Littleton, Lange Sls.	303-795-3600
CT	Clinton, Selmark Assocs.	203-573-9088
FL	Pompano Bch., Airpax Co.	305-978-9019
GA	Chamblee, BCI	404-455-0405
IL	Palatine, Somers-Stanton, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax Co.	301-243-3133
MA	Millis, Selmark	617-376-2914
MI	Farmington Hills, Airpax Co.	313-553-6030
MN	Minnetonka, Airpax Corp.	612-933-0170
MO	Florissant, Delltron	314-839-0033
MO	Kansas City, Delltron	816-436-6445
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Hyde Pk., Airpax Co.	914-229-0016
NY	Jericho, Airpax Co.	516-822-2410
NY	Rochester, Airpax Co.	716-654-7470
NC	Winston-Salem, L.G. White	919-725-3612
OH	Dayton, Baehr, Greenleaf	513-439-0724
OH	Westlake, Baehr, Greenleaf	216-892-1770
OH	Worthington, Baehr, Greenleaf	614-847-0220
OR	Beaverton, Airpax Co.	503-641-6130
PA	Harleysville, T. Jackson	215-643-5560
PA	Pittsburgh, Russell F. Clark	412-242-9500
SC	Greenville, L.G. White	803-271-0630
TX	Dallas, Airpax Co.	214-851-7433
UT	Salt Lake City, Lange Sls.	801-487-0843
WI	Wauwatosa, Larson Assocs.	414-258-0529

AIRPAX CORP., Cheshire Div., Cheshire Indl. Pk., Box E, Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 962421, TWX: 710-455-4048; Empl.: 800; *Sls. Mgr.:* John Ricardi **B•1194, 1877; D•1121**

Local Sales Offices & Reps

AL	Huntsville, B.C.I.	205-539-4411
AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	213-404-3881
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Airpax Co.	408-980-0410
CO	Littleton, Lange Sls.	303-795-3600
CT	Clinton, Selmark Assocs.	203-573-9088
FL	Pompano Bch., Airpax Co.	305-978-9019
GA	Chamblee, B.C.I.	404-455-0405
IL	Palatine, Somers-Stanton, Inc.	312-991-1108
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Marion, Rep Assocs.	319-373-0152
MD	Frederick, Airpax Co.	301-243-3133
MA	Millis, Selmark Assocs.	617-376-2914
MI	Farmington Hills, Airpax Co.	313-553-6030
MN	Minnetonka, Airpax Co.	612-933-0170
MO	Florissant, Delltron	314-839-0033
MO	Kansas City, Delltron Co., Inc.	816-436-6445
NH	Hopkinton, Selmark Assocs.	603-746-3299
NY	Hyde Park, Airpax Co.	914-229-0016
NY	Jericho, Airpax Co.	516-822-2410
NY	Rochester, Airpax Co.	716-654-7470
NC	Winston-Salem, L. G. White	919-725-3612
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770

OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L.G. White Southern, Inc. 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

AIRPAX COMPANY, A Division of North American Philips Corp., Husky Park P.O. Box 500, Frederick, MD 21701, Tel: 301-663-5141, TWX: 710-862-0901; Empl.: 600; *Sls. Mgr.:* Joe Ruth, Mktg. Mgr.; *Dist. Mgr.:* B. L. Reeder ..... **B•1357, 1835**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-539-4411
AZ Phoenix, Westrep 602-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088
FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Stanton Inc. 312-991-1108
IN Indianapolis, Leslie M. De Voe Co. 317-842-3245
IA Marion, Rep Assocs., Inc. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark Assocs. 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co., Inc 816-436-6445
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Jericho, Airpax Co. 516-822-2410
NY Hyde Pk., Airpax Co. 914-229-0016
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L. G. White Southern 919-725-3612
OH Dayton, Baehr, Greenleaf & Assocs. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Baehr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L. G. White Southern, Inc. 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

Local Distributors

CA Santa Ana, Norstan Elctrns. 714-540-4165
OK Tulsa, Altair 918-665-0524
TX Houston, Altair 713-462-3029
TX Richardson, Altair 214-231-5166

AIRPAX CORPORATION, International Div., West Johnson Ave., Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 643967; Empl.: 350; *Sls. Mgr.:* Walter Kalwara ..... **B•1192-1193**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-539-4411
AZ Phoenix, Westrep 609-997-8899
CA Anaheim, Westrep 213-404-3881
CA San Diego, Westerep 619-566-6580
CA Santa Clara, Airpax Co. 408-980-0410
CO Littleton, Lange Sls. 303-795-3600
CT Clinton, Selmark Assocs. 203-573-9088

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FL Pompano Bch., Airpax Co. 305-978-9019
GA Chamblee, B.C.I. 404-455-0405
IL Palatine, Somers-Stanton, Inc. 312-991-1108
IN Indianapolis, Leslie M. Devoe 317-842-3245
IA Marion, Rep Assocs. 319-373-0152
MD Frederick, Airpax Co. 301-243-3133
MA Millis, Selmark Assocs. 617-376-2914
MI Farmington Hills, Airpax Co. 313-553-6030
MN Minnetonka, Airpax Co. 612-933-0170
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6440
NH Hopkinton, Selmark Assocs. 603-746-3299
NY Hyde Pk., Airpax Co. 914-229-0016
NY Jericho, Airpax Co. 516-822-2410
NY Rochester, Airpax Co. 716-654-7470
NC Winston-Salem, L. G. White 919-725-3612
OH Dayton, Behr, Greenleaf & Assocs. 513-439-0724
OH Westlake, Behr, Greenleaf & Assocs. 216-892-1770
OH Worthington, Behr, Greenleaf & Assocs. 614-847-0220
OR Beaverton, Airpax Co. 503-641-6130
PA Harleysville, Thomas Jackson Assocs. 215-256-8877
PA Pittsburgh, Russell F. Clark Co. 412-242-9500
SC Greenville, L. G. White 803-271-0630
TX Dallas, Airpax Co. 214-851-7433
UT Salt Lake City, Lange Sls. 801-487-0843
WI Wauwatosa, Larson Assocs. 414-258-0529

AIRPAX CO., SENSOR DIV., A Division of North American Philips Corp., Cheshire Industrial Park, Cheshire, CT 06410, Tel: 203-272-0301, TELEX: 962421, TWX: 710-455-4048, FAX: 203-271-1395; Empl.: 200; *Sls. Mgr.:* Jim Rochford

AIRTRON, Litton Industries, Inc., 200 E. Hanover Ave., Morris Plains, NJ 07950, Tel: 201-539-5500, TWX: 710-986-7473, FAX: 201-539-0357; FSC No.: 80006; Empl.: 500; *Sls. Mgr.:* M. R. Grosso, Natl. Sls. Mgr.

AIR-VAC ENGRG., 100 Gulf St., Milford, CT 06460, Tel: 203-874-2541, FAX: 203-783-1383; Empl.: 40

AJAX MAGNETHERMIC CORP., 1745 Overland Ave., N.E., Warren, OH 44482, Tel: 216-372-8511, TELEX: 098-2482, FAX: 216-372-8644; Empl.: 500

AKG ACOUSTICS, INC., 77 Selleck St., Stamford, CT 06902, Tel: 203-348-2121, TELEX: 285481, FAX: 203-324-1942; Empl.: 25; *Sls. Mgr.:* Rowland Powers

AKRO-MILS, 1293 S. Main St., Akron, OH 44301, Tel: 216-253-5593, TELEX: 98-6321; Empl.: 200; *Sls. Mgr.:* W. J. Tonachio; *Dist. Mgr.:* D. Martin

ALADDIN ELCTRNS., See AIE Div. of Vernitron

ALAN GORDON ENTPRS., INC., P.O. Box 3914, 5362 Cahuenga Blvd., N. Hollywood, CA 91601, Tel: 818-985-5500, TELEX: AGE-FOTO LSA 662532, TWX: 910-321-4526 GO, FAX: 213-871-2193; FSC No.: 94972; Empl.: 81; *Sls. Mgr.:* D. Sahlein

ALAN INDUSTRIES INC., P.O. Box 1203, Columbus, IN 47201, Tel: 812-372-8869, FAX: 812-372-5909; FSC No.: 52750; Empl.: 36; *Sls. Mgr.:* Blayde A. Kennedy

Local Sales Offices & Reps

AL Huntsville, Saber Assocs. 800-327-0853
CA Los Angeles, RF Assocs. 213-478-1586
CA Palo Alto, RF Assocs. 415-494-3331
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Plainville, Addelco Corp. 203-747-9464
FL Apopka, Saber Assocs. 800-432-6288
FL Bradenton, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assoc. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
MD Randallstown, C. L. Malinow & Co. 301-922-2092
MA Needham, Addelco Corp. 617-444-4754
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Liverpool, R. & D. Assocs. 315-457-0100
NY New Rochelle, Ascor Elctrns. 914-235-8838
NC Clayton, Saber Assocs. 800-327-0853
OH Dayton, Frederic L. Ohmer 513-434-1454
OK Tulsa, Beacon Elctrns. 918-622-1494,
TX Austin, Beacon Elctrns. 512-345-3543,
TX Dallas, Beacon Elctrns. 214-437-1505,
UT Salt Lake City, Trembly Assocs. 801-486-5292
EXP CT, Stamford, Dage Corp. 203-324-3123
Can Ottawa, Ont., Giga-Tron 613-225-4090,

Local Distributors

AL Huntsville, Component Distrs. 205-883-7501,
AR Little Rock, Component Distrs. 501-227-6278,
CA Sunnyvale, Elctrn. Resources, Inc. 408-745-1420,
CO Englewood, Component Distrs. 303-799-4916,
FL Melbourne, Component Distrs. 305-724-9910,
GA Norcross, Component Distrs. 404-441-3320,
IL Des Plains, Compucon Distrs. 312-827-9444,
IN Fort Wayne, Compucon Distrs. 219-432-8919,
MD Randallstown, CLM Sls. 301-922-7717,
MA Reading, Compucon Distrs. 617-944-6875,
NY Ronkonkoma, Compucon Distrs. 516-981-8810,
NC Raleigh, Component Distrs. 919-834-9465,
TX Dallas, Component Distrs. 214-644-0373,
VA Sterling, Ice Components 703-478-2677,

ALARM CONTROLS CORPORATION, P.O. Box 280, Deer Park, NY 11729, Tel: 516-586-4220, FAX: 516-586-6500; FSC No.: 55042; Empl.: 50; *Sls. Mgr.:* John Benedetto

ALASCO RUBBER & PLASTICS CORP., 617 Mountain View Ave.67, Belmont, CA 94002, Tel: 415-595-4100; FSC No.: 13862; Empl.: 25; *Sls. Mgr.:* Philip K. Nordberg

ALBAR, INC., 19013 36th Ave. W., Lynnwood, WA 98036, Tel: 206-771-4006, FAX: 206-771-2163; Empl.: 30; *Sls. Mgr.:* Merv Eaton

ALBEROX CORPORATION, New Bedford Ind'l. Pk., New Bedford, MA 02745, Tel: 617-995-1725, FAX: 617-995-6954; Empl.: 180

ALBION INDUSTRIES, 800 N. Clark St., Albion, MI 49224, Tel: 517-629-9441

ALDEN COMPUTER SYSTEMS, One Salem Green, Ste. 420, Salem, MA 01970, Tel: 617–744-1314; *Sls. Mgr.:* Donald O'Brien

ALDEN ELECTRONICS, INC., 40 Washington Street, Westboro, MA 01581, Tel: 617-366-8851, TELEX: 94-8404, FAX: 617-898-2427; Empl.: 140; *Sls. Mgr.:* L. A. Farrington

ALDEN

FAX: 617-583-0164

ALDEN PRODUCTS CO., P.O. Box 860, 117 N. Main St., Brockton, MA 02403, Tel: 617-583-0160, TELEX: 28-7793 ALDN UR; FSC No.: 01009; Empl.: 150; *Sls. Mgr.:* Donald J. Paul ..... **C•1161**

Local Sales Offices & Reps

OR Portland, Elctrn. Comp. Sls. 503-245-2342
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WA Mercer Island, Electronic Comp. Sls. 206-232-9301

ALDES SYSTEMS, Alden Products Co., 262 N. Main St., P.O. Box 860, Brockton, MA 02403-0860, Tel: 617-583-0160, TELEX: 287 793 ALDN UR, FAX: 617-583-0164; Empl.: 150; *Sls. Mgr.:* Norbert A. Duhamel

A. L. DESIGN, INC., 4232 Ridge Lea Rd., Amherst, NY 14226, Tel: 716-833-6272, FAX: 716-833-8856; Empl.: 20

ALEPH INTERNATIONAL, 1026 Griswold, San Fernando 91340, Tel: 818-365-9856

ALEXANDER BATTERIES, New Product/OEM Divison, P.O. Box 28880, San Diego, CA 92128, Tel: 619-480-4445, TELEX: 371-9855, FAX: 619-480-1351; Empl.: 175; *Sls. Mgr.:* Dave Zeman ..... **D•1435**

Local Sales Offices & Reps

CO Denver, Aurora Mktg. 303-758-3051
GA Atlanta, Alexander Battery S.E. 404-968-4087
IL McHenry, Alexander Battery Co. 815-344-0666
IA Mason City, Jon Alexandres 515-423-8955
MN Minneapolis, Paul Ohlin 612-941-7697
NJ Middlesex, Jim Sapp 201-271-5880
OH Dublin, Alexander Battery, Mideast 614-764-8771
TX Arlington, Alexander Battery South 800-323-3813

Alexander Batteries
By Alexander Manufacturing

FAX: 515-423-1644

ALEXANDER MANUFACTURING COMPANY, P.O. Box 1508, Mason City, IA 50401, Tel: 800-247-1821, 515-423-8955, TELEX: 3719855; Empl.: 225 ..... **D•1435**

Local Distributors

CA San Diego, Alexander Batteries-West 619-480-4806
CO Denver, Aurora Mktg. Co. 303-758-3051
GA Atlanta (Morrow), Alexander Batteries-S.W. 404-968-4087
IL McHenry, Alexander Batteries-Midwest 815-344-0666
MN St. Paul, Alexander Batteries-North ... 612-941-7697
NJ Middlesex, Alexander Batteries-East .. 201-271-5880
OH Dublin, Alexander Batteries-Midwest .. 614-764-8771
TX Arlington, Alexander Batteries-South .. 800-323-3812
WA Bellevue, Arpac Ltd. 206-453-2132
Can Delta, B.C., Traeger Dists., Ltd. 604-946-0818
Can Edmonton, Alberta, Allcan Elctrns. 403-451-2355

ALFORD MANUFACTURING CO., P.O. Box 2116, 32 Sixth Rd., Woburn, MA 01801, Tel: 617-935-8610, TWX: 710-348-1063, FAX: 617-933-4512; FSC No.: 07177; Empl.: 20; *Sls. Mgr.:* Fred Abel

ALGO, INC., 9198-C Red Branch Rd., Columbia, MD 21045, Tel: 301-730-7442, TELEX: 333405; Empl.: 12; *Sls. Mgr.:* G. J. O'Mara

ALINABAL, 28 Woodmont Rd., Milford, CT 06460, Tel: 203-877-3241, TWX: 710-462-1178, FAX: 203-877-3241 (ext. 360); Empl.: 255

ALLACO PRODUCTS DIV., Bacon Industries, Inc., 192 Pleasant St., Watertown, MA 02172-2399, Tel: 617-926-2550, TWX: 710-327-6518; FSC No.: 99098; Empl.: 24; *Sls. Mgr.:* R.S. Cass

ALLEN AVIONICS, INC., 224 E. 2nd St., Mineola, NY 11501, Tel: 516-248-8080, FAX: 516-747-5481; Empl.: 300; *Sls. Mgr.:* Richard Mintz ..... **A•1496, 1635**

Local Sales Offices & Reps

AZ Phoenix, J. F. Hurlbut Co. 602-952-2079
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Palo Alto, Adtek Assocs. 415-323-5414
CA San Diego, Van Gott & Assocs. 619-308-0667
CO Golden, J. F. Hurlbut Co. 303-279-7796
NY Plainview, Eastern Metro Assocs. 516-931-1414
OR Beaverton, Evergreen Mktg. Grp. 503-643-8020
PA Huntingdon Valley, Rabal Assocs. 215-947-4825
TX Dallas, Bradenco Corp. 214-352-3554
VA Alexandria, Vanguard Engrg. Sls. 703-768-1660
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
EXP CT, Stamford, Dage Corp. 203-324-3123

AB ALLEN-BRADLEY
A ROCKWELL INTERNATIONAL COMPANY

FAX: 915-594-8922

ALLEN BRADLEY CO., ELECTRONIC COMPONENTS DIV., A Rockwell International Co., 1414 Allen-Bradley Dr., El Paso, TX 79936, Tel: 915-592-4888, 800-592-4888, TELEX: 749-400; Empl.: 6500; *Sls. Mgr.:* Hugh Tyler; *Dist. Mgr.:* Chestley Grimsley ..... **A•1854-1867, 2059-2061**

Local Distributors

AZ Phoenix, Wyle Labs. 602-249-2888
CA Calabasas, Wyle Laboratories 818-880-9000
CA Chatsworth, Marshall Elctrns. Grp. 818-407-4100
CA Chatsworth, TTI, Inc. 818-709-1010
CA El Monte, Marshall Inds. Elctrns. Grp. 818-459-5500
CA El Segundo, Wyle Labs. 213-322-8100
CA Irvine, Marshall Inds. Elctrns. Grp. 714-859-5050
CA Irvine, Wyle Labs. 714-863-9953
CA Milpitas, Marshall Elctrns. Grp. 408-943-4600
CA Milpitas, TTI, Inc. 408-946-5577,
CA Rancho Cordova, Wyle Labs. 916-638-5282
CA San Diego, Wyle Labs. 619-565-9171
CA Santa Clara, Wyle Labs. 408-727-2500
CO Thornton, Wyle Distbn. Grp. 303-457-9953
CT Stratford, TTI, Inc. 203-375-1400
CT Wallingford, Marshall Elctrns. Grp. 203-265-3822
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
GA Atlanta, Marshall Elctrns. Grp. 404-923-5750
GA Atlanta, TTI, Inc. 404-662-0911
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IN Ft. Wayne, Graham Elctrns. Supp., Inc. 219-423-3422
IN Indianapolis, Graham Elctrns. Div. 317-875-8200,
MD Gaithersburg, Almo Elctrns. Inc. 301-670-0090
MD Gaithersburg, Marshall Elctrns. Inc. ... 301-840-9450
MA Canton, Almo Elctrns. 617-821-1450
MA Wilmington, Marshall Elctrns. Grp. 617-658-0810
MA Wilmington, TTI, Inc. 617-658-4700,
MI Livonia, Marshall Elctrns. Grp. 313-525-5850
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MO St. Louis, Chelsea Inds. 314-997-7709,
NJ Fairfield, Marshall Inds. Elctrns. Grp. .. 201-882-0320
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NY Hauppauge, Marshall Elctrns. Grp. 516-273-2424
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NY Rochester, Marshall Elctrns. Grp. 716-235-7620
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UT Salt Lake City, Wyle Labs. 801-974-9953
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ALLEN-BRADLEY CO., MAGNETICS DIVISION, Div. of Rockwell Corp., 5900 N. Harrison St., Shawnee, OK 74801, Tel: 405-275-2100, TELEX: 4311016; *Sls. Mgr.:* Carl Tufts, Dir. Mktg./Sls.; *Dist. Mgr.:* Jerry White, Natl. Sls. Mgr.

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MD Rockville, All American Semiconductor Inc. 301-251-1205
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NY Ronkonkoma, All American Semiconductor Inc. 516-981-3935

RGA

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ALLEN CO., INC., ROBERT G., 7267 Coldwater Canyon, N. Hollywood, CA 91605, Tel: 818-765-8300, 800-423-3186, TELEX: 18-2699; Empl.: 35; *Dist. Mgr.:* Susan Duke ..... **A•1007, 1868-1869**

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CA Sunnyvale, Robert G. Allen Co., Inc. ... 408-243-7007

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FAX: 603-893-9042

ALLEN DATAGRAPH, INC., 2 Industrial Way, Salem, NH 03079, Tel: 603-893-1983, TWX: 710-366-0504; *Sls. Mgr.:* Tom Allen ..... **D•1416**

Telemecanique

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CA Tarzana, Component Mktg. Assocs., Inc. 818-708-8058
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CT Clinton, Selmark Assocs., Inc. 203-573-9088
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IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
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OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
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PA Pittsburgh, Process Engrg. Co. 412-561-5050
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TX Richardson, Comp. Technlg. 214-690-8537
VA Midlothian, Delta III Assocs., Inc. 804-379-1816
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Can North York, R. D. Assocs. 416-444-0959

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CO	Denver, Moss Mktg.	303-455-7205
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
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MS	Jackson, S. L. Welch & Assocs.	601-932-5534
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FL	St. Petersburg, Electrocomp Assoc.	813-327-9677
IL	Elk Grove Village, Control Sls.	312-595-2110
IN	Ft. Wayne, Aktron Corp.	219-747-3650
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CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CO	Englewood, FG Mktg. Co.	303-795-9176
CT	Bethel, Instr. Dynamics	203-743-5045
FL	Tampa, Temco Sls. Inc.	813-855-7566, 800-282-6815
GA	Atlanta, Kemp Instrs.	404-452-8050
IL	Bensenville, R. L. Lang & Assocs.	312-766-3667
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NY	Binghamton, Reagan/Compar, Inc.	607-723-8743
NY	Endwell, Reagan/Compar Endwell	607-754-2171/8946
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NY	Rochester, Reagan/Compar, inc.	716-271-2230
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WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WA Spokane, Eclipse Mktg. Grp. 509-922-3972
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GA Atlanta, Synergetic Reps., Inc. 404-451-5641
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AMERICAN CYANAMID CO., Metal Coated Fibers Dept., One Cyanamid Plaza, Wayne, NJ 07470, Tel: 201-831-3148, TELEX: 219-136, TWX: 710-988-3045, FAX: 201-839-8847; *Sls. Mgr.:* James Tonges

AMERICAN ELECTRIC CABLE CO., 181 Appleton St, Holyoke, MA 01040, Tel: 413-539-9893; Empl.: 125; *Sls. Mgr.:* Michael A. Bousquet

AMERICAN ELECTRONIC LABORATORIES, INC., 305 Richardson Rd., Lansdale, PA 19446, Tel: 215-822-2929, TWX: 510-661-4976; FSC No.: 93346; Empl.: 1,691; *Sls. Mgr.:* Arthur Gross

AMERICAN ELECTRONICS, 1600 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-3020, TWX: 910-592-1256; FSC No.: 89321; Empl.: 200; *Sls. Mgr.:* T. V. Sacco

AMERICAN ETCHING & MFG., 13730 Desmond St, Pacoima, CA 91331-2796, Tel: 818-896-1187; Empl.: 90

AMERICAN HV TEST SYSTEMS INC., Central Garrett Ind'l. Pk, Accident, MD 21520, Tel: 301-826-8651, TELEX: 86223; Empl.: 45; *Sls. Mgr.:* Steve Sanders

AMERICAN
INSULATED WIRE CORP.

FAX: 401-723-1420

AMERICAN INSULATED WIRE CORP., Leviton Mfg. Co., 36 Freeman St., Pawtucket, RI 02862, Tel: 401-726-0700, TWX: 710-384-0150; Empl.: 1300; *Sls. Mgr.:* John Pimental; *Dist. Mgr.:* Dennis Andrews .... **C•1770**

Local Sales Offices & Reps
AZ Scottsdale, Bill Earl Assocs., Inc. 602-994-3813
CA Pico Rivera, Leviton-American 213-949-6575
CT Hartford, Spec-Tech 617-795-7250,
FL Margate, EPM Corp. 305-977-0331
GA Atlanta, Cavendish & Winchester 404-449-5104
GA Atlanta, Leviton/American 404-691-9303
IL Chicago, Leviton/American 312-766-4100
KS Overland Park, Thomas L. Dowell & Assocs. 913-648-7373
LA New Orleans, Leviton/American 504-834-9415
MI Detroit, Leviton/American 313-933-3100
MN Lakeville, Peter Galdikas 612-435-7549
MO St. Louis, Thomas Dowell & Assocs. .. 314-849-4234
NY New York, Leviton Corp. Headquarters 212-229-4040
NY W. Hempstead, Schmitt Indl. Mktg. 516-486-3510
NC Kings Mountain, Cavendish & Winchester 704-739-9297
OH Cleveland, Leviton/American 216-831-1673
PA Philadelphia, Linton Assocs. 215-277-8600
TN Manchester, Cavendish & Winchester 615-728-7291
TX Dallas, Leviton/American 214-241-4556
TX Grapevine, Dan Cheetham 817-481-6238
TX Houston, Leviton/American 713-956-2816
WA Seattle, Dussault & Assocs. 206-527-5454
WA Seattle, Leviton/American 206-576-0242

AMERICAN LASER SYSTEMS, INC., 106 Fowler Rd., Goleta, CA 93117, Tel: 805-967-0423, TELEX: 4941760ALS; Empl.: 7; *Sls. Mgr.:* L. Shallenberger

AMERICAN MAGNETICS, 740 Watson Center Rd, Carson, CA 90745, Tel: 213-775-8651, FAX: 213-834-0685; Empl.: 300; *Sls. Mgr.:* Stuart Katcher

AMERICAN MAGNETICS, P.O. Box 49, Carterville, IL 62918, Tel: 618-985-4838; Empl.: 120

AMERICAN MAGNETICS, P.O. Box 2509, Oak Ridge, TN 37831-2509, Tel: 615-482-1056, TELEX: 557-592, FAX: 615-482-5472; Empl.: 25; *Sls. Mgr.:* E. T. Henson

AMERICAN MICROSEMICONDUCTOR, INC., 133 Kings Rd., Madison, NJ 07940, Tel: 201-377-9566, TWX: 710-986-8500, FAX: 201-377-3078; Empl.: 15; *Sls. Mgr.:* W. M. Foley; *Dist. Mgr.:* D. B. Wilson ..... **A•2115**

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AMERICAN MICROWAVE TECHNOLOGY INC.

FAX: 714-871-2453

AMERICAN MICROWAVE TECHNOLOGY, INC., 1127 S. Placentia Ave., Fullerton, CA 92631, Tel: 714-680-4936; Empl.: 25; *Sls. Mgr.:* Lowell A. Beezley ..... **D•1002-1003**

Local Sales Offices & Reps
AZ Scottsdale, T.D.S.I. 602-998-2444
CA Mission Hills, Detomasi & Grupp, Inc. 818-365-8285
CA San Diego, Detomasi & Grupp, Inc. ... 619-277-0178
CA Sunnyvale, Fuchs Tech. Sls., Inc. 408-245-3500
CA Torrance, Detomasi & Grupp, Inc. 213-618-8898
FL Indian Harbor Bch., Southeastern Comp. Sls., Inc. 305-773-3767
GA Atlanta, Southeastern Comp. Sls., Inc. 404-451-5353
GA Warner Robbins, King Consult. Svcs. ... 912-953-2835
IL Park Ridge, Probe Elctrns. 312-696-2828
IN Ft. Wayne, J & B Engrg. Sls. 219-483-2813
IA Cedar Rapids, Barnes-West Tech. Assocs. 319-393-9790
KS Overland Pk., Barnes-Midwest Sls. 913-469-9688
MD Linthicum, Advanced Technlg. Sls. 301-789-9360
MA Burlington, Tritek, Inc. 617-272-4550
NM Albuquerque, T.D.S.I. 505-293-8555
NY Deer Pk., MMD-East 516-667-7200,516-242-5900
NY New Rochelle, RDI 914-632-2828
NY Skaneateles, Robtron, Inc. 315-685-5731
OH Cleveland, J & B Engrg. Sls. Co., Inc. .. 216-642-9312
OR Beaverton, Thorson Co. N.W. 503-644-5900
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TX Dallas, The Thorson Co. 214-233-5744
TX Houston, The Thorson Co. 713-558-8205
WA Bellevue, Thorson Co. N.W. 206-455-9180

AMERICAN MONARCH, 2801-37th Ave., N.E., Minneapolis, MN 55421, Tel: 612-788-9161; FSC No.: 11146; Empl.: 120; *Sls. Mgr.:* B. Sutherland; *Dist. Mgr.:* Ron Anderson

AMERICAN PHOTONICS INC., 71 Commerce Dr., Brookfield Center, CT 06805, Tel: 203-775-8950, TELEX: 821353; *Sls. Mgr.:* James A. Walyus

AMERICAN POWER DEVICES, 7 Andover St., Andover, MA 01810, Tel: 617-475-4074, TELEX: 951206; Empl.: 140; *Sls. Mgr.:* R. Bryant

American Relays, Inc.

FAX: 213-944-0590

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FL	Pompano Bch., Bolton Assocs.	305-975-7245
IA	Cedar Rapids, Elctrn. Sls., Inc.	319-362-6413
MD	Baltimore, Eltron Sls. Ltd.	703-635-7201
MN	Burnsville, Elctrn. Sls., Inc.	612-894-8200
NJ	Turnersville, Pacesetters	609-589-1948
NY	Jericho, J-Square Mktg., Inc.	516-935-3200
OH	Cleveland, Components, Inc.	216-243-9200
OH	Dayton, Components, Inc.	513-436-0255
SC	Greenville, Eltron Sls., Ltd.	803-234-6931
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201

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Local Distributors

AL	Huntsville, Comp. Dists.	205-883-7501
CA	San Diego, Deco Elctrns.	619-693-1595
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CA	San Jose, Passive Technlg.	408-435-5566
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Comp. Dists.	303-799-4916
FL	Melbourne, Comp. Dists.	305-724-9910
MA	Burlington, TLC Elctrns.	617-273-0140
NJ	Parsippany, Fabe Electro Sls., Inc.	201-299-1123
NC	Raleigh, Comp. Dists.	919-787-7311
OR	Beaverton, Murphy Elctrns.	503-642-2001
WA	Redmond, Murphy Elctrns.	206-881-1234

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FAX: 818-710-0694

AMERICAN SHIZUKI CORPORATION, 21541 Blythe St., Canoga Pk., CA 91304, Tel: 818-710-8555, TELEX: 66-2633 SHIZAM; Empl.: 1000; *Sls. Mgr.:* Jeff Cohen ..... **A•1008**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5110
AZ	Phoenix, Compass Mktg. & Sls., Inc.	602-293-1220
CA	Chatsworth, WCV-Raltech, Inc.	818-700-0933
CA	Redwood City, James S. Heaton Co., Inc.	415-367-9000
CA	San Francisco, Wrathall & Krusi, Inc.	415-777-0226
CO	Wheatridge, Waugaman Assocs.	303-423-1020
GA	Norcross, R. O. Whitesell & Assocs.	404-449-9190
IL	Itasca, Circuit Sls., Inc.	312-773-0200
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, Insul-Reps., Inc.	317-251-1994
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell & Assocs.	317-457-9127
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs., Inc.	913-541-0505
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
LA	Hammond, Design Mktg. & Assocs.	504-294-3076
MD	Gaithersburg, Naudain Assocs. So. Inc.	301-258-5040
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MI	St. Joseph, R. O. Whitesell & Assocs.	616-983-7337
MN	Eden Prarie, Com-Tek Sls.	612-941-7181
MO	Creve Coeur, Hill & Co.	314-432-1136
MO	St. Louis, John G. Macke Co.	314-432-2830
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Buffalo, Quality Comps.	716-837-5430
NY	Great Neck, F & F Metro	516-482-4080
NY	Manlius, Quality Comps.	315-682-8885
NJ	Marlton, BGR Assocs.	609-983-1020
NC	Raleigh, Micro Sls., Inc.	919-872-7922
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-936-6161
TN	Knoxville, R. O. Whitesell & Assocs.	615-694-9476
TX	Austin, Design Mktg. & Assocs.	512-263-9151
TX	Dallas, Design Mktg. & Assocs.	214-480-8151
TX	El Paso, Compass Mktg. & Sls.	505-888-0800
TX	Ft. Worth, Design Mktg. & Assocs.	817-232-3155
TX	Houston, Design Mktg. & Assocs.	713-550-3318
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
WA	Bellevue, N. R. Schultz Co.	206-454-0300
WI	Brookfield, Circuit Sls. Inc.	414-784-7773

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AL	Huntsville, Bell	205-837-1074
AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Arizona Comps.	602-269-5655
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Bell	602-966-7800
AZ	Tempe, TTI	602-431-1191
CA	Chatsworth, Passive Comps.	818-341-1745
CA	Chatsworth, Passive Technlg.	818-882-2277
CA	Chatsworth, TTI	818-709-1010
CA	Garden Grove, Bell	714-895-7801
CA	Gardena, Bell	213-515-1800
CA	Hall-Mark, Canoga Pk.	818-716-7300
CA	Milpitas, Cal Cap	408-262-6000
CA	Milpitas, TTI	408-946-5577
CA	Sacramento, Bell	916-969-3100
CA	Sacramento, Hall-Mark	916-722-8600
CA	San Diego, Bell	619-268-1277
CA	San Diego, Hall-Mark	619-268-1201
CA	San Diego, Projections Unltd.	619-453-7900
CA	San Diego, TTI	619-587-4888
CA	San Jose, Hall-Mark	408-946-0900
CA	San Jose, Passive Technlg.	408-435-5566
CA	Sunnyvale, Bell	408-734-8570
CA	Thousand Oaks, Bell	205-499-6821
CA	Torrance, Hall-Mark	213-217-8400
CA	Tustin, Hall-Mark	714-669-4700
CA	Tustin, Projections Unltd.	714-544-2700
CO	Denver, Hall-Mark	303-790-1662
CO	Denver, TTI	303-429-6806
CO	Wheat Ridge, Bell	303-424-1985
CT	Wallingford, Hall-Mark	203-269-0100
FL	Deerfield Bch., Bell	305-421-1997
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
FL	Largo, Bell	813-541-4434
FL	Orlando, Hall-Mark	305-855-4020
FL	Orlando, TTI	305-859-1000
FL	Pompano Bch., Peerless	305-973-4141
FL	St. Petersburg, Hall-Mark	813-530-4543
GA	Atlanta, Hall-Mark	404-447-8000
GA	Norcross, Bell	404-662-0923
GA	Norcross, TTI	404-662-0911
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, PEI/Genesis	312-530-2272
IL	Elk Grove Vl, Bell	312-640-1910
IL	Urbana, Bell	217-328-1077
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-875-0200
IN	Indianapolis, Hall-Mark	317-872-8875
IN	South Bend, PEI/Genesis	219-287-2911
IA	Cedar Rapids, Bell	319-395-0730
KS	Kansas City, Hall-Mark	913-888-4747
MD	Baltimore, Hall-Mark	301-988-9800
MD	Baltimore, PEI/Genesis	301-561-5325
MD	Columbia, TTI	301-995-1331
MA	Boston, Hall-Mark	617-935-9777
MA	Wilmington, TTI	617-658-4700
MA	Winchester, Bell	617-729-5800
MI	Ann Arbor, Bell	313-971-9093
MN	Eden Prairie, TTI	612-944-5080
MN	Minneapolis, Hall-Mark	612-941-2600
MO	St. Louis, Hall-Mark	314-291-5350
NH	Hudson, Bell	603-882-1133
NJ	Edison, Peerless	201-906-1181
NJ	Fairfield, Hall-Mark	201-575-4415
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NY	Farmingdale, Bell	516-752-9303
NY	Lynbrook, Peerless	516-593-2121
NY	Ronkonkoma, Hall-Mark	516-737-0600
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cleveland, Hall-Mark	216-349-4632
OH	Columbus, EMC	614-299-4161
OH	Columbus, Hall-Mark	614-888-3313
OH	Columbus, TTI	614-848-5770
OH	Dayton, Bell	513-435-8660
OK	Tulsa, Hall-Mark	800-231-0253
OR	Portland, Bell	503-241-4115
PA	Philadelphia, Hall-Mark	215-355-7300
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Hall-Mark	214-553-4300
TX	Ft. Worth, TTI	817-595-3100
TX	Houston, Hall-Mark	713-781-6100
TX	Richardson, Bell	214-690-0466
UT	Salt Lake City, Bell	801-972-6969
UT	Salt Lake City, Hall-Mark	801-972-1008
WA	Redmond, TTI	206-882-0291
WA	Seattle, Bell	206-747-1515
WI	Milwaukee, Hall-Mark	414-797-7844
WI	Waukesha, Bell	414-547-8879
Can	Calgary, Alberta, Future	403-235-5325
Can	Downsview, Ont., Future	416-638-4771
Can	Edmonton, Alberta, Future	403-438-2858
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-694-7710
Can	St. Foy, Que., Future	418-682-8092
Can	Vancouver, B.C., Future	604-294-1166
Can	Winnipeg, Manitoba, Future	204-786-7711

AMERICAN STEAM TIMER, INC., Div. of JMR Electronics, Inc., 1525 Blondell Ave., Bronx, NY 11050, Tel: 212-597-6050; Empl.: 6; *Sls. Mgr.:* Jack Gaon

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FAX: 617-245-4531

AMERICAN SWITCH CORP., 134 Water St., Wakefield, MA 01880, Tel: 617-246-1007, TWX: 710-348-6756; FSC No.: 54659; Empl.: 40; *Sls. Mgr.:* Mike Palmerino; *Dist. Mgr.:* Mike Palmerino ..... **B•1643**

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AL	Decatur, Tenn Tech	205-350-0630
AZ	Scottsdale, BSE, Inc.	602-483-0373
CA	Arcadia, HMC, Inc.	818-447-0958
CA	Mtn. View, Serra Assocs.	415-964-4300
CO	Boulder, Stratford Grp.	303-530-3194
FL	Deerfield Bch., Newell-Hynes	305-429-3207
GA	Marietta, Tenn Tech	404-428-9594
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Acton, Nationwide Comps.	317-872-7207
IA	Marion, MSB Assocs.	319-377-6261
KS	Shawnee Mission, MSB Assocs.	913-432-2131
MA	Andover, Crawford Assocs.	617-470-2122
MI	Grand Blanc, Inter-Comm	313-695-0665
MN	Golden Valley, Highland Sls.	612-546-2123
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	W. Caldwell, M T S	201-228-4418
NY	Marcellus, Mullahy Sls.	315-685-6280
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Forest Grove, Doran Sls.	503-357-3333
PA	Elkins Pk., Arnold Assocs.	215-742-0600
TX	Dallas, Allied Comps.	214-238-0408
UT	Salt Lake City, Sage Sls.	801-467-5451
WA	Redmond, Doran Sls.	206-885-1885
EXP	CT/Litchfield, Intrade	203-567-5901

Local Distributors

AL	Birmington, Forbes Distbg.	205-251-4104
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AZ	Phoenix, Electro Comps.	602-258-2665
AZ	Tempe, RCD Inds.	602-838-0979
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CA	Hawthorne, Electrosonic Comps.	213-970-0997
CA	Los Angeles, Elec. Switches	213-660-1310
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Jose, Rose Elctrns.	408-263-9700
CA	San Jose, Sierra West	408-435-7477
CA	Santa Monica, Master Dists.	213-452-1229
CA	Sunnyvale, Power Supp. Comps.	408-737-1333
CA	Tustin, Western Switch & Controls	714-731-4333
CO	Englewood, Indl. Elctrns.	303-694-9444
CT	Bridgeport, Park Dists.	203-366-7200
CT	Greenwich, Wise Comps.	203-531-4880
CT	Wallingford, Mid-State Elctrns.	203-265-9900
DE	New Castle, Elctrns. Exchange	302-322-5401
FL	Ft. Lauderdale, Brothers Elctrns.	305-561-6700
FL	Largo, Elctrn. Precepts	813-544-3636
FL	Longwood, Intertec Comps.	305-834-7777
FL	Oakland Pk., Zelcon	305-565-2555
GA	Doraville, Specialty Distbg.	404-873-2521
ID	Spirit Lake, A-I Elctrns.	208-623-3111
IL	Chicago, Leeds Elctrns.	312-625-3800
IL	Chicago, Nep Elctrns.	312-625-8400
IL	Crystal Lake, Sub-Sem	312-782-3954
IL	Wheeling, Hawk Elctrns.	312-459-4030
IN	Carmel, Altex Elctrns.	317-848-1323
IN	Lafayette, CWY Elctrns.	317-448-1611
IN	Terre Haute, Midwest Supp.	812-232-0187
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
IA	W. Des Moines, Ramco Co.	515-225-6933
KS	Wichita, Radio, Inc.	316-264-2798
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MO St. Louis, Wes-Garde Comps. 314-567-7776
NH Hudson, Interconnect of N.E. 603-883-1515
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Mt. Laurel, PAC Elctrns. 609-387-3549
NJ Oakland, Relay Specialties 201-337-1000
NM Albuquerque, Intl. Elctrns. 505-345-8127
NY Amherst, Std. Elctrns. 716-691-3801
NY Bohemia, Key Comps. 516-567-7500
NY E. Syracuse, Add Elctrns. 315-437-0300
NY Hempstead, Davis Elctrns. 516-483-9200
NY Mt. Vernon, QAR 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Raleigh, Service Plus 919-850-9550
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Columbus, Whitehead Elctrns. 614-224-1186
OH Dayton, Stotts-Friedman 513-298-5555
OH Wickliffe, Gateway Megatech 216-944-5801
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Rose Elctrns. 503-629-9288
PA Norristown, Kimberly James Co. 215-666-7286
PA Philadelphia, Shap Elctrns. 215-969-3300
RI Pawtucket, Major/Edwards 401-725-7400
TN Chattanooga, Specialty Distbg. 615-267-9531
TN Knoxville, Curle Elctrns. 615-266-4727
TX Arlington, Bell Comp. Sls. 817-461-5303
TX Austin, Galtronics 512-837-7470
TX Dallas, Force Elctrns. 214-438-5700
TX Dallas, Wholesale Elctrns. 214-824-3001
TX El Paso, Intl. Elctrns. 915-598-3406
TX Ft. Worth, Indl. Elctrns. 817-731-7321
TX Garland, J & S Elctrns. 214-487-8808
TX Houston, Angie Elctrns. 713-659-8386
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Kent, Pyramid Elctrns. 206-872-5800
WA Seattle, Pacific Elctrns. 206-575-1050
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MD Severna Pk. 301-647-3879
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IN Ft. Wayne, Outman Sls. 219-483-7879
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NM Albuquerque, Reptronix Ltd. 505-292-1718
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NY Port Washington, Ashtec 516-767-0336
NC Raleigh, Prime Comps. 919-850-9866
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CA Santa Clara, Amphenol Corp. 408-986-0870
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IL Lisle, Connect Plus 312-355-6363
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
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MI Farmington Hills, R. C. Merchant & Co. 313-476-4600
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NH Amherst, D. A. Crowley Assocs. 603-673-7050
NJ Wayne, Astrorep Inc. 201-696-8200
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NY Babylon, Astrorep Inc. 516-422-2500
NC Greensboro, Amphenol RF Sls. 919-855-9033
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GA Norcross, Elctrn. Sls., Inc. 404-448-6554
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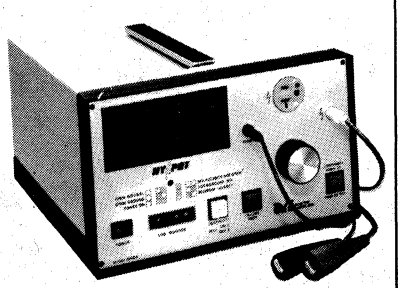

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IL	Streamwood, Fortier Testing & Sls.	312-837-5407
MN	Minneapolis, Minnkota Elec. Sls.	612-871-7838
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CA	Signal Hill, Thorson Co. of So. Calif.	213-595-0361,
FL	Pompano Bch., J.P. Elctrn. Sls. Co.	305-782-6830,
IL	Lombard, Genesis One Sls.	312-953-8716,
MA	Hopkinton, Mantec, Inc.	617-435-3434,
MN	Minneapolis, Deerland Distrs., Inc.	612-331-6433,
NY	Cutchogue, L. M. J. Martin Assocs., Inc.	516-734-5337,
TX	Richardson, Barger Engrg., Inc.	214-349-6171,

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CA	Los Angeles, Henry Radio	213-820-1234
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CO	Aurora, Electro Tech Sls.	303-343-8937
CO	Denver, CW Elctrns.	303-832-1111
GA	Marrietta, NBC Mktg.	404-424-9097
IL	Joliet, Communications Assoc.	815-744-6444
IL	Joliet, Primus Elctrns.	815-436-8945
MD	Cockleysville, Tessco.	301-785-5300
MA	N. Scituate, Two Comm Inc.	800-343-5519
MA	Reading, Graham Radio	617-944-4000
MA	Westport, Com Mar Inc.	617-636-6961
MN	St. Paul, Capital Sls.	612-642-1120
NJ	Clifton, Meridian Comms.	201-473-1623
OH	Cincinnati, Cartwright Comms.	513-489-1755
TX	Dallas, M. Hutton Co.	214-484-0580
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WI	Madison, Elmquist Elctrns.	608-222-0900
Can	Weston, Ont., Eastcom Inds.	416-743-7801

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CO	Englewood, Dynatech	303-773-2830
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IN	Mishawaka, Engineered Sls.	219-255-5111
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MA	Ashland, Polytek Assocs., Inc.	617-881-4741
MO	Bridgeton, Di-Tronix, Inc.	314-291-4777
MO	Raytown, Di-Tronix, Inc.	816-365-6340
NC	Charlotte, Jake Rudisill Assoc. Inc.	704-377-6901
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OR	Portland, Frys Controls, Inc.	503-226-2620
PA	Pittsburgh, Instrumentation Sys.	412-823-7005
PA	Warminster, Multi-Measurements	215-675-3082
TX	Dallas, Data Mktg. Assocs., Inc.	214-661-0330
WA	Bellevue, Fry Controls, Inc.	206-282-9270
WA	Seattle, Datacom & Assocs., Inc.	206-285-2525
WI	Appleton, Bu-Nell Eng. Co.	414-733-4242
WI	Waukesha, Bu-Nell Eng. Co.	414-784-0994
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CA	Cypress	714-220-6100
CA	Los Angeles	213-726-5184
CA	Sunnyvale	408-522-5555
CA	VanNuys	818-785-4911
FL	Orlando	305-345-7296
GA	Norcross	404-446-4710
IL	Itasca	312-250-9777
MA	Framingham	617-626-2161
MN	Minneapolis	612-724-2019
NJ	Berkeley Hgt.	201-771-2601
NC	Raleigh	919-790-9004
OR	Portland	503-244-3883
PA	King of Prussia	215-768-2626
TX	Bedford	817-354-9798

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CA	Irvine, Schweber	714-863-0200
CA	Sacramento, Schweber	916-929-9732
CA	San Diego, Schweber	619-450-0454
CT	Danbury, Schweber	203-748-7080
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GA	Norcross, Schweber	404-449-9170
IL	Elk Grove Vl, Schweber	312-364-3750
IA	Cedar Rapids, Schweber	319-373-1417
KS	Kansas City, Schweber	913-492-2922
MD	Baltiomore, Schweber	301-792-4025
MA	Bedsford, Schweber	617-275-5100
MO	St. Louis, Schweber	314-739-0526
NH	Manchester, Schweber	603-625-2250
NJ	Fairfield, Schweber	201-227-7880
NY	Rochester, Schweber	716-424-2222
NY	Westbury, Schweber	516-334-7474
OH	Dayton, Schweber	513-439-1800
OK	Tulsa, Schweber	918-622-8000
PA	Pittsburgh, Schweber	412-782-1600
TX	Houston, Schweber	713-784-3600

ATC POWER SYSTEMS, INC., 472 Amherst Street, Nashua, NH 03063, Tel: 603-882-1366, TELEX: 756779; FSC No.: 61814; Empl.: 35; *Sls. Mgr.:* Thomas J. Mealey

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ATLAS ENGINEERING CORP., 10 Cheney St, Dorchester, MA 02121, Tel: 617-445-7100; FSC No.: 07001; Empl.: 75; *Sls. Mgr.:* Norman Scotch

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FL	Deerfield Bch., Cartwright & Bean	305-429-3400
LA	Covington, Cartwright & Bean	504-892-1780
MA	Sharon, Cummings Assocs.	617-784-5600
MS	Jackson, Cartwright & Bean	601-981-1170
NY	Binghamton, Empire Tech. Sls.	607-772-0651
NY	Skaneateles, Empire Tech. Assocs.	315-685-5703
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
PA	Paoli, Stitzer Assocs.	215-644-5500
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345

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CA	Granada Hills, Acort Inds., Inc.	818-368-4474
CA	San Jose, Bisco Inds.	408-946-8980
IL	Franklin Pk., Bisco Inds.	312-451-1230
IN	Ft. Wayne, Graham Elec. Supp.	219-423-3422
IN	Indianapolis, Graham Elec. Supp.	317-634-8202
IA	Cedar Rapids, Deeco	319-365-7551
MA	Marlboro, Hardware Specialties	617-481-8622
MA	Winchester, Rush Inds.	617-729-5800
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Aerospace Computer	612-884-4725
NJ	Nutley, Essex Electric	201-661-2600
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NY	Bayshore, Merrit Fastener	516-242-1800
NY	Buffalo, Summit Dist.	716-887-2800
NY	Long Island City, Hardware Specialty	212-361-9393
NY	Plainview, Elctrn. Precepts	516-293-7441
NY	Plainview, G & B Fasteners	516-694-0990
NY	Rochester, Summitt Elec.	716-334-8110
TX	Dallas, National Precision	214-357-3921
TX	Houston, The Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
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ATOMIC ENERGY OF CANADA, Radiochemical Company, P.O. Box 13500, Kanata, Ontario, Canada K2K 1X8, Tel: 613-592-2790, TELEX: 053-4162, FAX: 613-592-6937

ATV RESEARCH, INC., 1301 Broadway, Dakota City, NE 68731, Tel: 402-987-3771; *Sls. Mgr.:* Mel Shadbolt

AUBURN MFG., Pease Ave. & Stack St., Middletown, CT 06457, Tel: 203-346-6677; Empl.: 45; *Sls. Mgr.:* Philip L. Balicki

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AUDRE, INC., 10915 Technology Place, San Diego, CA 92127, Tel: 619-451-2260, FAX: 619-451-0267; Empl.: 25; *Sls. Mgr.:* Randall Peterson; *Dist. Mgr.:* Randall Peterson

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AZ	Phoenix, Augat Inc.	602-860-6883
AZ	Scottsdale, Spectrum Mktg.	602-890-9000
CA	Montrose, Signal Entprs.	818-957-0640
CA	San Jose, Augat Inc.	408-249-8801
CA	Solano Bch., Signal Entprs.	619-994-9944
CO	Denver, Augat Inc.	303-757-2100
CO	Denver, Spectrum Mktg.	303-480-9991
FL	Coral Springs, Augat Inc.	305-755-4364
FL	Orlando, Augat Inc.	305-352-2020
GA	Marietta, Augat/Alco	404-256-0452
IL	Downer's Grove, Rockford Controls	312-960-2046
IL	Naperville, Augat Inc.	312-357-9083
IN	Indianapolis, Luebbe Sls. Co.	317-845-7389
IA	Marion, Ensco-Rep, Inc.	319-377-8551
KS	Wichita, Ensco-Rep, Inc.	316-683-1070
MA	Canton, Augat Inc.	617-762-3164
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Edina, Augat Inc.	612-925-0255
MN	St. Paul, Countryman Assocs.	612-645-9151
MS	Jackson, Glen White Assocs.	601-856-5411
MO	Maryland Hgts., Ensco-Rep, Inc.	314-423-3935
NJ	Bedminster, Augat, Inc.	201-781-1775
NY	Clarence Ctr., Leonard D. Allen Inc.	716-835-1955
NY	Selden, Augat, Inc.	516-331-1097
NY	Setauket, Augat, Inc.	516-331-1097
NY	Syracuse, L. D. Allen Inc.	315-437-8387
NC	Charlotte, Quantum Mfg.	704-523-8822
NC	Raleigh, Quantum Mfg.	919-846-5728
OH	Cincinnati, Luebbe Sls. Co.	513-891-5770
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Augat, Inc.	513-256-6118
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OR	Beaverton, Augat, Inc.	503-645-0644
PA	Pittsburgh, Luebbe Sls. Co.	412-364-0490
PA	Trevose, P.S.A., Inc.	215-245-0513
PA	West Chester, Augat Inc.	215-431-0231
TX	Dallas, Augat Inc.	214-788-4211
TX	Houston, Augat Inc.	713-781-9343
UT	Murray, Butterworth Mktg.	801-268-2244
VA	Lynchburg, P.S.A., Inc.	800-233-4242
VA	Oakton, P.S.A. Inc.	800-233-4242
WA	Bellevue, Augat Sls.	206-451-9777
WI	W. Bend, Rockford Controls Co.	800-323-1042
PR	Rio Piedras, D K Mktg.	809-765-5380

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AL	Huntsville, Hall-Mark Elexs.	205-837-8700
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Phoenix, Arrow/Kierulff Elex Grp.	602-437-0750
AZ	Phoenix, Hall-Mark Elexs.	602-437-1200
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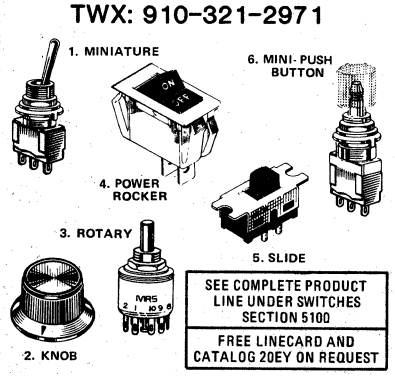

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TX Ft. Worth, Allied Elctrns. 817-336-5401
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TX Houston, Time Elctrns. 713-530-0800
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TX San Antonio, Sherman Elex. 512-224-1004
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Local Sales Offices & Reps

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AL Huntsville, Augat Inc. 205-882-0068

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AZ	Phoenix, Spectrum Mktg.	602-944-0899
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CA	San Diego, Wiley Co.	619-453-9018
CA	San Jose, Augat Sls.	408-249-8801
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CT	Marlborough, Augat Sls.	203-295-8542
FL	Casselberry, Augat Sls.	305-695-9232
FL	Coral Springs, Augat Sls.	305-474-2905
FL	Orlando, Augat Sls.	305-352-2020
GA	Marietta, Augat Inc.	404-256-0452
HI	Honolulu, Hawaii Elctrns.	808-845-8207
IL	Downers Grove, Rockford Controls	312-960-2046
IL	Naperville, Augat Sls.	312-357-9083
IN	Indianapolis, Luebbe Sls.	317-845-7389
IA	Marian, Ensco-Rep, Inc.	319-377-8551
KS	Countryside, Ensco-Rep, Inc.	913-384-0840
KS	Wichita, Ensco-Rep, Inc.	316-683-1070
MD	Silver Spring, NKA Inc.	301-585-6141
MA	Canton, Augat Sls.	617-762-3164
MI	Livonia, Luebbe Sls.	313-477-3131
MN	Edina, Augat Sls.	612-925-0255
MS	Jackson, Glen White Assocs.	601-856-5411
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NH	Manchester, Augat Sls.	603-647-7276
NJ	Bedminster, Augat Sls.	201-781-1775
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200, 800-257-8210
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NY	Setauket, Augat Sls.	516-331-1097
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NC	Charlotte, Quantum Mktg.	704-523-8828
NC	Raleigh, Quantum Mktg.	919-846-5728
NC	Raleigh, Rick Burns Assocs.	919-876-2224
OH	Cincinnati, Luebbe Sls.	513-530-0600
OH	Cleveland, Luebbe Sls.	216-333-0425
OH	Columbus, Luebbe Sls.	614-431-0474
OH	Dayton, Augat Sls.	513-256-6118
OH	Dayton, Luebbe Sls.	513-294-0426
OH	Kettering, NKA, Inc. (Gov't. only)	513-296-0324
OH	Richfield, Geotronix	216-659-6100
OR	Beaverton, Augat Sls.	503-645-0644
PA	Pittsburgh, Luebbe Sls.	412-364-0490
SC	Greer, Rick Burns Assocs.	803-297-8486
TX	Dallas, Augat Sls.	214-788-4211
TX	Houston, Augat Sls.	713-781-9343
UT	Murray, Butterworth Mktg.	801-268-2244
VA	Charlottesville, Trinkle Sls. Inc.	609-795-4200
WA	Bellevue, Augat Sls.	206-451-9777
WI	West Bend, Rockford Controls	800-323-1042
PR	Rio Piedras, DK Mktg.	809-765-5380
Can	Mississauga, Ont., Augat Elctrns. Inc.	416-677-1500

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Local Sales Offices & Reps

AL	Huntsville, Alpha	205-533-0766
AZ	Phoenix, Augat Sls.-AZ	602-224-6104
AZ	Phoenix, Spectrum Mktg.	602-943-9055
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-571-2881
CA	San Jose, Augat Sls.	408-249-8801
CO	Denver, Spectrum Mktg.	303-480-9991
FL	Orlando, Augat Sls.	305-352-2020
GA	Tucker, Alpha	404-491-9430
IL	Carol Stream, Reed Dvcs.	800-682-7333
IL	Downers Grove, Rockford Controls	312-960-2046
IN	Indianapolis, Luebbe Sls. Co.	317-845-7389
IA	Marion, Ensco-Rep., Inc.	319-377-8551
KS	Wichita, Ensco-Rep., Inc.	316-683-1070
MA	Canton, Augat Sls.	617-762-3164
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	St. Paul, Countryman	612-645-9151
MO	Maryland Hts., Ensco-Rep., Inc.	314-423-3935
NY	Selden, Augat Sls.-Metro	516-331-1097
NY	Syracuse, L. D. Allen	315-437-8387
NC	Kernersville, Wallace Elctrn.	919-996-2742
OH	Cincinnati, Luebbe Sls.	513-530-0600
OR	Beaverton, Augat Sls.	503-645-0644
PA	Trevose, P.S.A., Inc.	215-245-0513
SC	Kernersville, Wallace Elec. Sls.	919-996-2742
TN	Murfreesboro, Alpha Mktg.	615-896-6102
TN	Oak Ridge, Alpha Mktg.	615-482-4681
TX	Dallas, Augat Sls.	214-788-4211
TX	Houston, Augat Sls.	713-781-9343
UT	Murray, Butterworth Mktg.	801-268-2244
WA	Bellevue, Augat Sls.	206-451-9777
WI	Westbend, Rockford Controls	800-323-1042

Local Distributors

CA	Anaheim, Control Des.	714-821-1516
CA	Gardena, Calif. Switch & Signal	800-225-7924
CA	Los Angeles, Master Distr.	213-452-1229
CO	Englewood, Indl. Elctrns.	303-694-9444
FL	Altamonte Springs, Control Design	305-788-3220
IL	Arlington Heights, Lo Dan Elctrns.	312-398-5311
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, Newark Elctrns.	312-784-5100
IN	Ft. Wayne, Bell Inds.	219-423-3422
MA	Middleboro, Glynn Elec.	617-947-4262
MA	Peabody, Time Elec.	617-532-6200
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NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, R. Baker Elctrns.	716-586-9164
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OH	Columbus, E/M Equip. Co.	614-236-0888
OH	Columbus, Elctrns. Mktg. Co.	614-299-4167
PA	Malvern, Control Des.	215-296-0150
TX	Dallas, Control Des.	214-358-1441
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WI	West Allis, Marsh Elctrns.	414-475-6000

FAX: 612-560-4099

AULT, INCORPORATED, 1600 Freeway Blvd., Minneapolis, MN 55430, Tel: 612-560-9300, TWX: 910-576-3435; Empl.: 300; *Sls. Mgr.:* John Newhouse ..... **D•1600-1601**

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AL	Huntsville, L & D, Inc.	205-837-1469
CA	Los Angeles, A-F Sls. Eng., Inc.	213-681-5631
CA	Orange County, A-F Sls. Engrg. Inc.	714-641-2903
CA	San Diego, A-F Sls. Engrg. inc.	619-226-8424
CA	Santa Clara, Magna Sls.	408-727-8753
CO	Denver, William J. Purdy	303-790-2211,
CT	Wallingford, Marathon Sls., LTD	617-875-3566
FL	Deerfield Bch., Sls. Engrg. Concepts Inc.	305-426-4601
GA	Atlanta, L & D, Inc.	404-455-3483
IL	Arlington Hgts., MSI	312-956-1000
IA	Des Moines, Beams Co.	515-255-1148
KS	Shawnee Mission, Beams Co.	913-631-0300
MD	Columbia, Delta III Assocs.	301-730-4700
MA	Framingham, Marathon Sls., LTD	617-875-3566
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MN	Minneapolis, Cahill, Schmitz & Cahill	612-646-7217,
MO	St. Louis, Beams Co.	314-434-8448
NJ	Ocean, P. Saftler Assocs.	201-922-3014
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
NC	Greensboro, L & D, Inc.	919-292-3201
OH	Cleveland, Lyons Corp.	216-659-9224
OH	Dayton, E. Lyons Co.	513-278-0714
OR	Portland, Jas. J. Bacher Co.	503-297-8744
PA	Philadelphia, All-Tech Mktg.	717-763-4126,
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
WA	Seattle, Jas. J. Backer Co.	206-285-1300
Can	Toronto, Deskin Sls.	416-475-1412,

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CA	Santa Monica, Distr. Specialists	213-393-9666
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Can	St. Laurent, Que., Tech-Rep Elctrns., Ltd.	514-337-6046

AURIC CORP., 470 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4100, FAX: 201-242-5796; Empl.: 35

AUSTIN ELECTRONICS, The Austin Co., 17-01 Pollitt Drive, Fair Lawn, NJ 07410, Tel: 201-794-0200, TWX: 710-988-2262; Empl.: 100; *Sls. Mgr.:* Frank J. Cerven

FAX: 512-251-9685

AUSTRON, INC., P.O. Box 14766, Austin, TX 78761-4766, Tel: 512-251-2341, TWX: 910-874-1356; FSC No.: 24672; Empl.: 130; *Sls. Mgr.:* R. Ellis ..... **A•1342-1343**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices - SE	205-536-1969
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MN	Minneapolis, Loren Green Assoc.	612-571-6666
NY	Frankfort, Kapital Instr. Sls.	315-894-4245
NY	Huntington, CDB Entprs.	516-692-5200
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OH	Lyndhurst, Ashby Assocs.	216-461-0826
OK	Park Hill, Scientific Dvcs.-S.W.	918-457-4888
OR	Beaverton, Cascade Data Mktg.	503-641-9266
PA	N. Wales, Sci. Devices - Phila.	215-699-7707
TX	Austin, Scientific Dvcs.-S.W.	512-442-6215
TX	Houston, Sci. Devices - Gulfcoast	713-864-1711
TX	Richardson, Sci. Devices - SW	214-231-8106
TX	San Antonio, Scientific Dvcs.-S.W.	512-736-3164
VA	Reston, Austron	703-471-7963
WA	Kirkland, Cascade Data Mktg.	206-747-6190

AUTODESK, 2320 Marinship Way, Sausalito, CA 94965, Tel: 415-332-2344, TELEX: 275946, FAX: 415-331-8093; Empl.: 399; *Sls. Mgr.:* Richard Cuneo, Dir. of Sls.; *Dist. Mgr.:* Rex Johnson

AUTOMATED PRODUCTION CONCEPTS, 63 Hillside Terrace, Wayne, NJ 07470, Tel: 201-831-8300, TELEX: 130120; Empl.: 4

AUTOMATED PROD. EQUIP. CORP., 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1197, TWX: 510-228-2120, FAX: 516-289-4735; FSC No.: 57216; *Sls. Mgr.:* Arthur Ayala

AUTOMATIC COIL CORP., Sub. Designatronics, Inc., 3545 N.W. 71st St., Dept. E, Miami, FL 33147, Tel: 305-696-6660, FAX: 305-696-0626; FSC No.: 03765; Empl.: 245 ..... **A•1194-1197, 1498-1501**

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AL	Huntsville, Hughes Assocs.	205-533-9108
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CA	Mtn. View, Fetty/Schoenduve	415-962-8330
CA	San Diego, Mil-Com Sls.	619-484-3402
CA	Thousand Oaks, Mil-Com Sls.	805-647-8569
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PA McKees Rocks, Rockford Controls of Ohio 412-331-0306
TN Jonesboro, Hughes Assocs. 615-753-2719
VA Fairfax, Schibley Assocs., Inc. 703-591-3008

AUTOMATIC CONNECTOR, INC., 400 Moreland Rd, Commack, NY 11725, Tel: 516-543-5000, TWX: 510-226-3744; FSC No.: 94375; Empl.: 250; *Sls. Mgr.:* William Pitcher

AUTOMATIC SWITCH CO., 50-60 Hanover Road, Florham Park, NJ 07932, Tel: 1-201-966-2000, TELEX: 136422; Empl.: 1,200; *Sls. Mgr.:* Wayne Bouchard

AUTOMATIC TIMING & CONTROLS CO., 201 So. Gulph Rd., King of Prussia, PA 19406, Tel: 215-337-5500, 800-441-8245, TELEX: 84-6437; Empl.: 300; *Sls. Mgr.:* R. L. Swanson

AUTOMATION DISPLAYS INC., 3533 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-9595; Empl.: 19

AUTOMATION PRODS., INC., 3030 Max Roy, Houston, TX 77008, Tel: 713-869-0361, TELEX: 775-959

AUTOMATION UNLIMITED, Icon Corporation, 134 New Boston St., Woburn, MA 01801, Tel: 617-933-7288, FAX: 617-933-2042; *Sls. Mgr.:* Rich Farley; *Dist. Mgr.:* Kevin Bagaline

AUTOROLL MACHINE CORPORATION, 11 River St., Middleton, MA 01949, Tel: 617-777-2160, TELEX: 940250, FAX: 617-777-9453; Empl.: 85

Local Sales Offices & Reps
CA Woodland Hills, Autoroll West 818-340-5098
IL Schaumburg, Autoroll Central 312-894-4474
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NY Glendale, Autoroll East 718-456-5807
WI Green Bay, Autoroll Central 414-494-5166

AUTOSPLICE, INC., 59-12, 37th Ave, Woodside, NY 11377, Tel: 718-429-0500, TELEX: 420902, TWX: 968171; Empl.: 115; *Sls. Mgr.:* O. Nedelkovich

AUTO-SWAGE PRODS., 726 River Rd., Shelton, CT 06484, Tel: 203-929-1401, TELEX: 963-542; Empl.: 170; *Sls. Mgr.:* H. K. Feaster

AUTOTROL CORPORATION, P.O. Box 557, Crystal Lake, IL 60014, Tel: 815-459-3080, TELEX: 72-2417, FAX: 815-459-3227; Empl.: 140; *Sls. Mgr.:* Loris Thacker

AUTRONICS CORP., 314 E. Live Oak, Ste. A, Arcadia, CA 91006, Tel: 818-445-5470, TWX: 910-582-3216, FAX: 818-446-0014; FSC No.: 03972; Empl.: 80; *Sls. Mgr.:* Annabelle Cloud

AVA ELECTRONICS CORPORATION, P.O. Box 184, 4000 Bridge St., Drexel Hill, PA 19026, Tel: 215-284-2500, TELEX: 3711411, FAX: 215-259-8379; Empl.: 100; *Sls. Mgr.:* William McKinley; *Dist. Mgr.:* Michael Ward

AVA INSTRUMENTATION, INC., 8010 Highway 9, Ben Lomond, CA 95005, Tel: 408-336-2281, TELEX: 5101007906 AVA; FSC No.: 61933; Empl.: 7; *Sls. Mgr.:* Allan Hughes

Local Sales Offices & Reps
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MA Chelmsford, Bomara 617-452-2299
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Can Quebec, Techmatron 514-335-7604

AVANTEK, INC., 3175 Bowers Ave, Santa Clara, CA 95054, Tel: 408-727-0700, TELEX: 34-6337, TWX: 310-371-8717; Empl.: 3200

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AVEX ELECTRONICS, 1683 Winchester Rd., P.O. Box 1026, Bensalem, PA 19020, Tel: 215-638-1515, 800-345-1295, FAX: 215-638-9108; FSC No.: 58414; *Sls. Mgr.:* Mike Battery Batley; *Dist. Mgr.:* Mike Batley .... **D•1438-1440**

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IA Marion, Ensco-Rep 319-377-8550
KS Wichita, Ensco-Rep 316-683-1070
MO Maryland Hgts., Ensco Rep Inc. 314-423-3935
NE Countryside, Ensco Rep 913-384-0840

AVIBANK MANUFACTURING, INC., 210 S. Victory Blvd., Burbank, CA 91503, Tel: 818-843-4330, TWX: 910-498-2215; FSC No.: 84256; Empl.: 465; *Sls. Mgr.:* D. Ladin

FAX: 201-382-4996

AVIONIC INSTRUMENTS, 1414 Randolph Ave., Avenel, NJ 07001, Tel: 201-388-3500, TELEX: 844413; Empl.: 160; *Sls. Mgr.:* Bryce Wiedeman; *Dist. Mgr.:* George Kostick ..... **D•1603-1605, 2074-2080**

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SC Mt. Pleasant, Bruster Lawing & Assocs. 803-884-5748
VA Midlothian, Bruster Lawing & Assocs. 804-794-3879

FAX: 803-626-2442

AVX CORPORATION, Box 867, Myrtle Bch., SC 29577, Tel: 803-448-9411, TWX: 810-661-2252; FSC No.: 9K916; *Sls. Mgr.:* Allan Cole; *Dist. Mgr.:* Robert Burns ..... **A•1023-1026; B•1009**

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AZ Phoenix, Hallmark Elctrns. 602-437-1200
AZ Phoenix, Kierulff Elctrns. 602-437-0750
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Phoenix, Wyle Elctrns. 602-249-2232
AZ Tempe, Arrow Elctrns. 602-968-4800
CA Calabasas, Wyle Labs./EMG 818-880-9001
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IL Schaumburg, Marshall Elctrns. 312-490-0155
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MI Grand Rapids, RM Elctrns. 616-531-9300
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MN Plymouth, Marshall Elctrns. 612-559-2211
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TX Dallas, Hallmark Elctrns. 214-343-5000
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WA Bellevue, Almac Elctrns. 206-643-9992
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WA Kent, Kierulff Elctrns. 206-575-4420
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WA Redmond, Integrated Elctrns. 206-455-2727
WI Brookfield, Arrow Elctrns. 414-792-0150
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI New Berlin, NEP Elctrns. 414-785-9100
WI Waukesha, Marshall Inds. 414-797-8400
PR Hato Rey, Arrow/Kierulff 809-764-4384
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Can Mississauga, Ont., Arrow/Kierulff Elctrns. 416-672-7769
Can Montreal, Que., Arrow/Kierulff Elctrns. 514-735-5511
Can Montreal, Que., Arrow, Ltd. 514-735-5511
Can Nepean, Ont., Arrow/Kierulff Elctrns. 613-226-6903
Can Ottowa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Quebec, Que., Arrow/Kierulff Elctrns. 418-687-2431
Can Willowdale, Ont., Milgray Elctrns. 416-756-4481

AXEL ELCTRNS., General Signal Corp., 134-20 Jamaica Ave., Jamaica, NY 11418, Tel: 718-291-3900, TWX: 710-582-2618; FSC No.: 13058; Empl.: 250; *Sls. Mgr.:* J. Alaimo, VP Sls.

NORMAN N. AXELROD ASSOCS., Electro-Optical, Laser & Machine Vision Sys., 445 East 86th Street, New York, NY 10028, Tel: 212-228-0900

AXIAL MAGNETICS, Tencal Inc., 450 W. Los Angeles Ave., Simi Valley, CA 93065, Tel: 818-998-4850, TELEX: 551891; *Sls. Mgr.:* K. G. Kroll **B•1195**

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AYDIN CONTROLS, 414 Commerce Dr., Ft. Washington, PA 19034, Tel: 215-542-7800, TELEX: 6851057, TWX: 510-661-0518; Empl.: 533; *Sls. Mgr.:* Joseph J. Taylor

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AYDIN VECTOR DIV., Aydin Corp., Box 328, Newtown, PA 18940-0328, Tel: 215-968-4271, TWX: 510-667-2320, FAX: 215-968-3214; FSC No.: 13923; Empl.: 600

AZIMUTH ELECTRONICS, INC., 2605 So. El Camino Real, San Clemente, CA 92672, Tel: 714-492-6481, FAX: 714-492-0744; *Sls. Mgr.:* Kenneth C. Johnsen

BABCOCK, INC., 1717 West Collins Ave., Orange, CA 92667, Tel: 714-633-3700, TWX: 910-595-1517, FAX: 714-538-9740; FSC No.: 56623; Empl.: 270; *Sls. Mgr.:* Albin Gudis; *Dist. Mgr.:* Albin Gudis

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FAX: 714-490-1368

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CO Denver, Lindberg Co. 303-758-9033
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IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
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MD Columbia, Robert Elctrn. Sls. 301-995-1900
MN Eden Prairie, Com-Tek Sls. 612-941-7067/7181
MO Hazelwood, Spectrum Sls. 314-731-5151
CT Fairfield, Babcock Display Prods. 203-335-3433
NY Elmont, Crane & Egert Corp. 516-872-0800
NY Rochester, Apex Assocs. 716-254-6050
NC Cary, ESI 919-467-8486
NC Charlotte, ESI 704-522-8428
OH Centerville, SAI Mktg. Corp. 513-435-3181
OH Columbus, SAI Mktg. Corp. 614-876-8650
OH Shaker Heights, SAI Mktg. Corp. 216-751-3633
PA West Conshohocken, Eastern Comps. Sls. Corp. 800-223-3850,215-825-8610
TX Dallas, Pro-Comp Sls. Corp. 214-276-1948
TX Hurst, Pro-Comp Sls. Corp. 817-589-0336
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Kirkland, N.W. Comps. Sls. 206-828-4838
WI Milwaukee, Carlson Elctrn. Sls. Assocs. 414-476-2790
Can Anjou, Que., Bestec Elctrns. Ltd. 514-643-1702
Can Rexdale, Ont., Bestec Elctrns. Ltd. 416-674-1330

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Can Montreal, Que., Ferro Technique, Ltd. 514-341-3450

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BALLANTINE LABORATORIES, INC., P. O. Box 97, Boonton, NJ 07005, Tel: 201-335-0900, TWX: 710-987-8380; FSC No.: 50423; Empl.: 95; *Sls. Mgr.:* Robert Kerzman; *Dist. Mgr.:* Robert Kerzman ..... **D•1212**

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CO Commerce City, MC2 Consultants & Controls 303-286-1414
CT Plantsville, Scheinfein Assocs., Inc. 203-621-3492
FL Orlando, Micro Spec, Inc. 305-898-3504
GA Lilburn, Micro Spec, Inc. 404-921-3840
IL Schaumburg, Kenneth W. Meyers Co. 312-882-4808
IN Indianapolis, Kenneth W. Meyers Co. 317-783-1030
MA Reading, Scheinfein Assocs. 617-944-2304
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Minneapolis, Kenneth W. Meyers 612-920-7080
MO St. Louis, JNM 314-991-1399
NJ Elmwood Park, L & M Assocs. 201-797-0441
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
NY Canandaigua, Mamula Sls. 716-394-5560
NY New York, L & M Assocs. 212-243-6155
NC Rock Hill, Microspec, Inc. 803-366-3015
OH Dayton, Mann & Assocs. 513-434-2557
OH Dayton, WKM Assoc. 513-434-7500
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OR Portland, Westcon 503-283-0132
PA Andalusia, L & M Assocs. 215-245-6658
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TN Nashville, Micro Spec. Inc. 615-383-4064
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TX Richardson, Lear Assocs. 214-231-5388
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WA Federal Way, Weston, Inc. 206-859-8812
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Can Laval, Que., Techmatron 514-689-5889

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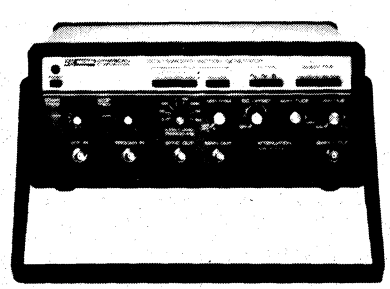

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GA Norcross, Hughes Assocs., Inc. 404-662-1587
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NY Huntington, CDB Entprs. 516-692-5200
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TX Richardson, Sci. Devices 214-231-8106
TX Spring, Sci. Devices 713-376-8666
VA Fairfax, Sci-Reps.-South 703-385-0600

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BALL ELECTRONIC, Systems Div., P. O. Box 589, Broomfield, CO 80020, Tel: 303-460-5260, TELEX: 244826; Empl.: 500; *Sls. Mgr.:* Bud Urling

BALLY ELECTRONICS, Bally Mfg., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-7223, TELEX: 190282; Empl.: 300; *Sls. Mgr.:* Lam McGannon

BALSTON, 703 Massachusetts Ave., Lexington, MA 02173, Tel: 617-861-7240, TELEX: 92-3481; Empl.: 50; *Sls. Mgr.:* J. Alpert

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NY Rochester, B & B Motor & Control Corp. 716-424-7040
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OH Cincinnati, B & B Motor & Control Corp. 513-381-1885
PA Allentown, B & B Motor & Control Corp. 215-439-8353
SC Greenville, B & B Motor & Control Corp. 803-268-5702
TX Dallas, B & B Motor & Control Corp. .. 214-641-0857
TX Houston, B & B Motor & Control Corp. 713-820-7931

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CA Los Angeles, B & B Motor & Control Corp. 213-222-7233,
CT Berlin, B & B Automation Sys. 203-828-8766,

B & K PRECISION, Maxtec International Corp., 6470 W. Cortland, Chicago, IL 60635, Tel: 312-889-1448, TELEX: 253475; FSC No.: 08098, 18110, 48560, 30678; Empl.: 250; *Sls. Mgr.:* Dennis Hoy ..... **D•1213-1217, 1410-1412, 1607**

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MD Joppa, Electra-Tech 301-877-0344
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MI Southfield, Robert Milsk Co., Inc. 313-354-3310
MN Minneapolis, HMR, Inc. 612-888-2122
MO St. Louis, Lowell-Kangas Assocs. 314-821-4050
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Bellmore, Selectra Sls. 516-221-7865
NY East Greenbush, Warren Kaufman & Assocs. 518-477-9864
NY Rochester, Warren Kaufman & Assocs. 716-266-2728
NC Charlotte, Maitland K. Smith, Inc. 704-372-2681
OH Cleveland, Marlow Assocs. 216-991-6500
OH Dayton, Marlow Assocs. 513-274-9666
OR Portland, Westmark Elctrns 503-641-8780
PA Pittsburgh, Marlow Assocs. 412-343-5050
TX Dallas, Erickson Sls. 214-739-5833
TX Houston, Erickson Sls., Inc. 713-266-1604
TX Round Rock, Erickson Sls, Inc. 512-244-3068
VA Dumfries, Electra-Tech 703-670-6962
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WI Waukesha, Brainard-Wilson Mktg. 414-797-7940
EXP NY, Plainview, Empire Exporters 516-293-5582
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BANNER ENGINEERING CORP., 9714 - 10th Ave. N., Minneapolis, MN 55441, Tel: 612-544-3164, FAX: 612-544-3573; *Sls. Mgr.:* Floyd Schneider

BARBER-COLMAN CO., Indl. Instrs. Div., P.O. Box 2940, 1354 Clifford Ave., Loves Park, IL 61132, Tel: 815-877-0241, FAX: 815-877-0299; Empl.: 5000; *Sls. Mgr.:* John Parry

BARBER COLMAN CO. (A SIEBE CO.), Motor Division, P.O. Box 2940, Loves Pk., IL 61132-2940, Tel: 815-968-0660, TELEX: 4330367, FAX: 815-962-0070; Empl.: 300; *Sls. Mgr.:* B. B. Stout ..... **B•1196**

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BASCOM-TURNER INSTRUMENTS, 111 Downey St., Norwood, MA 02062, Tel: 617-769-9660, TELEX: 92-2413; Empl.: 35; *Sls. Mgr.:* D. Weise

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BASIC ELECTRONICS, INC., 11762 Western Ave. "Q", Stanton, CA 90680, Tel: 714-530-2400; Empl.: 30; *Sls. Mgr.:* Tom Jones; *Dist. Mgr.:* Tom Jones

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BASIC SYSTEMS, See J. L. Moon & Co.

BASLER ELEC., Rte. 143, Highland, IL 62249, Tel: 618-654-2341, TWX: 510-100-3841, FAX: 618-654-2351; Empl.: 1299

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TX Irving, Space Elctrns. 214-251-3636,

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FAX: 203-367-9957

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IN Indianapolis, Hoster & Sieloff Assocs. 317-842-3700
MI Union Lake, Fox Inds. 313-363-7183
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BEAU PRODUCTS DIV., Vernitron Corp., Box 10, Laconia, NH 03247, Tel: 603-524-5101, FAX: 603-524-1627; FSC No.: 13150; Empl.: 230; *Dist. Mgr.:* Larry Murphy ..... **C•1286-1289**

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CA Los Angeles, The Knight Co. 213-670-2833
CO Denver, W.J. Purdy Co. 303-753-6800
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MA Needham, R. Perron & Co. 617-449-6162
MN Minneapolis, Hei-Lite Sls. 612-861-6051
MO St. Louis, KKB & Co. 314-647-2400
NH Merrimack, R. Perron & Co. 603-424-4394
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ West Caldwell, Grimm, Siegel Assoc. 201-575-9300
NM Albuquerque, C.T. Carlberg & Assoc. 505-883-3883
NY Buffalo, NRM Mktg. Inc. 716-634-4300
NC Raleigh, DHR Mktg., Inc. 919-781-1961
OH Beechwood, ESI 216-831-9555
OR Beaverton, Wm. J. Purdy Co. 503-641-9373
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, Erickson Sls. 214-739-5833
WA Redmond, Wm. J. Purdy Co. 206-8982-3144

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AL Huntsville, Century Fasteners 205-883-5844
AZ Tempe, Control Design Supp. 602-829-7481
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Carlton Bates 501-562-9100
CA Alhambra, Harper SID 818-289-0255
CA Anaheim, Control Design Supp. 714-821-1516
CA Fremont, Terminal Sls. 415-656-7722
CA San Carlos, Control Design Supp. 415-592-4808
CA Santa Clara, Pyramid 408-727-9810
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Abacus 408-732-2000
CA Sunnyvale, Sierra West 408-747-1188
CA Van Nuys, Pacific Switch 818-873-4802
CO Denver, Intergrated Elex 303-292-5537
CO Englewood, Ragon Elctrns. 303-762-0670
CT Hartford, Atlantic Switch 203-527-7705
CT Wallingford, Mid State Elex 203-265-9900
CT Wallingford, Sager Elex 203-265-4600
FL Altamonte Springs, Control Design Supp. 305-788-3220
FL Lakeland, Switch Controls 813-644-7564
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FL Tampa, Sunex Elex 813-885-4074
GA Doraville, Specialty Distr. 404-448-4004
GA Stone Mtn., Control Design Supp. 404-979-3500
IL Arlington Hgts., Ludan Elctrns. 312-398-5311
IL Bensonville, Voyager 312-860-1300
IL Carol Stream, Lectro Comps. 312-543-1680
IL Chicago, Newark Elctrns. 312-638-4411
IL Peoria, Klaus Radio 309-691-4840
IN Ft. Wayne, Graham Elec. 219-423-3422
IN Indianapolis, Control Design Supp. 317-788-4559
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Marion, Control Design Supp. 319-373-2923
KS Wichita, RSC 316-267-5213
KY Louisville, P I Burks 502-589-3960
LA Baton Rouge, Indl. Elex 504-357-4244
LA Baton Rouge, Ralph's 504-344-3761
ME W. Buxton, Nelson & Wright 207-883-4388
MD Gaithersburg, M S Elctrns. 301-340-6400
MA Hingham, Sager Elctrns. 617-749-6700
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Newton Upper Falls, In-Stock Prods. 617-964-6200
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Grand Rapids, S-F Elec. Supp. Inc. 616-459-0216
MI St. Clair Shores, SPEMCO 313-771-2700
MN Minneapolis, Control Design Supp. 612-721-1628
MO Kansas City, Elctrn. Supp. 816-931-0250
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MO St. Louis, Control Design Supp. 314-426-3150
MO St. Louis, Van Sickle 314-621-5000
NV Reno, Walker Distrbn. 702-323-2766
NH Hudson, C & H Elex. 603-882-1133
NJ Camden, General Radio 609-964-8560
NJ Hanover, State Elctrns. 201-887-2550
NJ Oakland, Relay Specialty 201-337-1000
NM Albuquerque, Elctrn. Parts 505-243-6161
NM Albuquerque, Walker Elctrns. 505-883-2992
NY Albany, E. E. Taylor 518-438-7813
NY Bohemia, Key Comps. 516-567-7500
NY Buffalo, Summit 716-884-3450
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Mt. Vernon, QAR 914-699-2224
NY Rochester, Simcona 716-328-3230
NC Pineville, Control Design Supp. 704-588-4410
NC Raleigh, Southeastern Elex 919-828-2311
OH Akron, Akron Elctrn. 216-762-8818
OH Cleveland, Roberts Elec. 216-238-1711
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OK Tulsa, Carlton Bates 918-850-1626
OK Tulsa, Radio Inc. 918-587-9123
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PA Malvern, Control Design Supp. 215-296-0150
PA McKean, Advacom 814-476-7774
PA McKeesport, Barno Radio 412-751-5966
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PA Philadelphia, Shap 215-969-3300
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SC Greenville, Hamond 803-233-4121
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TN Knoxville, Bondurant Bros. 615-573-9151
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TX Dallas, Control Design Supp. 214-358-1441
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TX San Antonio, Sherman Elec. 512-224-1004
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UT Salt Lake City, Standard 801-486-3371
VA Charlottesville, VEC 804-296-4184
WA Bellevue, Intergrated Elex 206-455-2727
WA Seattle, Radar 206-282-2511
WV Huntington, State Elec. Supp. 304-523-7491
WI Berlin, Control Design Supp. 414-784-1015

BEAU TECH, 98 Elm Street, Portland, ME 04101, Tel: 207-775-6139, TELEX: 950-027 Attn Beau; Empl.: 7; *Sls. Mgr.:* Diane Sanborn; *Dist. Mgr.:* Barbara Pike

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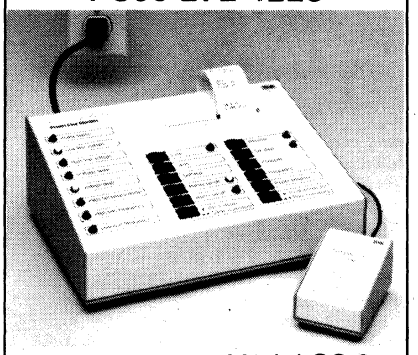

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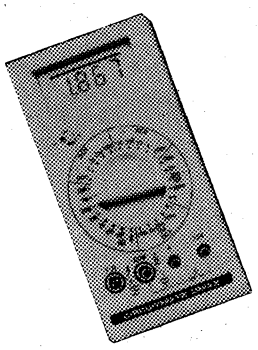

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MD	Columbia, Robert Elctm. Sls.	301-995-1900
MA	Taunton, Focus/Forsberg Sls., Inc.	617-824-3840
MI	Fenton, SAI Mktg. Corp.	313-750-1922
MN	Minneapolis, Comstrand, Inc.	612-788-9234
MO	St. Louis, Electri-Rep	314-993-4421
NJ	Fairfield, Tech. Applications & Mktg., Inc.	201-575-4130
NM	Albuquerque, Reptronix, Ltd.	505-292-1718
NY	E. Syracuse, Ossmann Comp. Sls. Corp.	315-437-7052
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OH	Dayton, SAI Mktg. Corp.	513-435-3181
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OR	Beaverton, Micro Sls., Inc.	503-645-2841
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TX	Austin, Norcom, Inc.	512-451-2757
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TX	Houston, Norcom, Inc.	713-778-0392
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WA	Bellevue, Micro Sls.	206-451-0568
WI	Milwaukee, Carlson Elctm. Sls. Co.	414-476-2790
Can	Downsview, Ont., Designtronics	416-747-1171
Can	Pointe Claire, Que., Designtronics	514-695-3124
Can	W. Vancouver, B. C., Blakewood Elctm. Sys., Inc.	604-261-8099

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Local Sales Offices & Reps

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CA	San Diego, Michael Latham	619-495-3348
IL	Schaumburg, Tom Abrahamson	312-397-9390
NJ	Bridgeport, Stewart Hopkins	609-467-4220

BECKMAN INSTRS., HELIPOT DIV., See Beckman Instrs., Electro-Prods. Grp.

BEEDE ELECTRICAL INSTRUMENT CO., INC., S. Main St., Penacook, NH 03303, Tel: 603-753-6362, TWX: 710-364-6977, FAX: 603-753-6201; FSC No.: 06555; Empl.: 520; *Sls. Mgr.:* Dan Russell; *Dist. Mgr.:* Gail Lyman Gould ..... **D•1357-1359**

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CA	Costa Mesa, F L W, Inc.	714-751-7512
FL	Apopka, Floritronics	305-886-4818
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MD	Mt. Airy, Strayton Assocs., Inc.	301-831-7007
MA	Billerica, Eastronix, Inc.	617-670-2400
MI	Madison Hgts., Michigan Romax Sls.	313-979-2450
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WI	Lake Mills, Saffro & Assocs.	414-648-2605
Can	Brampton, Ont., Mod-Tronics, Ltd.	416-457-6322

Local Distributors

CA	Santa Ana, Meter Craft, Inc.	714-973-8378
IL	Chicago, ALCA, Inc.	312-254-6293
MD	Sparks, E.I.L. Instrs., Inc.	301-771-4800
MI	Ferndale, Ram Meter, Inc.	313-398-6767
NJ	Pompton Lakes, REE Instr. Co.	201-839-2876

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BEI

FAX: 619-931-1212

BEI MOTION SYSTEMS CO., Corporate Off., 2111 Palomar Airport Rd., Ste. 250, Carlsbad, CA 92009, Tel: 619-931-1500, TWX: 910-380-5402; Empl.: 11 ..... **B•1880**

Local Sales Offices & Reps

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CA	Santa Ana, BEI Motion Sys. Co.	714-973-8510
CO	Westminster, BEI Motion Sys. Co.	303-426-1566
FL	Clearwater, BEI Motion Sys. Co.	813-791-6043
IL	Rockford, BEI Motion Sys. Co.	815-968-9528
MA	Wakefield, BEI Motion Sys. Co.	617-245-3851
MI	Plymouth, BEI Motion Sys. Co.	313-451-0359
NJ	Parsippany, BEI Motion Sys. Co.	201-984-5600
OH	Cincinnati, BEI Motion Sys. Co.	513-232-4545
OR	Beaverton, Thorson Co. NW	503-644-5900
PA	Exton, BEI Motion Sys. Co.	215-363-5444
TX	Hurst, BEI Motion Sys. Co.	817-284-4313
WA	Bellevue, Thorson Co. Northwest	206-455-9180
Can	Quebec, Willer Engrg., Ltd.	514-333-8555
Can	Willowdale, Willer Engrg., Ltd.	416-499-4421

BEI MOTION SYSTEMS CO., Computer Products Div., 1755 B La Costa Meadows Dr., San Marcos, CA 92069, Tel: 619-471-2600, TWX: 910-333-4534, FAX: 619-471-2675; *Sls. Mgr.:* Hank Robinson ..... **B•1880**

BEI MOTION SYSTEMS CO., Digital Products Div., P.O. Box 3838, Little Rock, AR 72203, Tel: 501-851-4000, TWX: 910-722-7384, FAX: 501-851-5476; Empl.: 103; *Sls. Mgr.:* H. O. Tyler ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Drive Components Engineering Center, 160 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5696, TWX: 910-322-1168

BEI MOTION SYSTEMS CO., Industrial Encoder Div., 7230 Hollister Ave., Goleta, CA 93117, Tel: 805-968-0782, TELEX: 888069, FAX: 805-968-3154; *Sls. Mgr.:* Glenn Avolio ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off., Carlsbad, CA for sales office information.

BEI MOTION SYSTEMS COMPANY, Kimco Division, 150 Vallecitos de Oro, San Marcos, CA 92069, Tel: 619-744-5671, TWX: 910-322-1168, FAX: 619-744-8815; Empl.: 43; *Sls. Mgr.:* George Beauchemin ..... **B•1880**

BEI MOTION SYSTEMS CO., Position Controls Div., 2280 Faraday Avenue, Carlsbad, CA 92008, Tel: 619-931-0200, TWX: 910-334-4903, FAX: 619-931-0772; *Sls. Mgr.:* John Buchanan ..... **B•1880**

Refer to BEI Motion Sys. Co., Corporate Off.,Carlsbad, CA for sales office information.

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FAX: 317-983-5294

BELDEN WIRE AND CABLE, Cooper Industries, P.O. Box 1980, Richmond, IN 47375, Tel: 317-983-5200, 800-BELDEN-1, TWX: 810-345-1393; Empl.: 2180; *Sls. Mgr.:* Ed Stull; *Dist. Mgr.:* Bill Donahue ..... **C•1762, 1772-1813**

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CA	Irvine, Belden W. & C.	714-474-1200
GA	Atlanta, Belden W. & C.	404-934-6767
IL	Geneva, Belden W. & C.	312-232-8900
IN	Richmond, Belden W. & C.	317-983-5200
MA	Shrewsbury, Belden W. & C.	617-845-5000
TX	Dallas, Belden W. & C.	214-788-4300

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FAX: 201-432-9542

BEL FUSE, 198 Van Vorst St., Jersey City, NJ 07302, Tel: 201-432-0463; Empl.: 225; *Sls. Mgr.:* A. Sutta; *Dist. Mgr.:* S. Rader ..... **A•1503-1532, 2194-2195; B•1302-1305**

Local Sales Offices & Reps

CA	Irvine, Groh Assoc.	714-837-9871

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AL	Huntsville, Beacon Elect.	205-881-5031
CA	Redwood City, James S. Heaton Co.	415-367-9000
FL	Maitland, Beacon Elect.	305-647-3498
FL	Boca Raton, Beacon Elect.	305-392-3500
IL	Chicago, MGA	312-775-1151
FL	Clearwater, Beacon Elect.	813-769-2378
FL	Melbourne, Beacon Elect.	305-724-8010
GA	Atlanta, Beacon Elect.	404-256-9640
ID	Boise, N.R. Schultz Co.	208-377-8686
MN	St. Paul, Northport Engrg.	612-457-8000
IN	Indianapolis, Insul. Reps., Inc.	317-842-5203
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Brighton, A.P. Associates	313-229-6550
NH	Amherst, David A. Cowley Assoc.	603-673-7050
NY	Fayetteville, TR-Tech Elect.	315-446-2881
NC	Raleigh, Beacon Elect.	919-787-0330
OR	Beaverton, N.R. Schultz Co.	503-643-1644
PA	Hatboro, J.S. Wurts Co.	215-674-3562
TN	Knoxville, Insul-Reps., Inc.	615-691-7586
VA	Sterling, Beacon North, Inc.	703-478-2480
WA	Bellevue, J.R. Schultz Co.	206-454-0300
PR	Hato Rey, Max Anderson Co., Inc.	809-751-2026
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Delay Lines

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CA	Irvine, Groh Assoc.	714-837-9871
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Clearwater, Semtronics Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assoc.	305-731-2484
FL	Houston, Oeler & Menelaides	713-682-1083
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NJ	E. Brunswick, Winch Sls. Assoc	201-828-4615
MO	St. Louis, Lowell-Kangas Assoc.	314-821-4050
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TX	Austin, Oeler & Menelaides	512-453-0275
TX	Dallas, Oeler & Menelaides	214-361-8876
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Sterling, Beacon North, Inc.	703-478-2480
TN	Knoxville, Insul. Reps.	615-691-7586
PR	Hato Rey, M. Anderson Co., Inc.	809-751-2020
Can	Scarboro, Ont., Cantronics, Ltd.	416-297-8668

Local Distributors

FL	Boca Raton, D & R	305-395-2341
NJ	N. Bergen, Cefco	201-869-7777
AL	Huntsville, CDI	205-883-7501
AZ	Phoenix, Lion Elctrns.	602-869-9611
CA	Anaheim, Deco	714-630-8252
CA	Chatsworth, West Valley Inds.	818-700-0700
CA	City of Industry, Ital Elctrns.	818-968-8515
CA	El Segundo, Force Elctrns.	213-772-1324
CA	Fullerton, Pyramid	213-691-0561
CA	Hayward, Kea Elctrns.	415-887-2900
CA	San Diego, Deco	619-693-1695
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Force Elctrns.	408-943-1324
CA	Santa Clara, Pyramid	408-727-9810
CT	Norwalk, Cobra Comps.	203-847-5442
FL	Ft. Lauderdale, CDI	305-971-4950
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MD	St. Charles, Finnigan Elctrns.	314-946-6201
MA	Canton, EPC Labs.	617-821-2111
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PA	Cornwall Hgts., Reliance Merchandising	215-638-8200
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CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
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IL	Palatine, Golbec Milota	312-705-0602
MA	Needham Hgts., Shain Assoc.	617-633-6651
MO	Grandview, Harris-Hanson Co.	816-763-6200
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Port Chester, Channel	914-939-8700
TX	Carrollton, Seaton Corp.	214-380-0414

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AZ	Phoenix, Jensen Tools & Alloys	602-968-6231
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Pasadena, Pasadena Elctrns.	818-796-7481
CA	San Marcos, Mitchell Instrs.	619-744-2690
CA	Santa Ana, W.H.T.	714-754-6822
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rocks Bch., P & R Instr. Supp.	813-596-8841
GA	Atlanta, P.R. Instr. Supp.	404-391-9117
IL	Palatine, Golbeck Milota Assocs.	312-705-0602
MA	Hingham, Shain Assocs.	617-740-2334
MO	St. Louis, Harris Hanson Co.	314-432-3611
NY	Rochester, Transcat	716-458-4801
OH	Dayton, Electro Entprs.	513-426-5551
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TX	Houston, American Analog	713-524-0528

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BELL INDUSTRIES

FAX: 213-631-4217

BELL INDS., J. W. Miller Div., 19070 Reyes Ave., P.O. Box 5825, Rancho Dominguez, CA 90224-5825, Tel: 213-537-5200, TWX: 910-346-6740; FSC No.: 76493; Empl.: 55 ..... **A•1199-1205**

Local Sales Offices & Reps

AZ	Mesa, Bidwell Sls. Assocs. of AZ	602-265-2029
CA	Campbell, Shur Sls.	408-374-5577
CA	Gardena, Bidwell Sls. Assocs.	213-770-0300
CO	Denver, West, Inc.	303-477-8180
FL	Clearwater, HHP Assocs., Inc.	813-797-4447
FL	Pompano Bch., HHP Assocs., Inc.	305-971-5750
FL	Winter Pk., HHP Assocs., Inc.	305-740-0320
GA	Atlanta, Millar Elctrns., Inc.	404-634-3350
IN	Indianapolis, Elctrn. Reps.	317-894-1414
IN	Mishawaka, Elctrn. Reps., Inc.	219-259-9365
KS	Overland Pk., Thomas L. Dowell & Assocs., Inc.	913-648-7373
MA	Burlington, Conti-Younger Assocs., Inc.	617-273-1582
MD	Woodbine, DJC Elctrn. Sls.	301-795-7020
MI	E. Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Eden Prairie, Electro Mark, Inc.	612-944-5850
MO	St. Louis, Thomas L. Dowell & Assocs., Inc.	314-849-4234
NJ	Englewood, Epstein & Siebel Assoc.	201-569-7600
NC	Raleigh, Millar Elctrns., Inc.	919-828-8840
OH	St. Mary's, Thomas Shelby & Co., Inc.	419-394-3377
OR	Beaverton, Earl & Brown Co., Inc.	503-643-5500
TX	Ft. Worth, Chet Wells & Co.	817-284-0261
WA	Redmond, Earl & Brown Co., Inc.	206-885-5064
WI	Waukesha, Janus, Inc.	414-542-7575
EXP	NY, New York, Robum Agencies	212-989-5939
Can	Montreal, Que., Bestec Elctrns., Ltd.	514-643-1702
Can	Rexdale, Ont., Bestec Elctrns., Ltd.	416-674-1330

Local Distributors

AZ	Phoenix, Arizona Comps. Co., Inc.	602-269-5655
AZ	Tempe, Bell Industries/EDD	602-966-7800
AZ	Tempe, Circuit Specialists	602-966-0764
CA	Buena Park, Cypress/RPS Elctrns.	714-521-5230
CA	Garden Grove, Bell Industries/EDD	714-220-0681
CA	Gardena, Bell Industries/EDD	213-515-1800
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Roseville, Bell Inds./EDD	916-969-3100
CA	San Diego, Bell Industries/EDD	619-268-1277
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CA	Sunnyvale, Bell Industries/EDD	408-734-8570
CA	Thousand Oaks, Bell Inds./Ventura/EDD	805-499-6821
CO	Arvada, Denver Beta Wintronic	303-431-7161
CO	Denver, Bell Industries/EDD	303-424-1985
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
CT	Danbury, Pilgrim Elctrns.	203-792-7274
CT	Wallingford, Greene-Shaw Co.	203-265-3333
CT	Wallingford, Sager Elctrcl. Supp.	203-265-4600
FL	Deerfield Bch., Bell Inds./EDD	305-421-1997
FL	Largo, Bell Inds./EDD	813-541-4434
FL	West Palm Beach, Nurmi Elctrns.	305-686-8553
GA	Norcross, Bell Inds./EDD	404-662-0923
IL	Chicago, Bell Industries/EDD	312-640-1910
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, Ohm/Elctrns, Inc.	312-359-5500
IL	Urbana, Bell Inds./EDD	217-328-1077
IN	Fort Wayne, Bell Inds./EDD	219-423-3422
IN	Indianapolis, Bell Inds./EDD	317-875-8200
IN	Indianapolis, Meunier Elctrn. Supp.	317-635-3511
IA	Cedar Rapids, Bell Industries/EDD	319-395-0730
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Hingham, Sager Elctrcl. Supp.	617-749-6700
MA	Newton, Greene-Shaw Co.	617-969-8900
MA	Winchester, Bell Inds./EDD	617-729-5800
MI	Ann Arbor, Bell Inds./EDD	313-971-9093
MN	Minneapolis, Ind. Comps., Inc.	612-831-2666
MN	Thief River Falls, Digi-Key Corp.	218-681-6674
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., Chelsea Inds., Inc.	314-997-7709
NH	Hudson, Bell Inds./EDD	603-882-1133
NJ	Camden, G.R.S. Elctrns.	609-964-8560
NJ	East Hanover, State Elctrn. Parts	201-887-2550
NM	Albuquerque, Bell Industries/EDD	505-292-2700
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Elctrns.	716-887-2800
NY	Farmingdale, Bell Inds./EDD	516-752-9303
NY	Melville, Arrow Elctrns./EDD	516-694-6800
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Columbus, Hughes-Peters, Inc.	614-294-5351
OH	Dayton, Bell Inds./EDD	513-435-8660
OH	Dayton, Bell Inds./EDD-Military	513-434-8231
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Bell Industries/EDD	503-635-6500
PA	Allentown, P. A. Peters, Inc.	215-434-5237
PA	Braddock, Leff Elctrns.	412-351-5000
PA	Drexel Hill, Kass Elctrns.	215-528-6120
PA	Philadelphia, PEI Genesis	215-673-0400
TN	Hixson, Techni-Tronics, Inc.	615-842-0514
TN	Nashville, Bell Inds./EDD	615-367-4400
TX	Dallas, Wholesale Elctrns./Ind. Div.	214-824-3001
TX	Houston, Lenert Co.	713-225-1465
TX	Richardson, Bell Inds./EDD	214-690-0466
UT	Salt Lake City, Bell Industries/EDD	801-972-6969
VA	Charlottesville, Virginia Elctrn. Comps. Inc.	804-296-4184
WA	Bellevue, Bell Industries/EDD	206-747-1515
WI	Milwaukee, Bell Industries/EDD	414-547-8879
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Huntsville, Bell Inds./EDD	205-837-1074
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	Willowdale, Ont., Electro Sonic, Inc.	416-494-1666

BELLOFRAM CORPORATION, Pulpit Rock Rd., Pelham, NH 03076, Tel: 603-635-2103, 800-343-0039, TELEX: 94-9457; Empl.: 300; *Sls. Mgr.:* Donald Rudolph; *Dist. Mgr.:* Donald Rudolph

BELTING INDUSTRIES CO., INC., 20 Boright Ave., Kenilworth, NJ 07033, Tel: 201-272-8591, TELEX: 229854; Empl.: 125

BEMCO, 9908 San Fernando Rd., Pacoima, CA 91331, Tel: 818-899-5296, FAX: 818-897-6525; Empl.: 70; *Sls. Mgr.:* Drew Dias

BENCHMARK TECHNOLOGY, 200 S. Turnbull Canyon Rd, City of Industry, CA 91745, Tel: 818-333-1201, TWX: 910-584-1861; Empl.: 185; *Sls. Mgr.:* S. Dorren

BENDIX CONNECTOR OPERATIONS, See Amphenol, Bendix Connector Ops.

BENDIX CORP., Electrodynamics Div., 11600 Sherman Way, N. Hollywood, CA 91605, Tel: 818-765-1010, TWX: 910-499-2151; Empl.: 1200

BENDIX CORP., MOTOR COMPS. DIV., See Facet Entprs.

BENJAMIN INTERNATIONAL, INC., 1460 Old Country Rd., Plainview, NY 11803, Tel: 516-753-0700, TELEX: 204945-BENCO, FAX: 516-753-0839

BENTLY NEVADA CORP., P.O. Box 157, Minden, NV 89423, Tel: 702-782-3611, TELEX: 354437; FSC No.: 1561105

BERG, W. M., INC., 499 Ocean Ave., East Rockaway, NY 11518, Tel: 516-599-5010, TELEX: 9103506176, FAX: 516-599-3274; Empl.: 150; *Sls. Mgr.:* Marie Raitz

BERGER-LAHR CORP., Fitzgerald Dr., Jaffrey, NH 03452, Tel: 603-532-7701, FAX: 603-532-6077; Empl.: 20; *Sls. Mgr.:* Steven R. Seabaugh

BERGQUIST

FAX: 612-835-4156

BERGQUIST, 5300 Edina Ind'l, Minneapolis, MN 55435, Tel: 800-328-3882, TWX: 910-576-2423; FSC No.: 55285; Empl.: 125; *Sls. Mgr.:* Bob Savage; *Dist. Mgr.:* Duane Dungey ..... **B•1809; C•1714**

Local Sales Offices & Reps

CA	Palo Alto, Shaw-Tech	415-961-4775
CA	San Diego, OMNI, Inc.	619-268-9606
CA	Santa Ana, Bergquist Co.	714-542-3383
CO	Broomfield, Connors Co.	303-466-9628
DE	Wilmington, Electro Tech. Sls.	302-764-2189
DC	Macrotech Assocs., Ltd.	301-766-1111
FL	Clearwater, Tech-Rep	813-530-1619
IA	Atkins, Bergquist	319-446-7456
IA	Cedar Rapids, Bergquist	319-366-8733
MA	Brookline, Harman Assocs.	617-232-6687
MO	St. Charles, Bergquist	314-946-8004
NY	Lynbrook, P. Saftler Assocs.	516-593-7880
NY	No. Syracuse, Leonard D. Allen	315-458-7470
OH	Cleveland, Staff Co.	216-331-5100
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

AL	Huntsville, Component Dist., Inc.	205-883-7501
CA	Fountain Valley, Components Center	213-582-0667
CA	Hawthorne, Electrosonic	213-970-0997
CA	Mtn. View, Energy Sls.	415-969-0800
CA	San Diego, Southland Fasteners	619-578-6630
CO	Aurora, JET Elctrns.	303-364-1000
FL	Ft. Lauderdale, Components Dist. Inc.	305-973-6915
GA	Norcross, Components Dist. Inc.	404-441-3320
IL	Chicago, NEP Elctrns.	312-625-8400
MA	Brookline, Harman Sls.	617-232-6687
NY	Farmingdale, Addem Dist.	516-752-9303
NC	Raleigh, Components Dist. Inc.	919-834-9465
TX	Dallas, Components Dist. Inc.	214-694-0373
WA	Redwood, Murphy Elctrns.	206-881-1234

BERKELEY NUCLEONICS CORP., 1121 Regatta Sq., Richmond, CA 94804, Tel: 415-234-1100, TELEX: 677-1167; Empl.: 30; *Sls. Mgr.:* E. J. Buchs ..... **D•1219**

All sales engineering services in the U.S. and Canada are provided by our factory-direct sales and applications staff. For immediate assistance please contact: Telesales Department (415) 527-1121 For immediate assistance please contact: Tele-sales Department (415) 527-1121

BERKELEY PROCESS CONTROL, INC., 5327-K Jacuzzi St., Richmond, CA 94804, Tel: 415-526-3333, FAX: 415-525-1894; Empl.: 14; *Sls. Mgr.:* Theodore Arbuckle; *Dist. Mgr.:* Theodore Arbuckle

BERKSHIRE TRANSFORMER CORP., Route 341, P.O. Box 129, Kent, CT 06757, Tel: 203-927-3541; FSC No.: 89870; Empl.: 105; *Sls. Mgr.:* Janis R. Donovan

BERK TEK, INC., Box 888, RD 1, New Holland, PA 17557, Tel: 717-354-6200, FAX: 717-354-7944; FSC No.: 19449; Empl.: 350; *Sls. Mgr.:* Arnold Harris, Ntl. Sls. Mgr.; *Dist. Mgr.:* Sarah Stech

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-994-3813
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	Santa Ana, Caltronics	714-751-9162
GA	Norcross, Hollingsworth & Still	404-447-1700
MD	Wheaton, Electronic Data Assocs.	301-933-6660
MA	Clinton, B&N Assoc.	617-365-6364
MO	St. Louis, Thomas Dowell & Assoc.	314-849-4234
NJ	Sicklerville, Brown Associates	609-629-2240
NY	Fayetteville, C.W. Floring & Assoc.	315-637-4552
NY	Scottsdale, C.W. Floring & Assoc.	716-889-4614
NC	Charlotte, Pace Sls.	704-365-3216
OR	Tualatin, NICOR	415-490-5975
PA	Pittsburgh, Cody Assoc.	412-322-3121
TX	Houston, Yeager, Sumners & Assocs.	713-271-8104
UT	Salt Lake City, Aspen Sls.	801-467-2401
Can	Mississauga, RFM Electro Sls.	416-677-0027

BERMAR CORP., P.O. Box 12844, Research Triangle Park, NC 27709, Tel: 919-489-4316, TWX: 510 601-7697; *Sls. Mgr.:* M. Conland

BERTAN ASSOCIATES, INC.

FAX: 516-935-1766

BERTAN ASSOCS., 121 New South Rd., Hicksville, NY 11801, Tel: 516-433-3110, TWX: 510-221-2144; FSC No.: 6130; Empl.: 140; *Sls. Mgr.:* Jim Donley ... **D•1608-1621**

Local Sales Offices & Reps

AL	Huntsville, Currie, Peak, Frazier	205-536-1506
AZ	Phoenix, Thor Engrg.	602-437-1463
CA	Encino, King-Way Assoc.	818-788-4124
CA	Los Altos, Cain-White & Co.	415-948-6533
CO	Boulder, H. Bass Assocs.	303-530-7509
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
GA	Norcross, Currie, Peak, Frazier	404-449-7662
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
MD	Randallstown, Beacon North	703-591-1300
MA	Needham, Ray Perron & Co., Inc.	617-449-6162
MI	Detroit, Geotronix, Inc.	313-559-2440
MN	Minneapolis, Electronic Instrs.	612-374-5628
MO	St. Louis, Acorn Elctrns., Inc.	314-644-2510
NH	Dover, Ray Perron & Co., Inc.	603-742-2321
NM	Albuquerque, Thorson/Desert States Co.	505-293-8555
NY	Elmont, Crane & Egert Corp.	516-872-0800
NY	Hicksville, Bertan Assocs., Inc.	516-433-3110
NY	Liverpool, Northern Tech. Sls. Co.	315-451-1091
OH	Cleveland, Geotronix	216-659-6100
PA	Audubon, Holmes Assocs.	215-666-0636
TX	Dallas, Automated Motion Control	214-340-4192
UT	Bountiful, H. Bass Assoc.	801-295-7100
VA	Fairfax, Beacon North	703-591-1300
WA	Bellevue, Cain-White & Co., Inc.	206-462-2118
WI	Milwaukee, Coombs Assocs.	414-351-6123
Can	Downsview, Ont., Rayonics Sci., Inc.	416-736-1600

BERTSCH U.S., SYCAMORE RESCH. CTR., 2142F Industrial Ct., Vista, CA 92083, Tel: 619-727-7420; FSC No.: 619-727-4436; Empl.: 25; *Sls. Mgr.:* B. Linko

BEST POWER TECHNOLOGY, INC., P.O. Box 280, Necedah, WI 54646, Tel: 608-565-7200, 800-356-5794, TELEX: 701934; Empl.: 205; *Sls. Mgr.:* Donald Soe

BEST TECHNOLOGY INC., 400 Boren Ave. North, Seattle, WA 98109, Tel: 206-382-1300, TWX: 910-444-2154, FAX: 206-382-0186; Empl.: 8 ..... **B•1839**

Local Sales Offices & Reps

CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890

BESWICK, Dubilier International Plc., Alert Works, Frome, United Kingdom BA11 1PP, Tel: (0373) 64311, TELEX: 449196 G, FAX: (0373) 73175; *Sls. Mgr.:* Matthew Farrington

BETA AUTOMATION, INC., 3541 Old Conejo Rd., Newbury Park, CA 91320, Tel: 805-499-5785; Empl.: 8; *Sls. Mgr.:* James Valentino

BETATHERM CORP., 910 Turnpike Rd. (Rte. 9), Shrewsbury, MA 01545, Tel: 617-842-0516, TELEX: 374-8389, FAX: 617-842-0748; Empl.: 80

BEY ELECTRIC, INC., 362 Main St., Box 548, Lincoln Park, NJ 07035, Tel: 201-694-5000; *Sls. Mgr.:* Fred DeMauro, Gen. Mgr. ..... **A•2197**

BG ELECTRONICS, 30 South St., Mt. Vernon, NY 10550, Tel: 914-664-5591, TELEX: 6818048; FSC No.: 33791; Empl.: 26

B-G INSTRUMENTS, INC., P.O. Box 67, Alta Loma, CA 91701, Tel: 714-989-4802, 980-2826, TELEX: 517174, FAX: 714-989-0699; *Sls. Mgr.:* John Baum .... **D•1077**

Local Sales Offices & Reps

WA	Spokane, B-G Instrs., Inc.	509-238-4757

B. G. LABORATORIES, INC., 75 Travis Ave., Binghamton, NY 13904, Tel: 607-722-2376, FAX: 607-722-4204; FSC No.: 26522; Empl.: 150; *Sls. Mgr.:* Marj Jayne

BH Electronics

FAX: 612-894-9380

BH ELECTRONICS, INC., 12219 Wood Lk. Dr., Burnsville, MN 55337, Tel: 612-894-9590; FSC No.: 3677; Empl.: 300; *Sls. Mgr.:* Fred LaMarche ..... **A•1206-1207, 2198-2201**

Local Sales Offices & Reps

AZ	Fountain Hills, Halbar Assocs.	602-837-2464
CA	Glendale, Halbar Assocs.	818-246-8263
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Electro Comp. Sys.	303-797-0894
IL	Chicago, I. E. Hampton & Assocs.	312-634-8890
IN	Indianapolis, Shamrock Sls.	317-253-2563
MA	Norwood, Tom Maguire Assocs.	617-551-0500
MI	Detroit, I. E. Hampton & Assocs.	313-348-7714
MI	St. Joseph, I. E. Hampton & Assocs.	616-983-0862
MN	Osseo, Gaffney Sls. Co.	612-425-5484
OH	Dayton, Shamrock Sls.	513-258-1227
OH	Worthington, Shamrock Sls.	614-888-7638
OR	Portland, Halbar & Assocs.	206-696-0170
PA	Broomall, TCA Assocs.	215-692-6853
PA	Pittsburgh, Shamrock Sls.	412-343-5877
TX	Austin, Swearingen Sls.	512-339-8663
TX	Dallas, Swearingen Sls.	214-418-1817
TX	Houston, Swearingen Sls.	713-933-3517
WA	Redmond, Halbar Assocs.	206-882-0990
WI	Theinsville, TFL Assoc.	414-242-6800

B.H. INDS., INC., 5784 Venice Blvd., Los Angeles, CA 90019, Tel: 213-937-4763; Empl.: 6

BICC-VERO ELECTRONICS, INC., 1000 Sherman Ave, Hamden, CT 06514, Tel: 203-288-8001, TWX: 510-227-8890, FAX: 203-287-0062; Empl.: 50; *Sls. Mgr.:* David Sargent; *Dist. Mgr.:* Christine A. Martin

BICRON™

FAX: 203-824-1137

BICRON ELECTRONICS, 100 Barlow Street, Canaan, CT 06018, Tel: 203-824-5125; FSC No.: 10617; Empl.: 110; *Sls. Mgr.:* Peter B. Kent ..... **A•2202-2203**

Local Sales Offices & Reps

CA	San Clemente, ATA Assocs.	714-498-7180
CO	Denver, Omega, Ltd.	303-762-1921
IN	Indianapolis, J & W Sls.	317-842-3740
MN	Minneapolis, PSI	612-944-8545
NY	Hollis Hills, SAM Assocs.	718-464-1595
PA	Media, Homer Smith Co.	215-543-2434
PA	Pittsburg, Gormley Elec.	412-795-8010
UT	Salt Lake City, Omega, Ltd.	303-762-1921
VA	Salem, Homersmith, Inc.	703-387-1600
WI	Milwaukee, KMA Sls. Co.	414-259-1771
Can	Ottawa, Ellam & Assocs.	613-727-3892

BIDDLE INSTRUMENTS, 510 Township Line Rd., Blue Bell, PA 19422, Tel: 215-646-9200, TELEX: 685 1045 JGBCO, FAX: 215-643-2670; Empl.: 285

BIKOR, Microsemi Corporation, 1504 W. 228th St, Torrance, CA 90501, Tel: 213-539-6320, FAX: 213-539-0296; FSC No.: 58996; Empl.: 50; *Sls. Mgr.:* James Rorke

BINDICATOR, P.O. Box 0009, 1915 Dove St, Port Huron, MI 48061-0009, Tel: 313-987-2700, TWX: 810-231-5261 BINDICATOR P THY, FAX: 313-987-4476; Empl.: 50; *Sls. Mgr.:* Rick Secord; *Dist. Mgr.:* Rick Secord

BIRD ELECTRONIC CORP., 30303 Aurora Rd, Cleveland, OH 44139-2794, Tel: 216-248-1200, TELEX: 706898 Bird Elec. UD; FSC No.: 70998; Empl.: 267; *Sls. Mgr.:* W. F. Kail; *Dist. Mgr.:* Greg Johns

BIRTCHER CORP., See EG & G Birtcher

BISHOP ELECTRONICS CORP., 3729 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-695-0446, 213-692-9391, FAX: 213-692-4008

Local Sales Offices & Reps

AZ Scottsdale, BSE 602-483-0383
CA Garden Grove, Elsco Elctrns. 213-533-1255
CA Mtn. View, West Mark Assocs. 415-969-1700
CA San Diego, Elsco Elctrns. 619-292-1771
CO Denver, West High 303-477-8180
IL Oakbrook, Winner Co. 312-990-3545
KS Overland Pk., A.M.E. Sls. 913-262-3971
MD Middletown, S. T. Woolard 301-371-4500
MA Chelmsford, I.S.A. Interstate 617-256-2287
MN Minneapolis, Intl. Elctrns. 612-571-0000
NJ Leonia, Peter E. Schmitt Co. 201-944-1096
NY N. Syracuse, R. F. Roux 315-458-9169
NC Greensboro, United Sls. 919-674-9849
OH Dayton, J.D.S. 513-274-3224
OH Mansfield, J.D.S. 419-756-6933
PA Erie, Ecco Elctrns. 814-838-9804
SC Pickens, S. T. Woolard 803-878-3830
WA Bellevue, Olsen Tech. Sls. 206-883-7792
Can Oakville, Ont., Haltronics 416-844-2121

Local Distributors

AZ Phoenix, Arizona Comps. 602-269-5655
CA Chatsworth, MIL Comm. 818-998-3111
CA Orange, Western Micro/Ryno Elec. ... 714-637-0200
CA San Diego, Projection Unltd. 619-268-2929
CA San Diego, Western Micro/Ryno Elec. 619-453-8430
CA San Jose, Compass Comps. 408-946-7676
CA San Jose, Projection Unltd. 408-748-9280
CA Santa Ana, Projection Unltd. 714-261-2323
FL Largo, Elctrns. Precepts 813-544-3636
PA McKean, Advacom Inc. 814-476-7774
WI Oconomowoc, G.W. Elctrns. 414-567-9445

BISHOP GRAPHICS, INC., 5388 Sterling Center Drive, Westlake Village, CA 91359, Tel: 818-991-2600, TELEX: 66-2400 BISHOP WKVG, FAX: 818-889-3744; Empl.: 140; *Sls. Mgr.:* Fred Kern

BIT 3 COMPUTER CORPORATION, 8120 Penn Avenue S., Minneapolis, MN 55431-1393, Tel: 612-881-6955, TELEX: 4997016; FSC No.: 7Y590; *Sls. Mgr.:* Gordon Mitchell

Bivar

FAX: 714-951-3974

BIVAR, INC., 4 Thomas, Irvine, CA 92718, Tel: 714-951-8808, TELEX: 852348; FSC No.: 32559; Empl.: 22; *Sls. Mgr.:* Martin Lambert; *Dist. Mgr.:* Martin Lambert ..... **C•1017**

Local Sales Offices & Reps

CA San Jose, Veer Mktg. 408-432-1818
CO Englewood, B.C. & Assocs. 303-694-3999
IL Downers Grove, Richmar Elec. Corp. 312-968-0118
IN Indianapolis, Richmar Elec. Corp. 317-577-9950
MN Minneapolis, D. A. Case Assocs. Inc. .. 612-869-3700
NJ Berkeley Heights, Cambridge-Allen ... 201-464-0203
NY Syracuse, T-Squared Elctrns. 315-463-8592
NC Cary, 20th Century Mktg. Inc. 919-481-3370
OH Dayton, JFCO, Inc. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Elkins Park, K. B. Erdman Co. 215-224-1833
TX Plano, Richmar Elec. Corp. 214-424-8388
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Butler, Richmar Elec. Corp. 414-781-1730
Can Mississauga, Ont., Wilson Sls. 416-677-8200
Can Scarborough, Ont., Carsten Elec. Ltd. 416-495-9999

Local Distributors

AZ Phoenix, EKO Sales 602-437-4646
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fremont, Alatec 415-657-7701
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Diego, Southland Fasteners 619-578-6630
CA Santa Fe Springs, F T R Fasteners 714-957-0202, 213-946-6464
CA Sunnyvale, R. C. Dudek 408-734-3830
CA Sunnyvale, Vic/Tal Sls. 408-738-3450
CA Westlake Village, R. C. Dudek 818-707-1310
CO Englewood, Indus. Elctrns. 303-694-9444
CT Milford, Plastic & Metal Comps. Co. ... 203-877-2723
GA Norcross, Atlanta Hardware Specialty 404-449-3000
GA Peachtree City, Spyraflo, Inc. 404-487-7600
IL Chicago, EMF 800-621-0080,312-889-8323
IL Elmhurst, Miltex Sls. 312-941-7100
IN Carmel, Altex Elctrns. 317-848-1323
MD Beltsville, Petricko Sls. 301-937-4960
MD Gaithersburg, Capitol Fasteners 301-948-9310
MA Ashland, Quality Comps. 617-881-6504
MA Waltham, Electronic Fasteners 617-890-7780
MA Winchester, RUSH 617-729-5800
MI Detroit, Tri-West Prods. 313-273-0400
MN Eden Prairie, S. W. Anderson Co. 612-941-4198
NH Londonderry, E.P.E. Corp. 603-669-9181
NJ So. Hackensack, Fastbolt Corp. 201-440-9100
NY Bohemia, Key Comps. 516-567-7500
NY Long Island City, Hardware Specialty Co. 718-361-9393
NY Mt. Vernon, QAR Elctrns. 914-699-2224
NY Plainview, Tower Fastener Co. 516-289-8800
NY Rochester, Masline Elctrns. 716-546-5373
NC Raleigh, Century Elctrn. Comps. 919-872-2203
NC Raleigh, Century Fasteners 919-787-1800
OH Cincinnati, Hughes-Peters 513-351-2000
OH Columbus, Hughes-Peters 614-294-5351
OH Englewood, Argent Inds. 513-836-8633
OH Solon, Repco 216-248-8900
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Murphy Elctrns. 503-642-2001
PA Huntingdon Valley, Plastic & Metal Prods. 215-322-2000
PA Norristown, Century Elctrns. 215-631-5400
TX Dallas, Global Fasteners 214-340-6068
TX Grand Prairie, Tech Supp. 214-660-4888
WA Redmond, Murphy Elctrns. 206-881-1234
WA Seattle, Component Resources 206-454-8666
EXP CA/Bakersfield, Gray-Weatherhead Equip. 805-397-4281
Can Mississauga, Ont., Rush/Ontario 416-677-7280

BIW CABLE SYSTEMS, INC., 22 Joseph E. Warner Blvd., N. Dighton, MA 02764, Tel: 617-822-6600, TELEX: 94-0604, FAX: 617-822-1944; Empl.: 600; *Sls. Mgr.:* L. Latino, Mktg. Mgr./Elctrns.

BLACK & WEBSTER, 219 Bear Hill Rd., Waltham, MA 02254, Tel: 617-890-9100, TELEX: 951102; Empl.: 50; *Sls. Mgr.:* Andy Anderson

BLACKBURN, Division of FL Industries, 1525 Woodson Rd., St. Louis, MO 63144, Tel: 314-993-9430, TELEX: 4312046; Empl.: 500; *Sls. Mgr.:* T. T. Latanision

BLACKHAWK NETWORKS CORP., 14 N. Parker Dr., P.O. Box 919, Janesville, WI 53545, Tel: 608-752-8701, FAX: 608-752-8701; FSC No.: 12724; Empl.: 10; *Sls. Mgr.:* D. Adee

Local Sales Offices & Reps

CA Livermore, United Tech. Mktg. 415-449-7644
CA N. Hollywood, Crown Elctrns. 213-877-3550
FL Longwood, Mathias Assocs., Inc. 305-682-1700
GA Atlanta, Grady Duckett Sls. Co. 404-451-3529
IA Cedar Rapids, Snider Sls. Co. 319-362-4410
MA Burlington, Dynamic Sls. 617-272-5676
MN Brooklyn Center, Willman Assocs. 612-566-5010
MO Ellisville, Gateway Tech. Sls. 314-391-6543
NY Syracuse, Murcan Sls. Corp. 315-437-0734
TX Richardson, Precision Technlg. Assocs. 214-234-8071
Can Quebec, Milltron Inc. 514-331-9992

BLATEK, INC., Box 574, Bellefonte, PA 16823, Tel: 814-355-4910; Empl.: 20; *Sls. Mgr.:* Linda C. Feltman ..... **B•1882**

Local Sales Offices & Reps

CA Anaheim, Universal NDT, Inc. 714-526-1638
PA Paoli, Stitzer Assoc. 215-644-5500

BLH ELCTRNS., 75 Shawmut Road, Canton, MA 02021, Tel: 617-821-2000, TELEX: 92-3413, TWX: 710-324-0683; FSC No.: 03089; Empl.: 170; *Sls. Mgr.:* C. Wesley

Local Sales Offices & Reps

AL Huntsville, Currie, Peak & Frazier 205-536-1506
CA Oakland, Frost Engrg. 415-568-7000,
MD Baltimore, Automation Indl. Controls .. 301-944-8400
FL Orlando, Currie, Peak & Frazier 305-855-0843
GA Norcross, Currie, Peak & Frazier 404-449-7662
IL Chicago, Comtel Midwest 312-539-4838
IN Indianapolis, Comtel Midwest 317-253-1681
IA Cedar Rapids, Comtel Midwest 319-377-9434
KS Shawnee Mission, Comtel Midwest ... 913-268-0762,
MI Farmington Hills, Great Lakes Processing Control, Inc. 313-478-8892
MN Wayzata, Comtel Midwest 612-476-1551
MO St. Louis, Comtel Midwest 314-991-5363
NY E. Syracuse, Ossmann Instrs. 315-437-7052
NY Rochester, Ossmann Instrs. 716-424-4460
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
OH Cincinnati, Alpha Controls 513-874-2000
OH Westlake, Advanced Technlg. Assocs. 216-835-5050
OK Tulsa, Bauman Instrument Co. 918-492-8086
TX Corpus Christi, Collier Equip. Corp. 512-289-6181
TX Houston, American Analogue 713-941-7265
TX Plano, Summit Controls, Inc. 214-867-6056
WA Woodinville, Frost Engrg. Svc. Corp. .. 206-485-8500
WI New Berlin, Comtel Midwest 414-544-6042

BLILEY ELECTRIC CO., 2545 W. Grandview Blvd., Erie, PA 16506, Tel: 814-838-3571, TWX: 510-696-6886, FAX: 814-833-2712; FSC No.: 71034;3098; Empl.: 170 ..... **A•1345-1353**

Local Sales Offices & Reps

AL Huntsville, R. W. Mitscher Co., Inc. 205-882-6050
AZ Tempe, Cain Technlg. Inc. 602-966-4322
CA Mountain View, Woempner-Arnold Assocs. 415-964-5454
CA Orange, Cain Technology, Inc. 714-997-7311
CA Van Nuys, Cain Technology, Inc. 818-904-9392
CO Englewood, Cain Technlog., Inc. 303-220-8118,
CT Plainfield, R. W. Mitscher Co., Inc. 203-564-1691,
FL Boca Raton, R. W. Mitscher Co., Inc. .. 305-368-3841
FL Largo, R. W. Mitscher Co., Inc. 813-581-1588,
FL Sanford, R. W. Mitscher Co., Inc. 305-322-7141,
GA Lawrenceville, R. W. Mitscher Co., Inc. 404-923-3239
MD Laurel, R. W. Mitscher Co., Inc. 301-498-6090
MA Needham, Sturgeon Co. 617-444-6603
NJ Princeton, R. W. Mitscher Co., Inc. 609-924-7026,
NM Albuquerque, C. T. Carlberg & Assocs., Inc. 505-888-3883
NY Clarence, R. W. Mitscher Co., Inc. 716-759-2350
NY Islandia, Schmitt Indl. Mktg. Corp. 516-582-5888,
NY Pittsford, R. W. Mitscher Co., Inc. 716-586-4012
NY Rochester, R. W. Mitscher Co., Inc. 716-227-0839
NY Utica, R. W. Mitscher Co., Inc. 315-738-0383
NC Charlotte, R. W. Mitscher Co., Inc. 704-366-9131,

BLILEY REPRESENTATIVES COVER THESE STATES:

Southern California, Arizona
Colorado, Utah
CAIN TECHNOLOGY, INC.

Northern California, Northwestern Nevada
WOEMPNER-ARNOLD ASSOCIATES

Massachusetts, Maine
New Hampshire, Vermont
STURGEON COMPANY

New York (Metropolitan NYC), Northern New Jersey
SCHMITT INDUSTRIAL MARKETING CORP.

New York State (excluding Metropolitan NYC), Connecticut, Rhode Island, Virginia, North & South Carolina, Georgia, Mississippi, Alabama, Tennessee, Maryland, Delaware, Florida, Eastern Pennsylvania, Southern New Jersey, Canadian Provinces of Ontario & Quebec
R.W. MITSCHER CO., INC.

Washington, Oregon
WESTMARK ELECTRONICS, INC.

Texas, Louisiana, Arkansas, Oklahoma
VECTOR SALES CO., INC.

DESC/Dayton, Ohio
THOMAS HERMAN & ASSOCIATES, INC.

New Mexico, El Paso County Texas
C. T. CARLBERG & ASSOCS. INC.

See adjacent listing for the address and telephone number of your Bliley representative.

Bliley
ELECTRIC COMPANY

NC Raleigh, R. W. Mitscher Co., Inc. 919-848-0941
OH Bellbrook, Thomas Herman & Assocs., Inc. 513-848-8332,
OR Portland, Westmark Elctrns. Inc. 503-641-8780
PA Huntingdon Valley, R. W. Mitscher Co., Inc. 215-355-4452
TN Johnson City, R. W. Mitscher Co., Inc. 615-929-7258
TX Richardson, Vector Sales Co. 214-234-4291
VA Richmond, R. W. Mitscher Co., Inc. 804-264-6883,
WA Seattle, Westmark Elctrns. Inc. 206-281-4025
EXP CT, Stamford, Dage Corp. 203-324-3123

BLOXCOM CORPORATION, A Siemens Company, 1130 Larkin Dr., Wheeling, IL 60090, Tel: 312-520-8010, FAX: 312-520-8049; *Sls. Mgr.:* Joe Smiesko

BLUE M

FAX: 312-331-2515

BLUE M, A UNIT OF GENERAL SIGNAL, 138th & Chatham Sts., Blue Island, IL 60406, Tel: 312-385-9000, TWX: 910-689-3398; Empl.: 275; *Sls. Mgr.:* H. G. Mathews; *Dist. Mgr.:* George Dixey ..... **D•1186**

Local Sales Offices & Reps

AZ Tempe, Blue M 602-894-2305
CA El Monte, Blue M 818-442-6672
CA Sunnyvale, Blue M 408-734-8734
DE Wilmington, Blue M 302-478-6983
FL Casselberry, Blue M 305-332-9322,
GA Atlanta, Blue M 404-455-3452
KS Overland Park, Blue M 913-888-6483
MA Millis, Blue M 617-376-4727
MI Livonia, Blue M 313-474-4312
NY Spring Valley, Blue M 914-426-1880,
NY Syracuse, Blue M 315-437-0192
NC Charlotte, Blue M 704-527-2492
OH Cincinnati, Blue M 513-821-6278
OH Hudson, Blue M 216-656-1177
TX Garland, Blue M 214-272-2509
WA Seattle, Blue M 206-763-1030

BMW INC., 17 Willow St, Lynn, MA 01903, Tel: 617-581-9241, 800-458-4020, FAX: 617-592-0964; Empl.: 25; *Sls. Mgr.:* William J. Valles; *Dist. Mgr.:* Richard Pelletier

BODINE® ELECTRIC COMPANY

FAX: 312-410-5202

BODINE ELECTRIC COMPANY, 2500 W. Bradley Pl, Chicago, IL 60618, Tel: 312-478-3515, TELEX: 25-3646; Empl.: 800; *Sls. Mgr.:* R. J. Stuchly; *Dist. Mgr.:* R. J. Stuchly ..... **B•1197**

Local Sales Offices & Reps

CA Saratoga, E. W. Duemmlein 408-253-1201
KS Shawnee Mission, J. F. Gleeson & Assocs. 913-362-4422
MA Woburn, J. A. Cascino 617-938-1446,
MI Southfield, Bodine Elec. Co. (c/o Steve Cavender) 313-350-3610
MN Mound, John F. Rynkar 612-472-4252
NY Massapequa, D. V. Mayorga 516-541-1611
NY Rochester, Application Specialists 716-586-6226
NY Syracuse, Application Specialists 315-437-2814
OH Hudson, J. H. Basten 216-656-4226
TX Richardson, Control Dynamics 214-644-6945
VA McLean, J. S. Hsia 703-734-1739
WA Seattle, Drive Motor Control Sys. Co. 206-575-4172
EXP IL, Chicago, Export Dept., Bodine Elec. 312-478-3515
Can Vancouver, BC, Madison Indl. Equip. Ltd. 604-872-8155

Local Distributors

AL Mobile, Brownell Instrs. & Conts. Co. .. 205-479-5405
AZ Phoenix, Minarik Elec. Co. 602-233-3000
CA Carson, Power Trans. Specialties 213-631-7502
CA Fremont, Elec. Motor Svc. 415-651-2706
CA Glendale, Minarik Elec. Co. 213-624-3161
CA Los Angeles, Minarik Elec. Co. 213-624-3161
CA Newark, Republic Supp. Co. 415-794-9019,
CA San Diego, Minarik Elec. Co. 619-560-6632
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CO Denver, Wazee Elec. Co. 303-623-8658
CT Berlin, B & B Motor & Control 203-828-8550
CT Hartford, Machine Drives & Controls .. 203-728-0403
CT Norwalk, Machine Drives & Controls .. 203-846-2007
FL Hialeah, Condo Elec. & Ind. Supp., Inc. 305-691-5400
FL Jacksonville, Electrical-Mech. Dr., Inc. 904-783-2730
FL Orlando, Brownell Instrs. & Conts. Co. 305-843-6770
FL Tampa, Electrical-Mech. Dr., Inc. 813-621-8675
GA Hapeville, Brownell Instrs. & Conts. Co. 404-762-5181
GA Tucker, Research Designs, Inc. 404-491-0745
IL Chicago, Excel Elec. Svc. Co. 312-421-7220
IL Franklin Pk., Flolo Elec. Co. 312-595-1010
IL Loves Park, Tek-Matic, Inc. 815-282-1775
IN Indianapolis, B & B Motor & Control ... 317-248-0396
IA Cedar Rapids, Precision Bearing Co. .. 319-365-5276
IA Des Moines, Precision Bearing Co. ... 515-265-9811
KS Kansas City, Kornfeld Thorp Elec. 913-321-7070
MD Baltimore, Advent Electric Inc. 301-532-8149,
MA Medford, Empire Elctrl. Co. 617-395-5000
MA Somerville, Electro Sls. Co., Inc. 617-666-0500
MI Detroit, Howard Elec. Co. 313-923-0430
MI Grand Rapids, MacKay Ind. Sls. 616-241-1671
MI Novi, Reserve Motion Control Sys. 313-473-1370
MN Minneapolis, Boustead Elec. & Mfg. ... 612-544-9131
MO St. Louis, State Elec. Co. 314-569-2140
MO St. Louis, Zeller Elec., Inc. 314-638-9641
NE Omaha, Precision Bearing Co. 402-593-7050
NH Manchester, Empire Elctrl. 603-627-6630
NJ Cherry Hill, Jos. T. Fewkes & Co. 609-424-5810
NY Binghamton, K. J. Elec. Corp. 607-772-1760
NY East Syracuse, K. J. Elec. Corp. 315-437-2826
NY Long Island City, B & B Motor & Control 718-784-1313
NY Rochester, B & B Motor & Control 716-424-7040
NC Charlotte, Brownell Instrs. & Conts. Co. 704-597-1270
NC Charlotte, Piedmont Motor &Control Ltd. 704-523-7121,
OH Dayton, Thal Mor Assoc., Inc. 513-298-9939
OH Middleburg Hgts., Reserve Motion Control Sys. 216-826-0290
OK Oklahoma City, Evans Elec. Mtr. Ctrs., Inc. 405-631-1344
OK Tulsa, Southwest Drives, Inc. 918-665-1455
PA Altoona, Miller Elec. Svc. & Supp. 814-942-9943
PA Bridgeport, Advent Elec., Inc. 215-277-6610
PA Pittsburgh, Braunlich-Roessle 412-471-6995
SC Taylors, B & B Motor & Control 803-268-5702
TN Memphis, Brownell Instrs. & Conts. Co. 901-795-8487
TN Nashville, Electric Motor Rewind, Inc. 615-256-2522,
TN Nashville, Tennessee Machinery Co. .. 615-244-8150
TX Dallas, Motion Inds. 214-351-2211
TX Dallas, Power Dynamics, Inc. 214-358-5500
TX Fort Worth, Motion Inds. 817-335-8131
TX Ft. Worth, Power Dynamics, Inc. 817-831-4581
TX Houston, B & B Motor & Control 713-820-7931
TX Houston, Research Des., Inc. 713-995-8591
TX San Antonio, Minarik Elec. Co. 512-822-7097
VA Richmond, Ind. Supp. Corp. 804-355-8041
WA Seattle, Indl. Elec. Mtr. & Mach., Inc. ... 206-329-3900
WI Milwaukee, Trester Svc. Elec. 414-264-8170
WI New Berlin, Elec. Sls. & Engrg. 414-782-2400
Can Brantford, Ont., Renold Canada 800-265-9970
Can Edmonton, Alberta, Soper's Supp. Ltd. 403-423-4066
Can Montreal, Que., Lalonde Elec., Inc. 514-524-7507
Can Mt. Royal, Que., Renold Canada 514-731-3591
Can Scarborough, Ont., Toronto Elec. 416-755-7716
Can Toronto, Renold Canada Ltd. 416-453-2190,
Can Vancouver, B.C., Armature Elec. 604-879-6141
Can Vancouver, BC, Renold Canada Ltd. .. 604-255-8455

BOEING ELECTRONICS CO., P.O. Box 24969, M/S 9N-41, Seattle, WA 98124-6269, Tel: 206-657-7474, TELEX: 329430, FAX: 206-657-8883; Empl.: 5800; *Sls. Mgr.:* J. B. Ewell

BOGEN COMMUNICATIONS, INC.

FAX: 201-934-9832

BOGEN COMMUNICATIONS, INC., MPD Products, 50 Spring St., Ramsey, NJ 07446, Tel: 201-934-8500, TWX: 710-990-5047; *Sls. Mgr.:* Lou Asighiere; *Dist. Mgr.:* David Chambers, Natl. Sls. Mgr. ..... **C•1290**

Local Sales Offices & Reps

AZ Scottsdale, Dar-C Inc. 602-948-2240
CA Pleasonton, Moulthrop Sls. 415-463-0450
CA San Diego, Tauber Assocs. 619-274-7242
CO Englewood, Comp. Sls. 303-779-8060
FL Tampa, SRT Mktg. 813-884-4805
IL Palatine, Technig. Sls. 312-991-6600
IN Indianapolis, Marketing Engrg. 317-872-5665
IA Davenport, Rush West Assocs. 319-388-9494
KS Olathe, Rush West 913-764-2700
MA Burlington, Conti Younger 617-273-1582
MI Brighton, A. P. Assocs. 313-229-6550
MN Eden Prarie, Electro Mark 612-944-5850
MO St. Louis, Rush West 314-965-3322
NJ Berkeley Hgts., Cambridge Allen & Assocs. 201-464-0203
NC Greensboro, Hiile Sls., Inc. 919-288-1500
OR Beaverton, Advanced Power Prods. ... 503-646-0994
PA Philadelphia, Samuel K. Macdonald, Inc. 215-659-4414
TX Dallas, Dunbar 214-239-7151
UT Salt Lake City, Comp. Sls. 801-268-8440
WI Waukesha, Technig. Sls. 414-786-5015
Can Ontario, White Radio Ltd. 416-632-6894

Local Distributors

AL Huntsville, Resistacap, Inc. 205-883-4270
AZ Scottsdale, Electro Mark 602-991-0110
CA San Diego, Tauber Elec. 619-272-7242
CA San Jose, Rose Elctrns. 408-263-2934
CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
CA Van Nuys, Nesco 213-781-0505
CO Arvada, Denver Beta Wintronics 303-431-7161
FL Boca Raton, Plainview Elctrns. 305-997-7705
IL Morton Grove, Power Pak 312-966-6000
IN Indianapolis, Bell Elctrns. 317-875-8200
IN Indianapolis, Elctrn. Prod. Concepts ... 317-872-5665
MA Canton, Impact Sls. 617-821-1500
MA Danvers, Generation Elctrns. 617-777-4866
MA Sharon, Adcour 617-784-8123
MI Brighton, A. P. Sls. 313-227-3604
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi Key 218-681-6674
NJ Camden, Gen. Radio Supp. 609-964-8560
NJ Clifton, Engrd. Assemblies Corp. 800-4-Battery
NJ Plainfield, Mars Elec. 201-757-4332
NY Buffalo, Summit Dist. 716-887-2800
OR Beaverton, Micro Power Elctrns. 503-626-7086
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Dallas, Computer Comps. 214-239-0271
WI Milwaukee, Taylor Elctrns. 414-241-4321
Can Ontario, White Radio Ltd. 416-632-6894

BOGEN COMMUNICATIONS, INC., 50 Spring St., P.O. Box 575, Ramsey, NJ 07446, Tel: 201-934-8500, TWX: 710-990-5047, FAX: 201-934-9832; *Sls. Mgr.:* David Chambers; *Dist. Mgr.:* Len Charyak ..... **C•1290**

Local Sales Offices & Reps

AZ Phoenix, WesTech Mktg. 602-438-9763
CA Antioch, Lichtenauer & Assocs. 415-757-1200
CA Culver City, WesTech Mktg. 213-870-9286
FL Tampa, SRT Mktg. 813-884-4805
FL Winter Springs, SRT Mktg. 305-699-0505
GA Roswell, Henry W. Phillips Co., Inc. 404-992-3070
HI Honolulu, J.C. Elctrns. 808-943-8514
IL Deerfield, William M. Linz Assocs., Inc. 312-945-9600
IN Indianapolis, Kingston Sls. Corp. 317-876-2545
IA Cedar Rapids, R. W. Kunz & Assocs., Inc. 319-396-5386
KS Prairie Vl., R. W. Kunz & Assocs., Inc. 913-648-3535
MD Mt. Airy, Lowery Assocs. 800-345-1058
MA Northboro, W. B. Pray Sls., Inc. 617-393-3434
MI Farmington Hills, CM Sls. 313-553-8070
MN White Bear Lk., Yore Co. 612-770-9760
MO St. Louis, R. W. Kunz & Assocs., Inc. .. 314-966-4977
NJ Hopatcong, Bi-State Marketers 201-770-2262
NJ Ridgefield, Bi-State Marketers 201-943-5888
NY Lynbrook, Bi-State Marketers 516-593-8025
NY Syracuse, Paston-Hunter Co., Inc. 315-437-2992
OH Dayton, Shamrock Elctrns. Sls., Inc. 513-258-1227
OH Worthington, Shamrock Elctrns. Sls., Inc. 614-888-7638
PA Broomall, Lowery Assocs. 800-345-1058
PA Pittsburgh, Shamrock Elctrn. Sls., Inc. 412-343-5877
TX Dallas, Dimension/Pt. IX Mktg. Corp. .. 214-348-9657
TX Houston, Dimension/Pt. IX Mktg. Corp. 713-879-4010
UT Salt Lake City, Pro Tech Mktg. 801-943-8331
VA McLean, Lowery Assocs. 703-356-4654
WA Lynwood, Pacnor Mktg., Inc. 206-771-6016
WI Brookfield, William M. Linz Assocs., Inc. 414-782-0630
EXP New York/New York, Roburn Agencies, Inc. 212-989-5939
Can Burlington, Ont., White Radio Ltd. 416-632-6894

BOKER'S, INC., 3104 Snelling Ave., Minneapolis, MN 55406-1937, Tel: 612-729-9365, FAX: 612-729-8910; FSC No.: 85446; Empl.: 110; *Sls. Mgr.:* Andy Tscholl

BOMAR CRYSTAL, 201 Blackford Ave., Middlesex, NJ 08846, Tel: 201-356-7787, 800-526-3935, TWX: 710-480-4560, FAX: 1-201-356 7362; Empl.: 75; *Sls. Mgr.:* Phil Casciano

BOMCO, See MuShield Co.

BONAR SCI INC., A Bonar Power Supply Co., 49 Range Rd., Windham, NH 03087, Tel: 603-893-2330, FAX: 603-893-6280; Empl.: 100; *Sls. Mgr.:* Dale Raveney, VP Mktg. & Sls.

BOONTON

FAX: 201-584-3037

BOONTON ELECTRONICS CORP., 791 Route 10, Randolph, NJ 07869, Tel: 201-584-1077, TWX: 710-986-8215 BOONTRONICS; FSC No.: 04901; Empl.: 180; *Sls. Mgr.:* R. Morrell ..... **D•1226**

Local Sales Offices & Reps

AL	Huntsville, Sci. Devices	205-536-1969
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	North Hollywood, O'Halloran Assocs.	213-877-0173
CA	Palo Alto, O'Halloran Assocs.	415-969-1600
CO	Denver, Aztec Entprs.	303-779-5285
CT	Mt. Carmel, Sci. Devices	203-248-9361
FL	Orlando, Sci. Devices	305-841-8180
IL	Elmhurst, Sector Engrg. Sls., Inc.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls., Inc.	317-842-1120
KS	Lenexa, Ramsey Assoc.	913-541-1007
MD	Lanhan, Sel-Tronics	301-731-8080
MA	Lexington, R. J. Sickles	617-862-5100
MN	Minneapolis, Sector Engrg. Sls., Inc.	612-593-1809
MO	Maryland Hgts., Ramsey Assoc.	314-878-5042
NJ	Teaneck, Sci. Devices	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Rochester, Sci. Devices	716-334-2445
NC	Winston-Salem, Sci. Devices	919-765-5776
OH	Centerville, Micro Sls.	513-433-8171
PA	Melrose Park, R. Meyers	215-224-1663
TX	Austin, Testech	512-327-7033
TX	Richardson, Testech	214-644-5010
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Bellevue, Sci. Devices	206-747-5169
WI	Milwaukee, Sector Engrg. Sls., Inc.	414-352-8280

BOPLA ENCLOSURES, 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-770-2225, FAX: 301-984-8670; FSC No.: 4Y520; Empl.: 35; *Sls. Mgr.:* Andy Kassman ..... **C•1018**

Local Sales Offices & Reps

CA	Irvine, Comp. Mktg. Assocs.	714-951-5950
FL	Tampa, FL Comp. Sls.	813-960-7044
IL	Chicago, Paddock Mktg./Sls.	312-452-7852
IN	Nobelsville, R & D Elctrns.	317-849-2026
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PA	Lancaster, Indl. Comps. Inc.	215-889-0650
VA	Reston, Colrud Corp.	703-620-6621
WA	Federal Way, K. R. Jensen Sls.	206-874-2772

Local Distributors

MA	Framingham, Now Elctrns.	617-872-5876
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PA	Lancaster, Peak Elctrns.	215-293-9000
WA	Seattle, Radar Elec.	206-282-2511

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BOSCH, ROBERT, CORP., 2800 S. 25th Ave., Broadview, IL 60153, Tel: 312-865-5200, TELEX: 23-5563; *Sls. Mgr.:* Dieter Bloecks; *Dist. Mgr.:* Dave Robson

BOSCHERT, INC., Computer Products/Boschert, 3797 Spinnaker Ct., Fremont, CA 94538, Tel: 418-657-6700, FAX: 415-683-6400 ... **D•1644-1648, 1673-1674**

Refer to Computer Products, Inc., Pompano Beach, FL, for sales offices, Reps. and Distributors.

BOSCHERT, INC., See Computer Products, Inc.

BOURNS, INC., Resistive Components Group, 1200 Columbia Ave., Riverside, CA 92507, Tel: 714-781-5050, TWX: 910-332-1252; Empl.: 6000; *Sls. Mgr.:* Dennis Lause; *Dist. Mgr.:* Vince Ingrao ..... **A•1870-1871, 2064-2067**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Calabasas, Quad Rep. Inc.	818-887-4219
CA	Irvine, Quad Rep. Inc.	714-261-6706
CA	San Diego, SR Elctrns.	619-560-8330
CA	San Jose, QuadRep, Inc.	408-946-4000
CO	Parker, Parker Webster	303-841-4888
FL	Altamonte Springs, Dyne-A-Mark	305-831-2097
FL	Clearwater, Dyne-A-Mark	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark	305-771-6501
FL	Palm Bay, Dyne-A-Mark	305-727-0192
GA	Atlanta, CSR Elctrns.	404-396-3720
ID	Boise, Intermountain Technlg.	208-322-5022
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, REP Assocs. Corp.	319-373-0152
KY	Louisville, Technlg. Mktg. Corp.	502-499-7808
MD	Baltimore, Micro-Comp.	301-247-0400
MA	Lexington, John E. Boeing Co.	617-862-2500
MI	Detroit, Rathburg Assocs.	313-882-1717
MN	Edina, Mel Foster	612-941-9790
MO	Bridgeton, Centech	314-291-4230
MO	Raytown, Centech	816-358-8100
NJ	Bellmawr, Thomas Assocs.	609-933-2600
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Raleigh, CSR Elctrns.	919-878-9200
OH	Richfield, Bear Mktg.	216-659-3131
OK	Oklahoma City, Ammon & Rizos	405-942-2552
OR	Portland, J. J. Backer	503-297-8744
OR	Salem, J. J. Backer	503-362-0717
TX	Austin, Ammon & Rizos	512-454-5131
TX	Dallas, Ammon & Rizos	214-644-5591
TX	Houston, Ammon & Rizos	713-781-6240
UT	Salt Lake City, Parker Webster	801-266-9939
VA	Huddleston, Micro-Comp	301-247-0400
WA	Seattle, J. J. Backer	206-285-1300

Local Distributors

AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Hamilton/Avnet Elctrns.	205-837-7210
AL	Huntsville, Pioneer/Washington	205-837-9300
AL	Huntsville, Schweber	205-882-2200
AZ	Phoenix, Hall-Mark Elctrns.	602-243-6601
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Phoenix, TTI	602-861-0222
AZ	Tempe, Bell Inds.	602-966-7800
AZ	Tempe, Elctrn. Supp.	602-258-4769
AZ	Tempe, Hamilton/Avnet	602-231-5100
CA	Canoga Park, Schweber Elctrns.	213-999-4702
CA	Chatsworth, Avnet Elctrns.	213-700-2600
CA	Chatsworth, TTI	818-709-1010
CA	Citrus Hts, Hall-Mark Elctrns.	916-443-7282
CA	Compton, Harper S.I.D.	213-979-5090
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Avnet Elctrns.	213-558-2313
CA	Costa Mesa, Hamilton Elctrns.	714-641-4100
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CA	Culver City, Hamilton Electro Sls.	213-558-2121
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CA	Roseville, Bell Inds.	916-969-3100
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CA	Sacramento, Schweber Elctrns.	916-929-9732
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Elctrn. Supp.	619-278-5020
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Hamilton/Avnet	619-571-7500
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CA	Santa Ana, Teknopak	714-558-8840
CA	Santa Clara, Schweber Elctrns.	408-748-4700
CA	Santa Clara, Schweber Elctrns.	408-496-0200
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvale, Hall-Mark Elctrns.	408-773-9990
CA	Sunnyvale, Hamilton/Avnet	408-743-3300
CA	Tustin, Hall-Mark Elctrns.	714-669-0681
CA	Woodland Hills, Avnet Elctrns.	213-884-3322
CO	Denver, Newark Elctrns.	303-757-3351
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Englewood, Hamilton/Avnet	303-779-9998
CO	Wheat Ridge, Bell Inds.	303-424-1985
CT	Danbury, Hamilton/Avnet	203-797-2856
CT	Danbury, Schweber Elctrns.	203-792-3500
CT	Hamden, Almo Elctrns. Corp.	203-288-6556
CT	Norwalk, Pioneer Std.	203-853-1515
CT	Statford, TTI	203-375-1400
CT	Wallingford, Midan Elctrns.	203-265-2077
FL	Altamonte Springs, Pioneer Std.	305-834-9090
FL	Altamonte Springs, Schweber Elctrns.	305-331-7555
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Dania, Summit Distrs.	305-920-6253
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Ft. Lauderdale, Hamilton/Avnet	305-971-2900
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FL	Ft. Lauderdale, Pioneer/Washington	305-771-7520
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FL	Largo, Graham Elctrns.	813-541-4434
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FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Orlando, Pioneer/Orlando	305-834-9090
FL	Orlando, TTI	305-859-1000
FL	St. Petersburg, Hall-Mark Elctrns.	813-576-8691
FL	St. Petersburg, Hamilton/Avnet	813-576-3930
FL	Winter Park, Hamilton/Avnet	305-628-3888
GA	Norcross, Hall-Mark Elctrns.	404-447-8000
GA	Norcross, Hamilton/Avnet	404-447-7500
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Pioneer/Washington	404-448-1711
GA	Norcross, Schweber Elctrns.	404-449-9170
GA	Norcross, TTI	404-662-0911
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IL	Elk Grove Village, Schweber Elctrns.	312-364-3750
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IN	Carmel, Hamilton/Avnet	317-844-9333
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IN	Indianapolis, Graham Elctrns.	317-634-8202
IN	Indianapolis, Pioneer Std. Elctrns.	317-849-7300
IN	Lafayette, Graham Elctrns.	317-423-5564
IA	Cedar Rapids, Bell Inds.	319-395-0730
IA	Cedar Rapids, Hamilton/Avnet	319-362-4757
IA	Cedar Rapids, Schweber Elctrns.	319-373-1417
KS	Lenexa, Hall-Mark Elctrns.	913-888-4747
KS	Overland Park, Schweber Elctrns.	913-492-2921
KS	Overland Pk., Hamilton/Avnet Elctrns.	913-888-8900
MD	Baltimore, Radio Elec. Svc. Co.	301-529-0500
MD	Beltsville, Radio Elec. Svc. Co.	202-937-9100
MD	Columbia, Hall-Mark Elctrns.	301-796-9300
MD	Columbia, Hamilton/Avnet	301-995-3500
MD	Gaithersburg, Almo Elctrns. Corp.	301-670-0090
MD	Gaithersburg, Pioneer/Washington	301-921-0660
MD	Gaithersburg, Schweber Elctrns.	301-840-5900
MA	Bedford, Schweber Elctrns.	617-275-5100
MA	Canton, Almo Elctrns. Corp.	617-821-1450
MA	Lexington, Pioneer Std.	617-863-1200
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Woburn, Hall-Mark Elctrns.	617-935-9777
MA	Woburn, Hamilton/Avnet	617-273-7500
MI	Flint, RS Elctrns.	313-762-5800
MI	Grand Rapids, Hamilton/Avnet	616-243-8805
MI	Grand Rapids, RS Elctrns.	616-241-3483
MI	Kalamazoo, RS Elctrns.	616-381-5470
MI	Livonia, Hamilton/Avnet	313-522-4700
MI	Livonia, Pioneer Std. Elctrns.	313-525-1800
MI	Livonia, RS Elctrns.	313-525-1155
MI	Livonia, Schweber Elctrns.	313-525-8100
MI	Roseville, RS Elctrns.	313-779-2450
MI	Wyandotte, RS Elctrns.	313-AV2-5880
MN	Bloomington, Hall-Mark Elctrns.	612-854-3223
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MN	Edina, Schweber Elctrns.	612-941-5280
MN	Minneapolis, Newark Elctrns.	612-331-6350
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NY Hauppauge, Pioneer-Harvey 516-231-9200
NY Melville, Hamilton/Avnet 516-454-6000
NY Rochester, Hamilton/Avnet Elctrns. 716-475-9130
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rochester, Summit Distrs. 716-334-8110
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
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NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Pioneer/Washington 704-527-8188
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Hall-Mark Elctrns. 919-872-6286
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
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OH Cleveland, Hamilton/Avnet 216-831-3500
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OH Columbus, Graham Elctrns. 614-895-1590
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OH Dayton, Schweber Elctrns. 513-439-1800
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OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Westerville, Hall-Mark Elctrns. 614-891-4555
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OR Lake Oswego, Hamilton/Avnet Elctrns. 503-635-8831
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PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Pittsburgh, Almo Elctrns. Corp. 412-931-5990
PA Pittsburgh, Pioneer Std. Elctrns. 412-782-2300
PA Pittsburgh, Schweber Elctrns. 412-782-1600
SC Greenville, Hammond Elctrns. 803-233-4121
TN Nashville, Graham Elctrns. 615-242-2682
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Hamilton/Avnet 512-837-8911
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TX Fort Worth, TTI 214-429-1440
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Hamilton/Avnet 713-975-3501
TX Houston, Harrison Equip. Co. 713-879-2600
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Pioneer Std. Elctrns. 214-386-7300
TX Houston, Schweber Elctrns. 713-784-3600
TX Irving, Hamilton/Avnet 214-659-4100
TX Stafford, Harrison Equip. 713-879-2600
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Hamilton/Avnet 801-972-2800
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Hamilton/Avnet 206-643-3950
WI Brookfield, Schweber Elctrns. 414-784-9020
WI Mequon, Taylor Elec. 414-241-4321
WI Milwaukee, Electronic Expd. 414-228-8100
WI New Berlin, Hamilton/Avnet 414-784-4510
WI Oak Creek, Hall-Mark Elctrns. 414-761-3000
WI Waukesha, Bell Inds. 414-547-8879

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FAX: 617-263-3358

BOWMAR/ALI, Bowmar Instr. Corp., 531 Main St., Acton, MA 01720, Tel: 508-263-8365, TWX: 710-347-1441; Empl.: 250; *Sls. Mgr.:* Andy Roeper ..... **D•1353-1355**

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CA Lacanada, Brooks, Moore & Assocs. .. 818-790-8358
CA Orange, Brooks-Moore & Assocs. 714-771-1220
CA Palo Alto, Mollard Mktg. 415-961-0456
CA Santa Ana, Brooks-Moore & Assocs. .. 714-544-8900
CO Commerce City, Meas. Consits. 303-286-1414
FL Tampa, Lewis & Assocs., Inc. 813-988-2104
GA Atlanta, Horton Instr. Co. 404-231-3131
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
KS Overland Park, Barry Sls. 913-642-0270
LA Baton Rouge, Mid-South Sls. 504-924-0106
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MD Columbia, Tyler Griffin Co. 301-995-1215
MA Billerica, Eastronix, Inc 617-670-2400
MI Livonia, Amtech Reps. 313-474-8300
MN Minneapolis, Waltam Sls. Co. 612-781-2778
MO St. Louis, Barry Sls. 314-821-2525
NJ Perth Amboy, Cosine, Inc. 201-442-3600
NM Albuquerque, Meas. Consits. 303-286-1414
NY Clarence, EIL/Trott Elctrns. 716-634-8500
NY Pittsford, EIL/Trott Elctrns. 716-586-8251
NC Charlotte, EIL/Trott Elctrns. 704-376-2237
OH Cuyanoga Falls, J. C. Hofstetter Co. ... 216-928-5313
OH Dayton, J. C. Hofstetter Co. 513-296-1010
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UT Centerville, Measurement Consits. 801-298-3388
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CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Vishay District Off. 619-690-5112
CO Colorado Springs, Dale Elctrns. Inc. Sls. 303-593-7529
CO Loveland, Dale Elctrns. Sls. 303-667-7500
CT Guilford, Kaelber & Mack 203-389-8643
FL Coral Springs, Graham Assocs. Inc. ... 305-775-6733
FL Melbourne, Graham Assocs. 305-773-6631
FL Palm Bch Gdns., Graham Assocs. 305-622-4049
FL W. Palm Bch., Bradford Elctrns. Inc. ... 305-641-4077
FL Winter Garden, Graham Assocs. 305-656-9369
GA Atlanta, JWL Assocs. 404-320-7643
IL Libertyville, Bradford Elctrns. Inc. 312-816-7900
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OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, LD Elctrns. 503-684-5571
PA Horsham, TMI 215-441-4300
TX Dallas, E. F. Aymond Co. 214-826-7620
TX San Antonio, E. F. Aymond Co. 512-675-8339
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, IRI 414-259-0965
Can Scarborough, Ont., Bradford Elctrns., Inc. 514-483-3812

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AL Huntsville, Schweber Elctrns. 205-895-0480
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AZ Phoenix, Wyle Distbn. 602-249-2232
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
CA Calabasas, Wyle Distbn. Grp. 213-322-9953
CA Canoga Pk., Schweber Elctrns. 818-999-4702
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Garden Grove, Bell Inds. 714-220-0681
CA Gardena, Bell Inds. 213-515-1800
CA Irvine, Schweber Elctrns. 714-863-0254
CA Irvine, Wyle Distbn. Grp. 714-863-9953
CA Los Angeles, Bell Inds. 213-826-6778
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, Wyle Distbn. Grp. 619-565-9171
CA San Jose, Schweber Elctrns. 408-946-7171
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Santa Clara, Wyle Distbn. Grp. 408-727-2500
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Denver, IEC 303-292-6121
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CT Danbury, Schweber Elctrns. 203-748-7080
CT Wallingford, Almo Elctrns. Corp. 203-269-6801
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 305-849-6060
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
GA Norcross, Schweber Elctrns. 404-393-9669
IL Elk Grove Vl, Bell Inds., Inc. 312-640-1910
IL Elk Grove Vl, Schweber Elctrns. 312-364-3750
IN Ft. Wayne, Bell Inds., Inc. 219-423-3422
IN Indianapolis, Bell Inds., Inc. 317-875-8200
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Overland Pk, Schweber Elctrns. 913-492-2921
MD Gaithersburg, MB Elctrns. 301-921-0200
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MD Jessup, Almo Elctrns. Corp. 301-670-0090
MD White Marsh, Resco/Baltimore, Inc. ... 301-529-0500
MA Bedford, Schweber Elctrns. 617-275-5100
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Bell Inds., Inc. 313-971-9093
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828
MO Earth City, Schweber Elctrns. 314-739-0526
MO Independence, Shelley-Ragon, Inc. 816-254-3410
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ S. Plainfield, Sterling Elctrns. 201-769-7000
NM Albuquerque, Bell Inds., Inc. 505-292-2700

NY Bohemia, Justin Elctrns., Inc. 516-589-4000
NY Rochester, Schweber Elctrns. 715-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Greensboro, Hammond Elctrns. 919-275-6391
NC Raleigh, Resco/Raleigh 919-781-5700
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Columbus, Hughes-Peters, Inc. 614-294-5351
OH Dayton, Bell Inds, Inc. 513-435-8660
OH Dayton, Bell Inds, Inc. 513-434-8231
OH Dayton, Schweber Elctrns. 513-439-1800
OK Tulsa, Schweber Elctrns. 918-622-8000
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Beaverton, Shelley-Ragon, Inc. 503-641-1691
OR Lake Osego, Bell Inds, Inc. 503-241-4115
PA Horsham, Schweber Elctrns. 215-441-0600
PA Mars, Almo Elctrns. Corp. 412-931-5990
PA McKean, Advacom, Inc. 814-476-7774
PA Philadelphia, Almo Elctrns. Corp. 215-698-4009
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-458-8253
TX Austin, Sterling Elctrns. 512-836-1341
TX Dallas, Schweber Elctrns. 214-661-5010
TX Dallas, Sterling Elctrns. 214-243-1600
TX Houston, Schweber Elctrns. 713-784-3600
TX Houston, Sterling Elctrns. 713-627-9800
UT Salt Lake City, Bell Inds, Inc. 801-972-6969
VA Charlottesville, Viginia Elec. Comps., Inc. 804-296-4184
WA Bellevue, Bell Inds, Inc. 206-747-1515
WA Redmond, Shelley-Ragon, Inc. 206-241-1980
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds, Inc. 414-547-8879
Can Alberta, Future Elctrns. 403-235-5325
Can British Columbia, Future Elctrns. 604-438-5545
Can Ontario, Future Elctrns. 416-638-4771
Can Ontario, Future Elctrns. 613-820-8313
Can Quebec, Future Elctrns. 514-694-7710

BRADY CO., 63 Middlesex Ave., Iselin, NJ 07083, Tel: 201-283-0400; *Sls. Mgr.:* Ed Brady; *Dist. Mgr.:* John Blaze

BRADY, W. H., CO., Indl. Prods. Div., 2221 W. Camden Rd., Milwaukee, WI 53201, Tel: 414-351-6630, TELEX: 26-677, TWX: 910-262-3151, FAX: 1-800-292-2229; *Sls. Mgr.:* M. O. Williamson; *Dist. Mgr.:* M. O. Williamson

BRADY, W.H., CO. NAMEPLATE DIV., See Brady, W.H., Co., Elctrn. Prods. Div

BRADY, W. H., CO., Xymox Div., 8225 W. Parkland Ct., P.O. Box 571, Milwaukee, WI 53201, Tel: 414-355-8300, TELEX: 26-677, TWX: 910-262-3151, FAX: 414-354-0453; FSC No.: 85480; *Sls. Mgr.:* F. P. Yorio

BRAEMAR CORP., 11400 Rupp Drive, Burnsville, MN 55337, Tel: 612-890-5135; Empl.: 130; *Sls. Mgr.:* A. J. Chan

BRAILSFORD & CO., 670 Milton Rd., Rye, NY 10580, Tel: 914-967-1820, FAX: 914-967-1836; Empl.: 25

BRAND DIELECTRICS, INC., Route 203, N. Windham, CT 06256, Tel: 203-423-6321; Empl.: 5; *Sls. Mgr.:* Philip Harvey

BRANDEN, T. G., CORP., 15822 S.W. Upper Bns. Fry. Rd., Lake Oswego, OR 97035, Tel: 503-620-7571; Empl.: 8; *Sls. Mgr.:* Curt Norby

BRANDT ELECTRONICS, INC., 815 E. Middlefield, Mountain View, CA 94043, Tel: 415-967-4944, FAX: 415-967-4105; FSC No.: 57837; Empl.: 52; *Sls. Mgr.:* Frank D. Brandt

BRAXTON MFG., Echo Lake Rd. N., P.O. Box 429, Watertown, CT 06795, Tel: 203-274-6781, TWX: 710-477-0621, FAX: 203-274-9195; Empl.: 115; *Sls. Mgr.:* Richard Rosa

BREEZE ILLINOIS INC

FAX: 303-693-3308

BREEZE-ILLINOIS, Trans Technology Corp., 8823 North Industrial Rd., Peoria, IL 61615-1584, Tel: 309-693-3322, TWX: 510-390-3691; Empl.: 180; *Sls. Mgr.:* Stanley Profiri ..... **C•1814-1815**

Local Sales Offices & Reps
CA Newport Beach, Camda 714-642-7281
CA San Diego, Camda 619-571-4818
CA San Jose, Camda 408-978-6718
CA Woodland Hills, Cal Ward Sls. 818-883-2202
CO Longmont, Todd & Fry Assocs. 303-776-7331
GA Atlanta, Pro Mark Prof. Mktg. Svcs. 404-393-2923
IL Hillside, Cadre Tech. Rep., Inc. 312-449-3900
MD Glen Burnie, Macrotech Assoc. 301-766-1111
MA Tewksbury, Sequel Assoc., Inc. 617-851-4010
MI Madison Heights, Pine Sls., Inc. 313-589-0350
MO St. Louis, Roth Kopf & Assoc., Inc. 314-961-4485
NJ Roebling, J. A. Kais Assoc. 609-499-9488
OH Bandalia, Cleary Sls. Co. 513-890-8642
OH Chagrin Falls, Pine Sls., Inc. 216-247-6198
PA Pittsburgh, Pine Sls., Inc. 412-456-7471
TX Collinsville, DeArmond Entprs. 817-267-2048
WA Bellevue, Lehr Assocs. 206-453-9993

BREN-TRONICS, INC., 10 Brayton Ct., Commack, NY 11725, Tel: 516-499-5155, TELEX: 22-1213 TTCUR, FAX: 516-266-2964; FSC No.: 51828; Empl.: 75; *Sls. Mgr.:* Don Fagon

BREVEL MOTORS, INC., Sub. Vernitron Corp., Broad & 16th Sts., Carlstadt, NJ 07072, Tel: 201-933-0220, TELEX: 642-606; Empl.: 300; *Sls. Mgr.:* Jack Dominice ..... **B•1198**

Local Sales Offices & Reps
AR El Dorado, Industrial Control Assocs. 501-862-2051
CA Los Angeles, Electric Motor Engrg. 213-469-7393
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Old Saybrook, M. L. Assocs. 203-388-9718
FL Altamonte Springs, Machine Controls 305-788-6607
IL Chicago, Jerry Golten Co. 312-792-1991
KS Prairie Village, Darco Sls. 913-381-7913
MA Ashland, M. L. Assocs. 617-485-6190
MN St. Paul, Vikeland Sls. 612-645-4647
NJ Teaneck, Herbert Rude & Assocs. 201-836-6778
NY Penfield, Upstate Comps. 716-381-6070
NC Raleigh, Leigh Sls. 919-872-1484
OH Bucyrus, Sissler & Assocs. 419-562-9311
OH Columbus, Sissler & Assocs. 614-488-4455
PA Exton, Kiley Elec. Co. 215-363-8550
TN Cleveland, Hicks Sls. 615-472-7398

Local Distributors
AZ Phoenix, Johnstone 602-269-9354
CA Baldwin Park, Johnstone 213-962-7138
CA Los Angeles, Minarik 213-624-3161
CO Denver, Johnstone 303-573-5626
CT Hartford, Brownell Electro 203-278-9000
FL Ft. Lauderdale, Johnstone 305-971-9350
GA Norcross, Johnstone 404-446-0400
ID Boise, Johnstone 208-377-1600
IL Chicago, Johnstone Supply 312-226-3033
KS Wichita, Johnstone 316-267-3629
LA New Orleans, Johnstone Supply 504-733-1495
MD Rockville, Johnstone 301-251-0281
MA Medford, Empire 617-395-5000
MI Farmington Hills, Universal Elec. Prod. 313-476-9500
MO Kansas City, Johnstone Corp. 816-842-3250
MT Billings, Johnstone Corp. 406-252-1207
NE Omaha, Johnstone Corp. 402-339-2342
NV Sparks, Johnstone Corp. 702-356-6668
NJ Cherry Hill, Motor and Control Sys. 609-424-5810
NY Woodside, Johnstone Supply 718-545-4896
OH Cleveland, Reserve Elec. 216-771-5764
OK Oklahoma City, Johnstone Corp. 405-232-8576
OR Portland, Johnstone Corp. 503-233-1151
TN Memphis, Johnstone Supply 901-324-1111
TX Dallas, Johnstone Supply 214-357-0835

BRIGGS, C. A., CO., P.O. Box 151, Glenside, PA 19038, Tel: 215-885-2244, TELEX: 83-4753; Empl.: 10; *Sls. Mgr.:* C. A. Briggs, Jr.

BRIM ELECTRONICS, P.O. Box 336 E, Fair Lawn, NJ 07410, Tel: 201-796-2886, FAX: 201-778-2792; FSC No.: 57834 ..... **C•1816-1825**

Local Sales Offices & Reps
MA Stow, R G Assocs. 617-897-7146
EXP NY, N.Y.C., Robum Agencies 212-989-5939

Local Distributors
AL Dothan, Carmichael Whls. Supp. 205-793-7066
CA Canoga Park, Tim-Co. Sls. 213-992-5040
CA San Diego, Shanks & Wright 619-239-0176
CT Manchester, IMS 203-649-4415
CT Waterbury, Century Elec. 203-755-0405
FL Lake Mary, Electronic Fasteners 305-321-4000
KS Topeka, Acme Radio Supp. Co. 913-235-1363
LA New Orleans, Radio Parts 504-581-5959
MA Billerica, Eastern Video Sys. 617-667-0009
MA Lexington, Wholesale Elect. Supp. 617-862-3590
MA Springfield, Electro-Term 413-734-6469
MA Waltham, Linear Elect. 617-894-7300
NH Dover, American Radio Corp. 603-742-6800
NJ Hackensack, Milcor 201-489-1313
NY LIC, H.L. Dalis 212-361-1100
NY N.Y.C., Center Indl. 212-YU9-6363
OK Tulsa, Radio, Inc. 918-587-9123
RI Newport, J & S Elctrn. Distb. 401-847-2977
TN Knoxville, Bondurant Bros. Co. 615-573-9151
TX Texarkana, Lavender Elec. 501-773-4631
TX Texarkana, McCulloch Elctrns. 214-792-6923
VT Cavendish, C S Svc. & Supp. Co. 802-226-7582
VA Norfolk, Todd Elec. 804-855-3111
WA Seattle, Amateur Radio Supp. 206-767-3222

BRINTEC CORP., Brand-Rex Cable Systems Division, 1600 W. Main St., Willimantic, CT 06226-1128, Tel: 203-456-8000, TELEX: 99-4444, TWX: 710-440-2247; FSC No.: 71124; Empl.: 1000; *Sls. Mgr.:* J. F. Cichy

Local Sales Offices & Reps
CA El Toro, Par Mktg. 714-768-6021,
CA Laguna Hills, Brand-Rex 714-830-4278
CA Palo Alto, Baribeault Assocs. 415-493-4441
CO Boulder, Component Prod. Sls., Inc. 303-530-2800
CT Manchester, Manu-Rep, Inc. 203-646-6064
GA Dunwoody, Brand-Rex Cable Sys. 404-578-0156,
IN Indianapolis, Insulation Reps. 317-251-1994
MD Hanover, J. A. Maguire & Co. 301-796-0970
MA Clinton, CWS, Inc. 617-368-8753
MI Farmington Hills, Joseph H. Clark Sls. Co. 313-553-0610
MN Edina, Grayden & Flemmer 612-941-1120
MO Chesterfield, Durnin & Assocs. 314-532-9774
NH Amherst, Modern Technlg. 603-482-5443,
NJ Dunellen, J. A. Maguire & Co. 201-752-8480
NJ Pennsauken, J. A. Maguire & Co. 609-665-5136
NY Syracuse, Brand-Rex Cable Sys. 315-469-3599,
OH Chagrin Falls, Joseph H. Clark Sls. 216-247-7848
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
SC Greenwood, Bamco 803-229-6801
TN Knoxville, Insul-Reps 615-691-7586
TX Plano, C. J. Tellier Co. 214-231-6348
VA Portsmouth, J. A. Maguire & Co. 804-398-0202
WA Redmond, Eclipse Mktg. Grp. 206-885-6991

BRISTOL BABCOCK INC., 1100 Buckingham St., Watertown, CT 06795, Tel: 203-575-3000, 800-243-3576, TELEX: 962417, FAX: 203-754-1477; Empl.: 600; *Sls. Mgr.:* Carlos Batista

BROOKS INSTRUMENT DIV., Emerson Elec. Co., 407 W. Vine St., Hatfield, PA 19440, Tel: 215-362-3500, TELEX: 4975082, FAX: 215-362-3745; Empl.: 1500; *Sls. Mgr.:* H. T. Lund, Jr.

BROOKS MANUFACTURING CORP., 4001 N. American St., Philadelphia, PA 19140, Tel: 215-228-4433; Empl.: 70; *Sls. Mgr.:* G. Brooks; *Dist. Mgr.:* G. Brooks

BROOKS POWER SYSTEMS, 1810 Byberry Rd., Bensalem, PA 19020, Tel: 215-244-0264, 1-800-523-1551; Empl.: 90; *Sls. Mgr.:* Joan LaRocca

BROWN BOVERI ELEC., Norristown Rd., Spring House, PA 19477, Tel: 215-628-7400, TWX: 510-661-0168; Empl.: 3,500

BRUEL & KJAER INSTRS. INC., 185 Forest St., Marlboro, MA 01752-3093, Tel: 617-481-7000, TWX: 710-347-1187, FAX: 617-485-0519; Empl.: 200

BRUNING COMPUTER GRAPHICS, P.O. Box 3020, 777 Arnold Dr., Martinez, CA 94553, Tel: 415-372-7568, TWX: 910-481-5951 ZETAPLOTS MART; FSC No.: 52893; Empl.: 200; *Sls. Mgr.:* Gary Hasenfus

BRUSH FUSES INC., 2070 Maple St., Des Plaines, IL 60018, Tel: 312-299-2211, TELEX: 726-453, FAX: 312-299-2272; FSC No.: 72076;F15160E; Empl.: 200

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BTU ENGINEERING CORP., 23 Esquire Rd., N. Billerica, MA 01862, Tel: 617-667-4111, TELEX: 94-7489, FAX: 617-667-9068; Empl.: 600; *Sls. Mgr.:* D. Barry/T. Campbell

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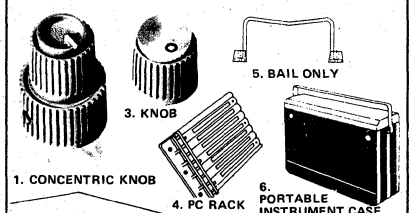

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BUCKEYE STAMPING CO., 555 Marion Rd., Columbus, OH 43207, Tel: 614-445-8433, FAX: 614-445-8224; Empl.: 85; *Sls. Mgr.:* Jim Willcox ..... **C•1019**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrns. Assocs.	714-551-4821
CA	Pasadena, P. Nurches Co.	213-681-8957
CA	Santa Clara, Engrg. Assocs.	408-988-5001
CO	Denver, Moss Mktg.	303-455-7205
FL	Indian Rock Bch., PAR Assocs., Inc.	813-596-8841
GA	Atlanta, Par Assoc.	404-391-9117
IL	Mt. Prospect, Robert Adams Sls.	312-297-8733
KS	De Soto, Midtec Assoc.	913-441-6565
MD	Columbia, Tyler Griffin Co.	301-995-1215
MA	Belmont, Elctrn. Comps. & Svc.	617-484-8680
MN	Minneapolis, A. J. Warner Co.	612-729-7371
MO	Florissant, Midtec Assocs., Inc.	314-837-5200
NJ	Ocean, P. Saftler Assocs.	201-922-3014
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Fulton, P. Saftler Assocs.	315-592-7184
NY	Lynbrook, P. Saftler Assoc.	516-593-7880
OH	Beechwood, Elctrn. Sls. Masters, Inc.	800-321-1848
OH	Columbus, McFadden Sls.	614-761-3177
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Forest Grove, Doran Sls. Assocs., Inc.	503-357-3333
PA	Paoli, T. Griffin Co.	215-647-1550
TX	Austin, Advance Tech. Sls.	512-440-7677
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
WA	Redmond, Doran Sls. Assocs., Inc.	206-885-1885

Local Distributors

CA	Los Angeles, Elect. Switches	213-664-1141
CA	Redwood City, Hi-Cor	415-368-3849
GA	Atlanta, Lakeland Engrg. Equip.	404-696-7334
MI	Ann Arbor, Wedemeyer Elctrns.	313-665-8611
MN	Albuquerque, Ideal Elctrn. Supp.	505-345-7887
NY	Hauppauge, Broadline Elctrn. Dist.	516-231-4100
OR	Portland, Radar Elec.	503-232-3404
TX	El Paso, Ideal Indl. Elctrn.	915-779-6647
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053

BUD INDUSTRIES, INC., 4605 E. 355th St., Willoughby, OH 44094-0431, Tel: 216-946-3200, TWX: 810-427-2604; FSC No.: 71218; Empl.: 200; *Sls. Mgr.:* Bill DeRoche; *Dist. Mgr.:* B. K. Haas

BUDWIG MFG., P.O. Box 829, Ramona, CA 92065-0829, Tel: 619-789-0900; Empl.: 7

BUEHLER PRODUCTS, INC., P. O. Box 33400, Raleigh, NC 27606, Tel: 919-469-8522, TWX: 510-924-2474; Empl.: 400; *Sls. Mgr.:* D. Frank Slightom ..... **C•1653**

BUGGIE H. H., See Caton Connector Corp.

BULBTRONICS, INC., 45 Banfi Plaza, Farmingdale, NY 11735, Tel: 516-249-2272, 1-800-654-8542; Empl.: 45; *Sls. Mgr.:* Elaine Gray; *Dist. Mgr.:* Diana Jacobson

BULOVA WATCH CO., See Frequency Control Prods., Inc., American Time Prods. Div.

BUMPER PRODUCTS CORP., 14 King St., P.O. Box 45, Mt. Holly, NJ 08060, Tel: 609-261-8100, 800-541-2500, FAX: 609-261-7300; *Sls. Mgr.:* Ed Rosenthal

BUNTING MAGNETICS CO., 500 So. Spencer Rd., Newton, KS 67114, Tel: 316-284-2020, 800-835-2526, TELEX: 437264, FAX: 316-283-4975; Empl.: 100; *Sls. Mgr.:* Robert J. Bunting

BURGESS SWITCH CO., American Electronic Components, 1010 N. Main St., Elkhart, IN 46515, Tel: 219-262-8608, FAX: 219-262-8819; FSC No.: 6U850; *Sls. Mgr.:* Robin Dick; *Dist. Mgr.:* Robin Dick ..... **B•1658-1660**

Local Sales Offices & Reps

CA	Mountain View, Westech Sls.	415-961-1422
CA	Tustin, Sierra Pacific Engrg.	714-731-3411
FL	Casselberry, Southern Elec. Sls. Corp.	305-332-4718
FL	Melbourne, Southern Elec. Sls. Corp.	305-242-9661
GA	Atlanta, Murphy and Cota	404-875-2525
IL	Des Plaines, Lincoln, Hodges and Assocs.	312-297-3810
KS	Mission, Mertens Co.	913-432-9323
MA	Cambridge, R.J.C. Assocs.	617-492-5858
MI	Royal Oak, Hilltronics	313-398-5556
MN	St. Paul, Kencotronics	612-645-7717
MO	St. Louis, Mertens Co.	314-993-6600
NJ	Palisades Park, A. P. Technical Sls.	201-461-8875
NY	Albany, Niagara Elec. Sls.	518-869-0130
NY	Buffalo, Niagara Elec. Sls.	716-825-3100
NY	East Syracuse, Niagara Elec. Sls.	315-437-1656
NY	Rochester, Niagara Elec. Sls.	716-271-1223
NC	Burlington, Murphy & Cota	919-584-6450
OH	Cincinnati, Anderson-Bolds, Inc.	513-528-5680
OH	Cleveland, Anderson-Bolds, Inc.	216-229-4700
OH	Worthington, Anderson-Bolds Inc.	614-885-3933
OR	Forest Grove, Doran Sls. Assocs.	503-357-3333
PA	Philadelphia, Kenneth B. Erdman, Co.	215-224-1833
TX	Houston, William Reese Assocs.	713-463-1453
WA	Redmond, Doran Sls. Assocs.	206-885-1885
WI	Janesville, Antek Mktg. Corp.	608-734-7745
WI	Waukesha, Lincoln, Hodges and Assocs.	414-542-3087

Local Distributors

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CA	Anaheim, Control Design Supp.	714-821-1516
CA	Fresno, Control Elec.	209-268-4411
CA	Long Beach, Elctrl. Power & Controls	213-498-6699
FL	Miami, B & R Elctrns. Supp. Inc.	305-255-4510
FL	Miami, Electro-Standards Labs	305-593-6060
FL	Oakland Pk., Zelcon Inc.	305-565-2555
IL	Chicago Heights, Helsel-Jepperson	312-756-5600
IL	Harvey, George Elctrns.	312-331-1983
MA	Fall River, Broadway Elec. Sls.	617-673-3339
MA	Holyoke, Falcetti & Clark Elec.	413-532-9402
MA	Medford, Empire Elec.	617-395-5000
MA	Springfield, Yankee Elec.	413-739-2101
MI	Grand Rapids, S & F Elctrns. Supp.	616-459-0216
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Elctrn. Center Inc.	612-371-5200
NE	Lincoln, Scott Elec. Supp.	402-446-8221
NH	Manchester, Cohen Machinery Co. Inc.	603-624-4324
NJ	Oakland, Relay Specialties	201-337-1000
NY	Gloversville, Montano Elctrl. Supp.	518-725-3139
NY	Roosevelt, Automated Equip. Co.	516-538-7417
NY	Woodside, Switches Unlimited	718-478-5000
NC	Durham, Triangle Elec. Motor	919-596-1333
NC	Gastonia, JMT Elctrns. & Control	704-867-4401
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
PA	Harrisburg, Cumberland Elctrns.	717-232-9715
PA	Philadelphia, Esco Elctrl. Supp.	215-923-6050
RI	Providence, J & H Elec. Co., Inc.	401-421-7840
SC	Greenville, Sawyer Elctrns. Corp.	803-235-0438
TX	San Antonio, Sherman Elec. Supp. Inc.	512-224-1004
VA	Roanoke, Peoples Elctrn. Supp.	703-342-8933
WI	Milwaukee, Midwestern Elec. Co.	414-449-1500

BURLEIGH INSTRUMENTS, Burleigh Pk., Fishers, NY 14453, Tel: 716-924-9355, TELEX: 978379; Empl.: 57; *Sls. Mgr.:* Timothy Van Slambrouck; *Dist. Mgr.:* Timothy Van Slambrouck

BURLING INSTRUMENTS, P.O. Box 298, Chatham, NJ 07928, Tel: 201-635-9481, FAX: 201-635-9530; Empl.: 29; *Sls. Mgr.:* Roger Nation

BURNDY CORPORATION, Richards Ave., Norwalk, CT 06852, Tel: 203-838-4444, TWX: 710-468-2546; Empl.: 3500; *Sls. Mgr.:* Stan Suszek

BURR-BROWN CORP., P.O. Box 11400, Tucson, AZ 85734, Tel: 602-746-1111, TELEX: 66-6491, TWX: 910-952-1111; Empl.: 1500; *Sls. Mgr.:* L. Davis/B. McGrath/J. Stoupa

BURTON ELECTRICAL ENGINEERING, Wyle Laboratories, 111 Maryland Street, P.O. Box 217, El Segundo, CA 90245-0217, Tel: 213-772-1406, TELEX: 858485, TWX: 910-348-6699, FAX: 213-322-3603; FSC No.: 81861; Empl.: 55; *Sls. Mgr.:* Nasir Shah

BUSINESS TIMEKEEPING SYSTEMS, INC., 170 Navajo St., San Marcos, CA 92069-2593, Tel: 619-744-3044; Empl.: 12; *Sls. Mgr.:* William W. Stephenson; *Dist. Mgr.:* William W. Stephenson

BUSSCO INC., 119 Standard St., El Segundo, CA 90245, Tel: 213-322-6580, TWX: 910-348-6295, FAX: 213-322-8130; FSC No.: 29593; Empl.: 55

Local Sales Offices & Reps

AZ	Tempe, Jarko	602-243-4387
CA	Los Angeles, Electrn. Tech. Assoc.	714-998-9241
FL	Ft. Lauderdale, IMR Inc.	305-942-2449,
MD	Rockville, Mechtronics Sls.	301-340-2130
MA	Brookline, Reliable Sls.	617-738-8305
MI	Jackson, Norwood Scroggs Co.	517-750-1170
NY	Great Neck, Trionics	516-466-2300
NY	Liverpool, Syronics Inc.	315-451-0968,
NC	Raleigh, L & D Inc.	919-876-5301,
PA	Hatboro, Jacobsen Assoc.	215-674-2937

BUSSMANN:COOPER INDUSTRIES, P.O. Box 14460, St. Louis, MO 63178, Tel: 314-394-2877, TELEX: 44 841; FSC No.: ;Multiple; Empl.: 3000; *Sls. Mgr.:* John Monter; *Dist. Mgr.:* John Monter ..... **C•1291**

BYTEK CORP., Instrument Systems Div., 1021 S. Rogers Circle, Boca Raton, FL 33431, Tel: 305-994-3520, FAX: 305-994-3615; Empl.: 45; *Sls. Mgr.:* Madeline Selwitz

BYTEX CORP., 120 Turnpike Rd., Southborough, MA 01772, Tel: 617-480-0840, TELEX: 951151; Empl.: 240; *Sls. Mgr.:* John Shoemaker

CABLESCAN, INC., Subsidiary of Eubanks Engrg. Co., 145 E. Emerson Ave., Orange, CA 92665, Tel: 714-998-1961, TELEX: 291693; *Sls. Mgr.:* Jerry Stephens

CABLE SYSTEMS, INC., 210 Broadway, Everett, MA 02149, Tel: 617-389-7080, TWX: 710-348-1760; FSC No.: 33426; Empl.: 175; *Sls. Mgr.:* Darrell Fernald ... **C•1826**

Local Sales Offices & Reps

CA	Santa Ana, Interconnect Engrg. Assoc.	714-852-1947
CA	Santa Clara, Caltronic Sls.	408-727-7552
CT	Tolland, TMR Corp.	203-872-3624
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Holden, G. T. Joyce	617-829-6521
NY	Commack, MTR Technlg.	516-543-1200
NY	Islip, ABS Assocs.	516-277-7101

CABLETEST PRODUCTS CO., 81 W. Wyoming Ave., Melrose, MA 02176, Tel: 617-665-2932; Empl.: 28; *Sls. Mgr.:* H. E. Holley; *Dist. Mgr.:* H. E. Holley

CABLEWAVE SYSTEMS, Celwave Systems, Inc., 60 Dodge Ave., North Haven, CT 06473, Tel: 203-239-3311, TWX: 710-465-0244; Empl.: 250; *Sls. Mgr.:* William Meola

CABLEX, INC., 96 Inverness Dr. E., Ste. J, Englewood, CO 80112, Tel: 303-792-5760, FAX: 303-792-3006; Empl.: 50; *Sls. Mgr.:* Reed C. Mulder; *Dist. Mgr.:* Reed C. Mulder

CABOT BERYLCO, DIV. OF CABOT CORP., See NGK Berylco, Div. of NGK Metals Corp.

CABTRON SYSTEMS INC.

FAX: 312-272-1095

CABTRON SYSTEMS, INC., 200 N. Anets Dr., Northbrook, IL 60062, Tel: 312-498-6090; Empl.: 45; *Sls. Mgr.:* Terry Pullega ..... **C•1020**

Local Sales Offices & Reps

CA	Northridge, XBX Sls., Inc.	800-874-3821
CA	Orange, XBX Sls., Inc.	714-998-8200
CA	San Diego, XBX Sls., Inc.	619-586-1577
CA	Santa Clara, Warren Assocs.	408-988-7762
CT	Cheshire, Meco, Inc.	800-225-3409
FL	Maitland, E.I.R.	305-660-9600
GA	Atlanta, REMCO	404-447-6937
GA	Lilburn, Phillip Matthews Corp.	404-381-1662,
KS	Wichita, Buckman & Assocs.	316-267-2052
MD	Silver Spring, Ansell Engrg.	301-949-1655
MA	Reading, Meco, Inc.	617-944-6660,800-225-3409
MI	Livonia, Lowell-Wendt	313-464-2722
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Charles, Buckman & Assocs.	314-947-4727
NV	Reno, Warren Assocs.	408-988-7762
NJ	Mt. Lakes, N.J. Comps. for Elctrns.	201-334-2921
NY	Johnson City, Tech-Mark	607-729-6340
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Kings, Phillip Matthews Corp.	919-983-9790,
OH	Cleveland, Geotronix	216-659-6100
OH	Dayton, Geotronix	513-854-5939
OR	Portland, McLaren, Inc.	503-297-2248
PA	Albrightville, Geotronix	412-487-1770
TX	Dallas, Dunbar Assocs.	214-239-7151
WA	Bellevue, McLaren	206-454-3400

CAC

FAX: 618-263-4295

CAC MICROCIRCUITS INC., 2 Southgate Dr., Mt. Carmel, IL 62863, Tel: 618-263-4343; Empl.: 95; *Sls. Mgr.:* Lloyd E.Dustmann ..... **A•1731**

Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls.	602-947-5745
CO	Boulder, Front Range Mktg.	303-443-4780
IA	Cedar Rapids, Dy-Tronix	319-377-8275
KS	Wichita, Dy-Tronix Inc.	316-838-0884
MN	Minnetonka, Gibb Elctrn. Sls.	612-935-4600
MO	Raytown, Dy-Tronix	913-229-6333
MO	St. Louis, Dy-Tronix	314-291-4777
NH	Amherst, D. A. Crowley & Assocs., Inc.	603-673-7050
UT	Salt Lake City, Front Range Mktg.	801-566-2500

CADDELL-BURNS MFG., 258 E. 2nd St., Mineola, NY 11501-3508, Tel: 516-746-2310; Empl.: 30 ..... **A•1208-1222**

CADDELL COIL CORP., 35M Main St., Poultney, VT 05764, Tel: 802-287-4055; Empl.: 6; *Sls. Mgr.:* James Caddell ..... **A•1223**

Local Sales Offices & Reps

FL	Vero Bch., R.B. Caddell	305-562-4496

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CADDOCK ELECTRONICS, INC., 1717 Chicago Ave., Riverside, CA 92507, Tel: 714-788-1700, TWX: 910-332-6108; FSC No.: 19647; Empl.: 300 ..... **A•1878-1901**

Local Sales Offices & Reps

OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OR	Beaverton, Elctrn. Sources	503-627-0838
WA	Bellevue, Elctrn. Sources	206-451-3500

Local Distributors

TX	Houston, Lenert Co.	713-225-1465

CADILLAC PLASTIC & CHEM. CO., Day International, 530 Stephenson Hwy., Troy, MI 48083, Tel: 313-583-1200, TWX: 810-232-1886, FAX: 313-583-4715; Empl.: 1000

CAIG LABS., 1175-0 Industrial Ave., Escondido, CA 92025, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 15

Local Distributors

CA	Hollywood, Yale Elctrns.	213-465-3186
DE	Wilmington, Wholesale Elctrn.	302-656-9988
FL	Miami, ESL Elctrn. Dist.	305-593-6060
IL	Champaign, Klaus Radio	217-356-1896
LA	Lafayette, Ralphs Elctrns. Supp.	318-233-0105
MO	Kansas City, Walters Indl. Elctrns.	816-531-7015
NY	New York, Argil Elctrns.	212-691-8111
VA	Norfolk, Priest Elctrns.	703-855-0105
VA	Norfolk, Radio Parts Distr. Co.	703-461-8095

CALABRO INDS., INC., See UNITRACK Div., Calabro Inds., Inc.

CAL-AV, INC., 515B Westchester Drive, Campbell, CA 95008, Tel: 408-371-0666; Empl.: 8

CALAY SYSTEMS, INC., 2698 White Road, Irvine, CA 92714, Tel: 714-863-1700, TELEX: 6711321, FAX: 714-863-0310; Empl.: 80

CAL COUNT, 101 H Executive Dr., Sterling, VA 22170, Tel: 703-471-0450, TELEX: 440732, TWX: 440733; Empl.: 35

CAL CRYSTAL LAB., INC., 1142 N. Gilbert, Anaheim, CA 92801, Tel: 714-991-1580, 800-854-XTAL, TWX: 910-591-1892; Empl.: 25; *Sls. Mgr.:* Herb Plumhoff

CALEX

FAX: 415-932-6017

CALEX MFG. CO., INC., 3355 Vincent Rd., Pleasant Hill, CA 94523, Tel: 415-932-3911, TELEX: 269888; FSC No.: 29988; Empl.: 75; *Sls. Mgr.:* Steve Corbett ..... **D•1008-1009, 1622-1626**

Local Sales Offices & Reps

AZ	Glendale, Aspen	602-931-9289
CA	Carson, AMASCO	213-516-8561
CA	Sunnyvale, AMASCO	408-733-8690
CT	Tolland, R.G. Assocs.	203-875-4201
MA	Lowell, R.G. Assocs.	617-458-9802
MA	Marshfield, R.G. Assocs.	617-837-3290
NJ	Marlton, Analectro Tech. Rep., Inc.	609-424-2883
NC	Raleigh, Geotronix	216-659-6100
OH	Trottwood, Geotronix	513-253-6700
OK	Tulsa, Spectra Sls. Corp.	918-665-8899
OR	Portland, Topp Engrg.	503-244-7265
PA	Allison Pk., Geotronix	412-487-1770
TX	Houston, Spectra Sls. Corp.	713-270-8212
TX	Richardson, Spectra Sls. Corp.	214-234-3600
VA	Alexandria, Analectro Tech. Rep., Inc.	703-823-1703
WA	Bellevue, Topp Engrg. Sls. Co.	206-747-5400

Local Distributors

OH	Richfield, Alpha Distr.	216-659-7100

CALIBRON INSTRUMENTS, Burton-Rogers Co., 220 Grove St., Waltham, MA 02154, Tel: 617-894-6440, FAX: 617-893-8393; Empl.: 14; *Dist. Mgr.:* W. Burton

CALIFORNIA AUTOMATION INC., 11815 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-452-1341

CALIFORNIA AVIONICS LABS., See Cal-Av, Inc.

CA DC CALIFORNIA DC

FAX: 805-498-8381

CALIFORNIA DC, 2150 Anchor Ct., Newbury Park, CA 91320, Tel: 805-499-3621; Empl.: 100; *Sls. Mgr.:* C. Paton; *Dist. Mgr.:* C. Paton ..... **D•1628-1630**

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MA	Wellesley Hills, Sturdy Corp.	617-235-2330
NY	Hicksville, L-Tronix	516-935-0220
TX	Houston, Prime Tech. Sls.	713-894-4161

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IL	Arlington, Coombs & Assocs.	312-439-9810
MA	Wellesley Hills, Target Elctrns.	617-235-2545
NY	Hicksville, L-Tronix	516-935-0220
OR	Wilsonville, Micro Power	503-694-5353
Can	Montreal, Que., Future Elctrns.	514-694-7710
Can	Ontario, RD Assocs.	416-444-0959

CALIFORNIA EASTERN LABS. INC., 3260 Jay St., Santa Clara, CA 95054, Tel: 408-988-3500, TELEX: 346393, TWX: 171197; Empl.: 100; *Sls. Mgr.:* Len Lea, Sls. Mgr.; *Dist. Mgr.:* Jim McAuley

California INSTRUMENTS

FAX: 619-279-8139

CALIFORNIA INSTRUMENTS, Amstar Electronics Group, 5125 Convoy St., Ste. 201, San Diego, CA 92111, Tel: 619-279-8620, 800-356-2244, 800-821-1634, TELEX: 695047 CALICO SDG; FSC No.: 16067; Empl.: 95; *Sls. Mgr.:* Don Chilcoat (Int'l) ... **D•2081-2083**

Local Sales Offices & Reps

AZ	Phoenix, Aztec Ent., Inc.	602-944-9185
CA	Huntington Beach, Sci. Dvcs. West	714-840-3501
CA	San Jose, Scientific Dvcs.	408-554-0455
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	305-724-0924
IL	Chicago, EIA, Inc.	312-298-2290
IN	Indianapolis, EIA, Inc.	317-257-7231
KS	Lenexa, Ramsey Assocs.	913-541-1007
LA	Metairie, Data Mktg. Assocs.	504-833-3655
MD	Rockville, Creative Mktg. Assocs.	301-251-4100
MA	Waltham, McBar Assocs.	617-890-0233
MN	Minneapolis, E.I.A., Inc.	612-374-5628
MO	St. Louis, Ramsey Assocs.	314-532-9386
NJ	Teaneck, Sci. Dvcs. East, Inc.	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NY	Albany, The Robert F. Lamb Co., Inc.	518-869-3355
NY	Buffalo, The Robert F. Lamb Co., Inc.	716-827-1111
NY	Rochester, The Robert F. Lamb Co., Inc.	716-323-1305
NY	Syracuse, The Robert F. Lamb Co., Inc.	315-455-2469
OH	Dayton, Hocker Assocs.	513-253-3642
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
OR	Beaverton, Northwest T&M	503-645-9000
PA	Springhouse, Sci. Dvcs. East	215-643-3335
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
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CALIFORNIA MICROWAVE, 990 Almanor Ave., Sunnyvale, CA 94086, Tel: 408-732-4000, TELEX: 35 2016, TWX: 910-339-9231, FAX: 408-732-4244; Empl.: 780

CALMARK CORPORATION

FAX: 818-287-7350

CALMARK CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-0451, TWX: 910-589-1540; FSC No.: 52094; Empl.: 80; *Sls. Mgr.:* Bruce Rockwell; *Dist. Mgr.:* Bruce Rockwell ... **C•1021**

Local Sales Offices & Reps

AL	Huntsville, Par Mktg.	205-859-5702
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Oceanside, Noo Rep. Tech. Sls.	619-941-0558
CA	San Gabriel, Calmark Corp.	818-287-0451
CA	San Jose, Calmark Corp.	408-998-2808
CO	Lakewood, Cristee-Meade	803-232-0287
CT	Bethel, Livera-Polk Assocs. Inc.	203-748-4639
FL	Goldenrod, Sunland Assocs.	305-365-9533
GA	Alpharetta, Par Mktg.	404-442-8858
IL	Elk Grove, Parcom Inc.	312-228-9046
KS	Lenexa, Midtec Assocs.	913-541-0505
MA	Needham, Component Technlgy.	617-449-8490
MI	Farmington Hills, W.R.Hummon	313-474-0661
MN	Minneapolis, Comps. Grp.	612-374-1250
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Cooperstown, Fitzelle Assocs.	607-547-9333
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
OH	Cleveland, Electronic Comps.	216-582-4440
OH	Miamisburg, Electronics, Inc.	513-866-3340
OR	Beaverton, LD Elctrns. Inc.	503-684-8221
PA	Telford, Dalbrook Corp.	215-723-3300
TX	Houston, Zonk & Assocs.	713-895-9131
TX	Richardson, Zonk Assocs.	214-238-7651
WA	Snohomish, LD Elctrns. Inc.	206-568-0511
EXP	Ireland/Cappoquin, Calmark Ireland, Ltd.	TLX 80066
EXP	San Gabriel, CA, Calmark Corp.	818-287-0451
PR	Santruce, SISCO	809-726-3137
Can	Islington, Ont., Pipe-Thompson Ltd.	416-236-2355

Local Distributors

AZ	Phoenix, Aero-Space Computer Supps.	602-582-2779
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fremont, Terminal Sls. Corp.	415-656-7722
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Denver, Solder Tec.	303-922-6214
FL	Largo, Lo-Dan	813-586-2851
FL	Longwood, Intertec Comps.	305-834-7777
IL	Elk Grove, Martec Assocs.	312-956-8090
MD	Beltsville, Petricko, Inc.	301-937-4960
MA	Haverhill, Cord	617-374-0100
MN	Minneapolis, Aero-Space Computer Supp.	612-884-4725
NJ	Sicklerville, Index	609-629-3158
NM	Albuquerque, Betatron	505-344-2381
NY	Elmsford, Multimetrics Co.	914-347-3667
NY	Endwell, Pryme-Line Distrs.	607-748-5200
TX	Dallas, Cypress Elctrns.	214-869-1435
TX	El Paso, International Elex.	915-598-3406
TX	Richardson, Zec Sls.	214-669-0895
WA	Bothell, Cypress Elctrns.	206-483-1144
Can	Mississauga, Ont., Rush Elex. Ltd.	416-677-7280

CALMAX CORP., 3410-C W. MacArthur Blvd., Santa Ana, CA 92704, Tel: 714-957-1299, TELEX: 67-8389, FAX: 714-957-3349; Empl.: 5; *Sls. Mgr.:* Yoshi Fukuda

CALMOS SYSTEMS INC., 20 Edgewater Street, Kanata, Ontario, Canada K2L 1V8, Tel: 613-836-1014, 800-267-7231, TELEX: 053-4501, FAX: 613-831-1742; Empl.: 39; *Sls. Mgr.:* Greg Gravelle; *Dist. Mgr.:* Greg Gravelle

CAL-POWER CORP., 140 Kansas St., El Segundo, CA 90245, Tel: 213-772-2171, TWX: 910-348-6678; Empl.: 30; *Sls. Mgr.:* James L. Dragomir

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CAL-TEK ENGINEERING, 36 Riverside Drive, Kingston, MA 02364, Tel: 617-585-5666; Empl.: 5

CAMBRIDGE AEROFLO INSTRUMENTS, INC., 900 Mount Laurel Circle, Shirley, MA 01464, Tel: 617-425-2346, TELEX: 948503, FAX: 617-425-2338; Empl.: 25 ... **C•1654**

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CO	Denver, Comp. Technlg., Inc.	303-758-5750
CT	Canton, Motoreps of New England	203-693-6366
MA	Needham, Motoreps of New England	617-449-3252
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NY	Rochester, Talty Assocs.	716-323-1210
WI	Racine, KMG Assocs.	414-639-9005

CAMBRIDGE ELECTRONICS LABORATORIES, 1b20 Chester St., Somerville, MA 02144, Tel: 617-629-2805, TELEX: 948580 RACE

CAMBRIDGE FILTER CORP., P.O. Box 4906, Syracuse, NY 13221-4906, Tel: 315-457-1000, TELEX: 322096; Empl.: 400-500

CAMBRIDGE INSTRUMENTS, INC., Optical Systems Division, P.O. Box 123, Buffalo, NY 14240, Tel: 716-891-3000, TELEX: 91-285 REICHERT BUF UW; Empl.: 650; *Sls. Mgr.:* Ronald Armstrong, VP Sls. & Mktg.

CAMBRIDGE PRODUCTS, 244 Woodland Ave., Bloomfield, CT 06002, Tel: 203-243-1761, 800-243-8814, FAX: 203-242-7006; Empl.: 32; *Sls. Mgr.:* Bill Pitcher; *Dist. Mgr.:* Bill Pitcher

CAMBRIDGE TECHNOLOGY, INC., 23 Elm Street, Watertown, MA 02172, Tel: 617-923-1181, TWX: 910-250-7539 CAMTECH BSN; Empl.: 25; *Sls. Mgr.:* E. Grenda

CAMELCO ASSEMBLY, 605136 Ontario Limited, 7400 Victoria Park Avenue, No. 1, Markham, Ontario, Canada L3R 2V4, Tel: 416-477-8269; Empl.: 39

C.A.M. GRAPHICS CO., INC., 15 Ranick Dr. W., Amityville, NY 11701, Tel: 516-842-3400, TWX: 510-224-6181, FAX: 516-842-1005; FSC No.: 63203; *Sls. Mgr.:* Tracy Delorio

CANADA WIRE AND CABLE LIMITED, 250 Ferrand Dr., Don Mills, Ontario, Canada M3C 3J4, Tel: 416-424-5000, TELEX: 065-24120, FAX: 416-424-1008; Empl.: 5,000; *Sls. Mgr.:* John Murphy (Long Beach)

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C & K COMPONENTS, INC., 15 Riverdale Ave., Newton, MA 02158-1082, Tel: 617-964-6400, TELEX: 92-2544, TWX: 710-335-1163; FSC No.: 09353; Empl.: 600; *Sls. Mgr.:* P. Kincaid; *Dist. Mgr.:* J. DeMarco ... **B•1662-1664**

Local Sales Offices & Reps

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AR	Little Rock, R.F. Kimball Co., Inc.	216-231-3447
CA	Los Altos, Ewing-Foley	415-941-4525
CA	Los Angeles, Universal Comps.	213-641-4255
CA	Roseville, Ewing-Foley, Inc.	916-969-2672
CO	Boulder, Front Range Mktg.	303-443-4780

CT	Glastonbury, Barton Assoc.	203-633-9417
FL	Boca Raton, Beacon Elctrns.	305-997-5740
FL	Clearwater, Beacon Elctrns.	813-796-2378
FL	Longwood, Beacon Elctrns.	305-332-1940
GA	Atlanta, Beacon Elctrns.	404-256-9640
IL	Elk Grove Vlg., Control Sls.	312-595-2110
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IN	Ft. Wayne, Technlg. Mktg. Corp.	219-432-5553
IA	Cedar Rapids, Dy-Tronix, Inc.	319-377-8275
KS	Leawood, Dy-Tronix, Inc.	919-339-6333
KS	Wichita, Dy-Tronix, Inc.	316-838-0884
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Randallstown, Beacon North, Inc.	301-478-2480
MA	Waltham, Gerber Sls. Corp.	617-890-3334
MI	Southfield, Rathsburg Assoc.	313-559-9700
MN	Minnetonka, Gibb Elctrns.	612-935-4600
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MO	Raytown, Dy-Tronix,Inc.	816-356-6340
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OH	Beachwood, Thompson & Assocs.	216-831-6277
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OH	Orient, Thompson & Assocs.	614-272-2086
OR	Tigard, LD Elctrns.	503-684-8221
PA	Wayne, Quality Comps.	215-687-3553
TX	Austin, R. F. Kimball Co., Inc.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Sterling Park, Beacon North	703-478-2480
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Thiensville, Control Sls.	414-242-4580
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Can	Pointe Clare, QUE, Avotronics, Ltd.	514-697-2135

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MI	Southfield, Rathsburg	313-559-9700
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NY	Latham, L-Tron	518-785-5032
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TX	Richardson, R. F. Kimball	214-231-3447
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CANYON electronics

FAX: 602-943-0739

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CAPCON, INC., 147 West 25th Street, New York, NY 10001, Tel: 212-243-6275; *Sls. Mgr.:* Ed Reeves; *Dist. Mgr.:* B. Cameron

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OH	Dayton, Lessis Assoc.	513-294-1551
PA	Southampton, Campbell Assoc.	215-322-6630
Can	St. Laurent, QUE, Tech-Rep Elctrns. Ltd.	514-337-6046

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CARDINAL CONTROL CO., 110 Kensington Rd., Kensington, CT 06037, Tel: 203-828-6379; *Sls. Mgr.:* L.E.P. Beatman; *Dist. Mgr.:* L.E.P. Beatman

CARDION ELCTRNS., See ISC Cardion Electronics, Inc.

CARDON CORP., One Exeter Plaza, Boston, MA 02116, Tel: 617-267-1760; Empl.: 10

CAREY ELECTRONIC ENGINEERING CO., 1880 Clifton Ave., Springfield, OH 45505, Tel: 513-323-6300; Empl.: 10-25

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Call toll free 1-800-243-8556 for locations of Representatives and Distributors.

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AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
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CA	Pleasant Hill, David Berryman	415-676-7788
CA	West Lake Village, Scott Johnson	805-497-0658
CO	Denver, Quorum 3 Sls. Grp.	303-696-8480
CT	Plainville, Carlingswitch, Inc.	203-793-9281
FL	Deerfield Beach, Florida Comp. Sls., Inc.	1-800-782-0224
FL	Tampa, Florida Comp. Sls., Inc.	813-960-5856
GA	Atlanta, CSR Elctrns.	404-396-3720
IN	Indianapolis, D-M Assoc.	317-842-4424
KS	Mission, Mertens Co.	913-432-9323
MD	Gaithersburg, Naudain Assocs.	301-258-5040
MA	Hopkinton, Berkshire Elctrns.	617-435-9356
MI	Lathrup Village, R. C. Nordstrom & Co.	313-559-7373
MN	Crystal, Technical Comp.	612-536-9512
MO	Clayton, Mertens Co.	314-993-6600
NH	Gonic, Berkshire Elctrns.	603-335-1897
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NJ	Union, Pacent Engrg.	201-687-7197
NY	Great Neck, Pacent Engrg.	516-482-4678
NY	Rochester, VDE Elctrns.	716-473-5015
NC	Siler City, Crossroads Elctrns. Assoc.	919-742-2372
OH	Columbus, Gerry Bryant	614-294-7103
SC	W. Columbia, Crossroads Elctrns.	803-859-1033
TX	Dallas, Control Comps.	214-458-8877
UT	Salt Lake City, Quorum 3 Sls. Grp.	801-943-9227
WA	Kirkland, Carlingswitch, Inc.	206-822-8834
WI	Mequon, Wm. Bolles Assocs.	414-241-3320
Can	Markham, Ont., Deskin Sls.	416-475-1412

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AL	Montgomery, Southern Controls	205-277-5030
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CA	Buena Park, Cypress Elctrns.	213-744-0355
CA	Gardenia, Cal Switch	213-770-2330
CA	Hayward, Electro Comps.	415-783-5800
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Van Nuys, Pacific Switch Controls	213-873-4802
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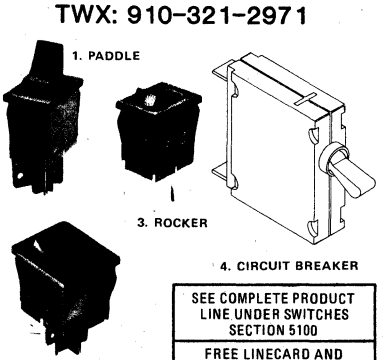

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NJ	Oakland, Relay Specialties	201-337-1000
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GA	Atlanta, Cartwright & Bean	404-368-0160
HI	Honolulu, West Pacific Agy.	808-395-3152
IL	Skokie, IRI, Inc.	312-967-8430
IN	Indianapolis, Electronic Reps. Inc.	317-894-1414
KS	Shawnee Mission, Lowell-Kangas	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MA	Seekonk, Rudolph Mktg.	617-399-6270
MI	E. Detroit, J. M. Thorpe	313-779-6363
MN	S. St. Paul, Northport Engrg.	612-457-8000
MO	St. Louis, Lowell-Kangas	314-821-4050
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NC	Raleigh, Cartwright & Bean	919-876-4130
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CASEMAKER DIVISION, Stebco Industries, Inc., 1020 West 40th Street, Chicago, IL 60609, Tel: 312-254-1221, TWX: 910-221-2470, FAX: 312-254-4030; FSC No.: 36-2405334; Empl.: 25; *Sls. Mgr.:* Allen E. Terman

CASSO-SOLAR, P.O. Box 163, U.S. Route 202, Pomona, NY 10970, Tel: 914-354-2500, TELEX: 475-4099, FAX: 914-362-1856; Empl.: 50; *Sls. Mgr.:* T. Corl

CATALYST RESEARCH, Mine Safety Appliances Co., 1421 Clarkview Rd., Baltimore, MD 21209, Tel: 301-296-7000, Ext. 304, TELEX: 898095; FSC No.: 00681; Empl.: 400; *Sls. Mgr.:* Edward S. Hatch, Jr.; *Dist. Mgr.:* Edward Hatch ..... **D•1442**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
CA	Los Angeles, Power Partners	213-215-0800
CA	San Diego, Power Partners	800-468-5400
CA	San Jose, M.T.S.R.& Co.	408-288-8862
CA	Santa Barbara, Power Partners	800-468-5400
FL	Brandon, R.C.Simon & Co.	813-689-6524
FL	Lighthouse Point, R. C. Simon & Co.	305-941-2757
GA	Norcross, Montgomery Mktg.	404-447-6124
IL	Palatine, T-Squared Assocs.	312-991-2144
KS	Overland Pk., Electri-Rep	913-649-2168
MA	Lincoln, W.H. Assocs.	617-259-8103
MI	Farmington Hills, W. R. Hummon & Assoc. Inc.	313-474-0661
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Electri-Rep	314-993-4421
NC	Cary, Montgomery Mktg.	919-467-6319
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
OR	Hillsboro, TAC Assocs.	803-648-6110
PA	Hickory, J.C.Hofstetter	412-356-2305
NC	Raleigh, Montgomery Mktg.	919-851-0010
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Assocs.	214-437-3355
TX	Houston, Kruvand Assocs.	713-780-9710
VA	Richmond, Glasscock Assocs.	804-740-0063
WI	Milwaukee, Key Entprs., Inc.	414-453-9462

Local Distributors

MD	Savage, Pyttronic	301-792-0780

CATEL TELECOMMUNICATIONS, 4050 Technology Pl., Fremont, CA 94537, Tel: 415-659-8988, TWX: 910-338-2263; Empl.: 150; *Dist. Mgr.:* Wendell Woody

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FAX: 617-585-2973

CATON CONNECTOR CORP., Jones River Indl. Pk., 20 Wapping Rd., Kingston, MA 02364, Tel: 617-585-4315, TWX: 710-391-7546; FSC No.: 52196; Empl.: 28; *Sls. Mgr.:* D. Galambos ..... **C•1296-1300**

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CA	Fullerton, ISI	714-773-0411
GA	Marrietta, Electro-Comp Sls., Inc.	404-992-2344
IL	Carol Stream, Chemistry, Ltd.	312-690-1736
MD	Ellicott City, Technical Sls.	301-461-2400
MA	Tewksbury, Sequal Assocs.	617-851-4010
MN	Minneapolis, Parker Shoap & Assocs.	612-934-5812
NM	Albuquerque, Westfahl & Assocs.	505-881-0995
OH	Cincinnati, Delta Sales	513-271-5444
OK	Tulsa, Barry Sls.	918-749-7775
OR	Portland, SPS Elctrns.	503-297-6919
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
WA	Redmond, SPS ELctrns.	206-323-4140
Can	Thornhill, Ont., RFQ, Ltd.	416-881-1976

CATRONIX CORP., 2298 Lower Roswell Rd. SE, Marietta, GA 30067, Tel: 404-977-8220; Empl.: 11; *Sls. Mgr.:* Dr. Charls Pearson

CCD IMAGING, Fairchild Weston Systems, Inc., 810 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-720-7600; *Sls. Mgr.:* Jim Johnson

C-COR ELCTRNS., 60 Decibel Rd., State College, PA 16801, Tel: 814-238-2461, TWX: 510-670-3513; FSC No.: 12775; Empl.: 385; *Sls. Mgr.:* A. B. McGuire

CDRL DATA, INC., 21642 North 9th Ave., Suite 103, Phoenix, AZ 85027-2823, Tel: 602-582-8844, FAX: 602-582-2199; FSC No.: 56060; Empl.: 25; *Sls. Mgr.:* James J. Edwards

CDS - COLORADO DATA SYS., 3301 W. Hampden, Unit C, Englewood, CO 80110, Tel: 303-762-1640, 800-CDS-ATE1, TWX: 910-933-0193; Empl.: 60; *Sls. Mgr.:* Louis Klahn

CEA DIVISION OF BERKLEONICS, INC., A Subsidiary of EG & G, 1 Aerovista Pk., San Luis Obispo, CA 93401, Tel: 805-544-5454, TWX: 910-351-6705; FSC No.: 04932; Empl.: 120; *Sls. Mgr.:* Jerry Satuloff

CEAG ELECTRIC CORP., 1324 Motor Pkwy., Hauppauge, NY 11788, Tel: 516-582-4422, TWX: 510-227-4904, FAX: 516-582-4922; FSC No.: 57973; Empl.: 175; *Sls. Mgr.:* John Apelian

CEC, 330 W. Taft Ave., Orange, CA 92665, Tel: 714-637-2970; Empl.: 50

CELCO, 70 Constantine Dr., Mahwah, NJ 07430, Tel: 201-327-1123, TWX: 710-988-1018; FSC No.: 05954; Empl.: 45; *Sls. Mgr.:* P. S. Christaldi

CELESCO TRANSDUCER PRODS., INC., 7800 Deering Ave., Canoga Pk., CA 91304, Tel: 818-884-6860, TELEX: 499-8137; *Sls. Mgr.:* Bart Gudmundson, Douglas VondenBenken

CELESTION INDUSTRIES, INC., 89 Doug Brown Way, Holliston, MA 01746, Tel: 617-429-6706, TELEX: 948417, FAX: 617-429-2426; *Sls. Mgr.:* David Derainian

CENTECH CORP., 200 W. 88th St., Minneapolis, MN 55420, Tel: 612-881-8245, TWX: 431-0015-L8M, FAX: 612-888-3073; *Sls. Mgr.:* Norton G. Saude

CENTENT CO., 3879 S. Main St., Santa Ana, CA 92707, Tel: 714-979-6491; Empl.: 12; *Sls. Mgr.:* A. Freimanis

CENTERFLEX TECHN. CORP., 221 Seventh Ave., P.O. Box 21, Hawthorne, NJ 07507, Tel: 201-423-0505, TWX: 710-988-4147; Empl.: 50; *Sls. Mgr.:* Rolf Fasth

CENTRALAB, See Mepco/Centralab

CENTRAL DATA CORP., 1602 Newton Dr., Champaign, IL 61821, Tel: 217-359-8010, TWX: 910-245-0787, FAX: 217-359-6904; Empl.: 75; *Sls. Mgr.:* N. E. MacGregor; *Dist. Mgr.:* Steve Nagele

CENTRAL MICROWAVE CO., Alpha Inds., Inc., 12180 Prichard Farm Rd., Maryland Heights, MO 63043, Tel: 314-291-5270, TELEX: 949436, TWX: 910-762-0649; FSC No.: 55729; Empl.: 120; *Sls. Mgr.:* William A. Ruff

CENTRE ENGINEERING, 2820 E. College Ave., State College, PA 16801, Tel: 814-237-0321, TWX: 510-670-3517; FSC No.: 51642; Empl.: 278; *Sls. Mgr.:* Roger Guisewite, Natl. Sls. Mgr.

CENTRONIC, INC., Morgan Crucible Co., Electronics Div., 1829 B DeHavilland Dr., Dept. E , Newbury Park, CA 91320-1702, Tel: 805-499-5902, FAX: 805-499-7770; FSC No.: 63334; Empl.: 20; *Sls. Mgr.:* George Pankau; *Dist. Mgr.:* Lou McCall

C. E. PRECISION ASSEMBLIES, 1031 W. Fremont Dr., Tempe, AZ 85282, Tel: 602-820-5596, FAX: 203-853-1815; FSC No.: 67810; Empl.: 10; *Sls. Mgr.:* Henry Richards

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NY	Stony Brook, Gama Metro, Inc.	516-751-2072

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Advanced Ceramic/Metal Technology

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CERAMASEAL, Box 260, New Lebanon, NY 12125, Tel: 518-794-7800, TELEX: 14-5442; FSC No.: 07601; Empl.: 89; *Sls. Mgr.:* Gene D. Sawin ..... **C•1301**

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CA	Atherton, Wadsworth/Bryant	415-321-3619
CA	Hacienda Hgts., Wadsworth/Bryant	818-330-5592
CO	Golden, J. F. Hurlbut Co.	303-279-7796
FL	Orlando, Physimetrics	305-894-8081
GA	Atlanta, Physimetrics	404-955-0155
IL	Mt. Prospect, Automation Equip. Co.	312-398-7550
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Baltimore, R. A. Wafer Assoc.	301-744-1133
MA	Boston, P-J Engrg. Sls.	617-783-0510
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Piscataway, Eastern Metro Assocs.	201-752-9292
NY	Farmington, Canavan-Scanlon Assoc.	716-924-7450
NY	Plainview, Eastern Micro Assocs.	516-931-1414
NY	Syracuse, Canavan-Scanlon Assoc.	315-437-1271
NY	W. Hempstead, Eastern Metro Assocs.	516-292-1131
NC	Charlotte, JWL Assoc.	704-541-5750
PA	Clairton, Kurt J. Lesker Co.	412-233-4200
PA	Feasterville, Knowles Assocs.	215-322-7100
TN	Knoxville, Physimetrics	615-966-7553
TX	Richardson, Spectra Sls.	214-234-3600
UT	Salt Lake City, J. F. Hurlbut	801-595-8818
WA	Seattle, J.J. Assocs.	206-246-6619

CERAMAWIRE, Box 1084, Cranford, NJ 07016, Tel: 201-276-1170; Empl.: 4; *Sls. Mgr.:* Edward Hamilton

CERAMIC MAGNETICS, INC., 87 Fairfield Rd., Fairfield, NJ 07006, Tel: 201-227-4222, TELEX: 138 730, FAX: 201-227-6735; Empl.: 90

CERA-MITE CORP., 1327 Sixth Ave., Grafton, WI 53024, Tel: 414-377-3500, TELEX: 62916271, FAX: 414-377-7309; Empl.: 215; *Sls. Mgr.:* Claude Marquardt

CERMETEK MICROELECTRONICS INC., 1308 Borregas Ave., Sunnyvale, CA 94088-3565, Tel: 408-752-5000, TWX: 910-379-6931, FAX: 408-752-5004; Empl.: 110; *Sls. Mgr.:* Ken Archbold

CES ELCTRNS., 2968 Avenue Z, Brooklyn, NY 11235; Empl.: 20

CETEC RAYMER, 13278 Ralston, Sylmar, CA 91342, Tel: 213-875-0423, FAX: 818-765-2534; Empl.: 56; *Sls. Mgr.:* Hugh T. Wilcox

CGRS MICROTECH, P.O. Box 102L, Langhorne, PA 19047, Tel: 215-757-0284; Empl.: 5; *Sls. Mgr.:* J. Swope; *Dist. Mgr.:* J. Swope

CGTI, 2 Windward Ave., White Plains, NY 10605, Tel: 914-949-3719, TWX: 710-568-1305; Empl.: 170; *Sls. Mgr.:* G. N. Snider

CHABIN CORP., 890 Fortress St., Chico, CA 95926, Tel: 916-891-6410, TWX: 910-536-1001; *Sls. Mgr.:* Peter Tunis ..... **C•1302-1303**

CHA INDUSTRIES, 3565 Haven Avenue, Menlo Park, CA 94025, Tel: 415-363-8011, TELEX: 334426, FAX: 415-363-8061; *Sls. Mgr.:* Jack Patten

CHALCO ENGRG. CORP., Chalco Industries, Inc., 15126 S. Broadway, Gardena, CA 90248, Tel: 213-321-0121, 213-323-5525, FAX: 213-323-0405; Empl.: 95; *Sls. Mgr.:* Steven Kierman, Dir. Sls.

CHANNEL INDUSTRIES, 839 Ward Dr., Santa Barbara, CA 93111, Tel: 805-967-0171, TELEX: 658416, FAX: 805-683-3420; Empl.: 75

CHANNEL MICROWAVE, TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, TELEX: 76266, FAX: 44-382-562643; Empl.: 30

CHAPMAN CORP., P.O. Box 10700, 125 Presumpscot St., Portland, ME 04104, Tel: 207-773-4726, TELEX: 493 1536 CHAP UI, FAX: 207-775-7369; Empl.: 35; *Sls. Mgr.:* David Hall

CHARLES RIVER DATA SYSTEMS, INC., 983 Concord St., Framingham, MA 01701, Tel: 617-626-1000, TELEX: 681-7373; Empl.: 170; *Sls. Mgr.:* David Greer; *Dist. Mgr.:* David Greer

CHARTPAK, 1 River Rd., Leeds, MA 01053, Tel: 413-584-5446; Empl.: 195

CHASSIS-TRAK, See General Devices

CHATHAM CONTROLS, 33 River Rd., Chatham, NJ 07928, Tel: 201-635-8892; FSC No.: 04814; Empl.: 11

CHATSWORTH DATA CORPORATION, 20710 Lassen St., Chatsworth, CA 91311, Tel: 818-341-9200; Empl.: 65; *Sls. Mgr.:* Hank Boehm ..... **D•1227**

CHEMTRONICS INC., 681 Old Willets Path, Hauppauge, NY 11788, Tel: 516-582-3322, 800-645-5244, TELEX: 968567, FAX: 516-582-3046; FSC No.: 21267; Empl.: 112; *Sls. Mgr.:* Louis Friedman; *Dist. Mgr.:* Scott Friedman

CHENANGO INDUSTRIES, INC., 200 Stage Road, Vestal, NY 13850, Tel: 607-748-1572, TWX: 510-252-0899, FAX: 717-879-4220; *Sls. Mgr.:* Rick Hammond

FAX: 714-838-4742

CHEROKEE INTERNATIONAL, INC., Core Industries, 2841 Dow Avenue, Tustin, CA 92680-7211, Tel: 714-544-6665, TWX: 510-101-0493; Empl.: 225; *Sls. Mgr.:* Lonnie Friend ..... **D•1634-1638**

Local Sales Offices & Reps

CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	619-549-9699
CA	Santa Clara, Cindel, Inc.	408-988-8331
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Ft. Lauderdale, Panamtech	305-587-3769
GA	Stone Mtn., Naylor Assocs.	404-498-6814
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IL	Prairie Vl, Lima & Assocs.	913-642-7471
IN	Indianapolis, Richmar Elctrns. Corp.	317-846-6383
MN	Minneapolis, Robt. W. Marshall Co., Inc.	612-929-0457
MO	Ferguson, Lima & Assocs.	314-521-0785
NH	Londonderry, Bennetron	603-432-9092
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Ithaca, Bob Dean, Inc.	607-257-1111
NY	Wappinger Falls, Bob Dean, Inc.	914-297-6406
NC	Resch. Triangle Pk., Naylor Assocs., Inc.	612-929-0457
OH	Richfield, Geotronix	216-659-6100
OH	Trotwood, Geotronix, Inc.	216-659-6100
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PA	Allison Pk., Geotronix, Inc.	412-487-1770

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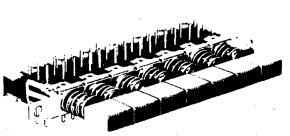

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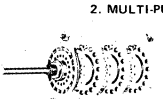

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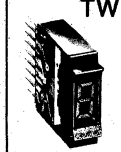
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AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Catec Future Elctrns. 602-968-7140
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AR Little Rock, Carlton-Bates 501-562-9100
CA Chatsworth, Cetec Future Elctrns. 818-700-0914
CA Compton, Harper S.I.D. 213-979-5090
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CA Los Angeles, Elec. Switches 213-660-1310
CA Oakland, Brill Elctrns. 415-834-5888
CA Sacramento, Integrated Elec. 916-424-5297
CA San Diego, Cetec Future Elctrns. 619-278-5020
CA San Diego, Harper S.I.D. 619-578-2500
CA San Jose, Cetec Future Elctrns. 408-434-1114
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CA Sunnyvale, Target Elctrns. 408-734-5611
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CT Wallingford, Midan Elec., Inc. 203-265-2077
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MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Walters Radio Supp. 816-531-7015
MO St. Charles, Finnigan Elctrns. 314-946-6201
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NJ Oakland, Relay Specialties, Inc. 800-526-5376, 201-337-1000
NM Albuquerque, Walker Elctrn. Supp. 505-883-2992
NY Buffalo, Summit Dists. 716-887-2800
NY Hempstead, Davis Elctrns. 516-483-9200
NY Rochester, Summit Dists. 716-334-8110
NY Westbury, Tennant Elctrns. 516-333-3930
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Can Mississauga, Ont., Prelco Elect., Ltd. .. 416-678-0401
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CHERRY SEMICONDUCTOR CORP, 2000 S. County Trail, East Greenwich, RI 02818, Tel: 401-885-3600, TELEX: WUI 6817157; FSC No.: WUI 6817157;;;401-885-5786; Empl.: 365

CHESSELL CORP., 1 Pheasant Run, Newtown, PA 18940, Tel: 215-968-0660, TELEX: 685-1130; Empl.: 65; *Sls. Mgr.:* D. Neal; *Dist. Mgr.:* C. Fetty

CHESTER CABLE, Alcatel, N. A., Oakland Ave., Chester, NY 10918, Tel: 914-469-2141, TWX: 510-249-4813, FAX: 914-469-9935; *Dist. Mgr.:* Peter P. Deschner

CHESTERFIELD PRODUCTS, 37 Midland Ave., Elmwood Park, NJ 07407, Tel: 201-797-9655; Empl.: 35; *Sls. Mgr.:* M. Perry ..... **A•1638**

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MA Randolph, Bengal Assocs. 617-961-4120
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NJ Elmwood Park, L & M Assocs. 201-797-0441
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TX Richardson, Carl Tinch Sls. Co. 214-231-1322
WA Seattle, Datacom Assocs., Inc. 206-285-2525

CHICAGO CONDENSER CORP., 2900 West Chicago Ave., Chicago, IL 60622, Tel: 312-227-7070

CHICAGO LASER SYSTEMS, INC., 4034 N. Nashville Ave., Chicago, IL 60634, Tel: 312-282-2710, TELEX: 671-1269, FAX: 312-282-8455; *Sls. Mgr.:* Bernard Alpiner, V.P.

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CHRISTIANSEN RADIO INC., 1950 San Remo, Laguna Beach, CA 92651, Tel: 714-497-1506; Empl.: 9

CHRISTIE
ELECTRIC CORP

FAX: 213-618-8368

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NM Albuquerque, Brytec Sls., Inc. 505-884-1123
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PA Pittsburgh, Carter, McCormic & Peirce 412-826-3800
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UT Murray, Butterworth Mktg. 801-268-2244
WA Seattle, Advanced Power Prod. 206-852-9558

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CHROMALOX INSTRS. & CONTROLS, 1382 Heil-Quaker Blvd., La Vergne, TN 37086-3536, Tel: 615-793-3900, TELEX: 55-5129; Empl.: 110; *Sls. Mgr.:* John Cox ..... **D•1124**

CHROMATICS, 2558 Mountain Ind. Blvd, Tucker, GA 30084, Tel: 404-493-7000, TWX: 810-766-8099

CHRONO-LOG CORP., 2 W. Park Rd., Havertown, PA 19083, Tel: 215-853-1130, TELEX: 831579; Empl.: 20; *Sls. Mgr.:* Frank Sherlock ..... **D•1078**

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CHRONOMITE LABS, 21011 S. Figueroa St., Carson, CA 90745, Tel: 213-320-9452; Empl.: 15

CHURCHILL CORP., 344 Franklin St., Box G, Melrose, MA 02176, Tel: 617-665-4700; FSC No.: 94867; Empl.: 30; *Sls. Mgr.:* W. Schermerhorn

CIMCO WIRE & CABLE, INC., See Specialty Cable Corp.

CINCH CYLINDRICAL DIVISION, Labinal Comps. & Systems, Inc., 8821 Science Center Dr., Minneapolis, MN 55428, Tel: 612-537-1010, TWX: 910-576-2748; *Sls. Mgr.:* Jim Simmons

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CA Culver City, Hamilton/Avnet 213-558-2800
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CINCINNATI ELCTRNS., 2630 Glendale Milford Rd., Cincinnati, OH 45241, Tel: 513-733-6100, TELEX: 21-4452, TWX: 810-464-8151; FSC No.: 80045; Empl.: 800; *Sls. Mgr.:* Kenneth Gilkey

CINCINNATI ELECTROSYS., 420 Wards Corner Rd., Loveland, OH 45140, Tel: 513-831-4347

CINCINNATI SUB-ZERO PRODS., 12011 Mosteller Rd., Cincinnati, OH 45241, Tel: 513-772-8810, TELEX: 214390 SUBZERO CIN, FAX: 513-772-9119; Empl.: 80; *Sls. Mgr.:* George Molenaar

CIPHER DATA PRODS., INC., P.O. Box 85170, San Diego, CA 92138, Tel: 619-578-9100, TWX: 910-335-1251, FAX: 619-549-8037; Empl.: 2000; *Sls. Mgr.:* Wes Bankston, VP Sls.; *Dist. Mgr.:* Wes Bankton

CIPRICO INC., 2955 Xenium Lane, Plymouth, MN 55441, Tel: 612-559-2034, FAX: 612-559-8799; Empl.: 73; *Sls. Mgr.:* Bill Rost

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CIRCUIT ASSEMBLY CORP., 18 Thomas St., Irvine, CA 92718-2703, Tel: 714-855-7887, TELEX: 183109UD; FSC No.: 52072; Empl.: 275; *Sls. Mgr.:* Edward Cadden

CIRCUITECH, INC., Division of Heyco, Inc., 542 Industrial Way West, Eatontown, NJ 07724, Tel: 201-542-6550, FAX: 201-542-1612; Empl.: 80; *Sls. Mgr.:* Jim Harrison

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CIRCUIT TECHNOLOGY INC., 160 Smith St., Farmingdale, NY 11735, Tel: 516-293-8686, TWX: 510-224-6555; Empl.: 600; *Sls. Mgr.:* Kurt Kuhl

CIR-Q-TEL, INC., 6600-04 Virginia Manor Rd., Beltsville, MD 20805, Tel: 301-946-1800, TWX: 710-828-0521, ESYLNK: 62756149, FAX: 301-949-1874; FSC No.: 21377; Empl.: 45

CIRRIS SYSTEMS, 1864 S. State, Ste 90, Salt Lake City, UT 84115, Tel: 801-466-6600, 800-424-7747, FAX: 801-487-7494; *Sls. Mgr.:* Brent Stringham ..... **D•1229**

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NY Hewlett, Metropolitan Sls. Co. 516-599-7900
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MO Raytown, Cen Tech, Inc. 816-358-8100
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TX Dallas, J. B. Guenther 214-691-8500
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MA Norwell, Bordewieck Eng. Sls. 617-659-4915
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NY Buffalo, Summit Distr. 716-884-3450
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SC Columbia, Dixie Radio 803-779-5332
TN Knoxville, Dixie Elctrns. 615-938-4131
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TX Richardson, Altair 214-231-5166
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CLARE DIVISION, General Instrument Corp., 3101 W. Pratt Blvd., Chicago, IL 60645, Tel: 312-262-7700, TELEX: 210075; Empl.: 2400; *Sls. Mgr.:* Dermot Brereton; *Dist. Mgr.:* Dermot Brereton ..... **B•1354, 1384-1385**

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FL Deerfield Beach, Sales Engrg. Concepts 305-426-4601
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IN Indianapolis, Schank Elctrn. Mktg. 317-842-6204
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NJ Palisades Park, Janco Technlg. 201-941-4008
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NY Syracuse, Electra Sls. Corp. 315-463-1248
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OH Dayton, Baehr-Greenleaf & Assocs. ... 513-439-0724
OH Lakewood, Baehr, Greenleaf & Assoc. 216-892-1770
OR Portland, Westmark Elctrns. Inc. 503-641-8780
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PA Evans City, Baehr-Greenleaf & Assocs. 412-776-2151
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TX Houston, Electra Reps 512-339-1163
UT Salt Lake City, Western Region Mktg. 801-486-1646
VA Sterling, Beacon North, Inc. 703-478-2480
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CLARKE-HESS COMMUNICATIONS RESEARCH CORP., 220 West 19th St., New York, NY 10011, Tel: 212-255-2940, TELEX: 238667-RAPID NYK; FSC No.: 34423; Empl.: 14 ..... **D•1230-1232**

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CLIFTON PRECISION, Litton Systems, Inc., Marple at Broadway, Clifton Hgts., PA 19018, Tel: 215-622-1000, TWX: 510-669-9782, FAX: 215-623-6344; FSC No.: 86197; Empl.: 1000; *Sls. Mgr.:* C.Scalies ..... **B•1200**

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TX Garland, Carey, McMahill & Assocs. ... 214-681-1414
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WA Bellevue, Vantage Corp. 206-455-3460,

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CML MACARR DIV., Marine Electric RPD, Inc., 666 Pacific St., Brooklyn, NY 11217, Tel: 718-857-2400, TELEX: 12-5327; FSC No.: 00062; Empl.: 100; *Sls. Mgr.:* Gary Mandell ..... **D•2084**

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Can Montreal, Metrone 514-483-2323,

CMV SOFTWARE SPECIALISTS INC., 5009 W. 12th St., Sioux Falls, SD 57106, Tel: 605-338-6645

COAST COIL CO., Coast Magnetics, 5333 W. Washington Blvd., Los Angeles, CA 90016, Tel: 213-936-6188, TELEX: 686103 AMI SPACE ASA; FSC No.: 05254; Empl.: 50

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COAXIAL DYNAMICS, 15210 Industrial Parkway, Cleveland, OH 44135, Tel: 1-800-COAXIAL, TELEX: 980630, FAX: 216-362-3804; Empl.: 40; *Sls. Mgr.:* R. J. Scott; *Dist. Mgr.:* J. R. Ittel

COAXITUBE CORP., 245 Naylor Mill Rd., Salisbury, MD 21801, Tel: 301-546-3911, FAX: 301-546-3913; Empl.: 10

COBER ELECTRONICS, 102 Hamilton Ave., Stamford, CT 06902, Tel: 203-327-0003, TWX: 710-474-3371; FSC No.: 28909; Empl.: 100; *Sls. Mgr.:* Saul Haffner

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CODENOLL TECHNOLOGY CORP., 1086 N. Bwy., Yonkers, NY 10701, Tel: 914-965-6300, TELEX: 646159; Empl.: 65; *Sls. Mgr.:* R.E. McInnis; *Dist. Mgr.:* E.H. Sakaguchi

CODI SEMICONDUCTOR, INC., 144 Market St., Kenilworth, NJ 07033, Tel: 201-298-0400, TELEX: 844-796; FSC No.: 16352;19500; Empl.: 48; *Sls. Mgr.:* Joe LaBruna; *Dist. Mgr.:* Joe LaBruna

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COGNITRONICS, 25 Crescent St., Stamford, CT 06906, Tel: 203-327-5307, TWX: 710-474-3523, FAX: 203-327-2002; Empl.: 180; *Sls. Mgr.:* Vincent Harrison

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COHERENT, INC., 3210 Porter Dr., Palo Alto, CA 94304, Tel: 415-493-2111, TELEX: 34-8304, FAX: 415-493-1566; Empl.: 1502; *Sls. Mgr.:* William Shiner/Paul Crosby

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Local Sales Offices & Reps
IN Fort Wayne, Walter W. Bieberich 219-432-2537
TN Fairview, Walter W. Bieberich 615-799-0120

COLE-HERSEE CO., 20 Old Colony Ave., Boston, MA 02127-2467, Tel: 617-268-2100, TELEX: 94-0901; *Sls. Mgr.:* Wesley L. Peterson

COLE
INSTRUMENT CORP

FAX: 714-241-9061

COLE INSTRUMENTS, 2650 S. Croddy Way, Santa Ana, CA 92704, Tel: 714-556-3100, TELEX: 678421; FSC No.: 31946; Empl.: 60; *Sls. Mgr.:* P. Hanson ..... **B•1676**

Local Sales Offices & Reps
AL Huntsville, Brandel-Stephens 205-883-0445,
AZ Scottsdale, Advent Comps. 602-481-0044
CA Anaheim, Gabriel & Assocs. 714-666-0660
CA Los Altos, Nickerson-Gray & Assocs. 415-941-5777
CO Parker, TMA Colorado Inc. 303-841-3435,
FL Deerfield Bch., Brandel-Stephens 305-427-5441,
FL Orlando, Brandel-Stephens 305-427-5441,
GA Atlanta, Brandel-Stephens 404-261-7579,
IL Rolling Meadows, Eagle Tech. Sls., Inc. 312-991-0700,
IN Ft. Wayne, Naunas Sls. Co. 219-432-4792,
MD Gaithersburg, Carwithen Assocs. 301-921-9545,
MA Norwood, Tom Maguire & Assocs. 617-551-0500,
MI Birmingham, Forand Sls. Co. 313-644-0087
MN Minneapolis, Design Technlg. Inc. 612-424-7605,
NJ Wayne, Howard Kagan & Assocs., Inc. 201-694-1115,
NY Scottsville, Floring & Assocs., Inc. 716-889-4614,
NC Greensboro, Brandel-Stephens 919-274-6952,
OH Hudson, Electro-Com 216-656-3273,
OR Portland, Westmark Elctrns. 503-641-8780,
PA West Chester, TCA 215-692-6853,
TX Dallas, Control Components Inc. 214-458-8877
UT Salt Lake City, TMA Colorado Inc. 801-483-1009,
WA Seattle, Westmark Elctrns. 206-281-4025,
Can Toronto, Ont., Wilson Entprs. 416-766-0510,

COLLINS AVIONICS DIVISIONS, Rockwell Intl., 400 Collins Rd. NE, Cedar Rapids, IA 52498, Tel: 319-395-1000, TELEX: 464-421, TWX: 910-525-1321; Empl.: 4,325; *Sls. Mgr.:* R.N. Thorpe

Collmer Semiconductor, Inc.

FAX: 214-233-0481

COLLMER SEMICONDUCTOR, INC., 14368 Proton Rd., Dallas, TX 75244, Tel: 800-527-0251, 214-233-1589, TWX: 910-860-5462; Empl.: 50; *Sls. Mgr.:* Gene Uecker ..... **A•2127-2129**

Local Sales Offices & Reps
TX Dallas, Collmer Semiconductor Inc. ... 800-527-0251
IL Des Plaines, Electron Mktg. Corp. 312-298-2330
IN Ft. Wayne, Arete Sls. Inc. 219-423-1478
IN Greenwood, Arete Sls. Inc. 317-882-4407
KS Lenexa, Midtec Assocs., Inc. 913-541-0505
CA S. Mission Viejo, Collmer Semiconductor Inc. 714-582-2188
MA N. Burlington, Omni-Rep 617-245-4511
MN Minneapolis, Loren Green Assocs. 612-571-6666
CA San Jose, Comtech Mktg. 408-294-5445
MO St. Louis, Midtec Assocs., Inc. 314-275-8666
NJ Nutley, Falk-Baker Assocs. 201-661-2430
NY Clark Mills, KLM Garner 315-853-6126
NC Cary, Tec Rep Svcs., Inc. 919-467-6444
NC Charlotte, Tec Rep Svcs. Inc. 704-342-3900
OH Beachwood, Elctrn. Salesmasters 216-831-9555
OR Portland, Elctrn. Engrg. Sls. 503-639-3978
PA Hatboro, Electro Rep 215-674-4421
RI Cumberland, Omni-Rep 401-333-2353
CO Golden, J. F. Hurlbut Co. 303-279-7796
TN Nashville, Tec Rep Svcs. Inc. 615-832-0449
TX Austin, Barry Sls., Inc. 512-837-3616
TX Houston, Barry Sls., Inc. 713-784-5860
CT Madison, Omni-Rep 203-421-4561
FL Oldsmar, Boggs & Assocs. 813-855-1812
TX Richardson, Barry Sls., Inc. 214-234-0255
VA Richmond, Glasscock Assocs. 804-740-0063
FL W. Palm Bch., Boggs & Assocs. 305-478-8062
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
WI Waukesha, Electron Mktg. Corp. 414-547-1505
GA Alphretta, Tec Rep Svcs., Inc. 404-594-8973
Can Mississauga, Ont., R-Theta Inc. 416-890-0221

Local Distributors
IN Carmel, Altex Elctrns., Inc. 317-848-1323
IL Chicago, NEP Elctrns., Inc. 312-625-8400

COLORADO CRYSTAL CORP.

FAX: 303-667-3500

COLORADO CRYSTAL CORP., 2303 W. 8th St., Loveland, CO 80537, Tel: 303-667-9248; FSC No.: 33096; Empl.: 105; *Sls. Mgr.:* David Lind ..... **A•1355-1357**

Local Sales Offices & Reps

CA Calabasas, Shel Schreiber Assocs. ... 818-703-8083
CA Los Altos, Kolm Mktg. Assoc. ... 415-948-2635
IA Cedar Rapids, Barnes Midwest Sls. ... 319-393-9790
KS Overland Park, Barnes Midwest Sls. .. 913-469-9688
MA Randolph, Bengal ... 617-961-4120
OR Beaverton, L. D. Elctrns. ... 503-649-6177
TX Austin, Oeler & Menelaides ... 512-453-0275
TX Dallas, Oeler & Menelaides ... 214-361-8876
TX Houston, Oeler & Menelaides ... 713-682-7001
WA Spokane, L. D. Elctrns. ... 509-922-4883

COLORADO DATA SYSTEMS, INC., 3301 W. Hampden Ave., Unit C, Englewood, CO 80110, Tel: 303-762-1640, TWX: 910-933-0193; Empl.: 70; *Sls. Mgr.:* Louis J. Klahn, Jr.

COLORADO VIDEO, INC., Box 928, Boulder, CO 80306, Tel: 303-530-9580, TWX: 910-940-3248, FAX: 303-530-9569; Empl.: 28; *Sls. Mgr.:* N. H. Bennett

COLORGRAPHIC COMMUNICATIONS CORP., New Peachtree Rd., P.O. Box 80448, Atlanta, GA 30366, Tel: 404-455-3921, FAX: 404-458-0616; Empl.: 50; *Sls. Mgr.:* Michael Parrish

COLUMBIA CHASE CORP., HUMISEAL DIV., See HumiSeal Div.

COLUMBIA COMPONENTS, 9 Division St., Sidney, NY 13838, Tel: 607-563-3520; FSC No.: 59178; Empl.: 12; *Sls. Mgr.:* Helen Montren

COLUMBIA ELEC. MFG., 4519 Hamilton Ave. N.W., Cleveland, OH 44114, Tel: 216-361-8060; Empl.: 60; *Sls. Mgr.:* H. W. Sussman

COLUMBIA ELCTRN. CABLES DIV., See Carol Cable Co., Inc., Columbia Elctrn. Cables Div.

COLUMBIA RESCH. LABS., Macdade Blvd. & Bullens La., Woodlyn, PA 19094, Tel: 215-872-3882, TWX: 510-669-3625, FAX: 215-872-3882; FSC No.: 07571; Empl.: 95; *Sls. Mgr.:* Jack Sarty

COLUMBUS ELECTRIC MFG. CO., Switch Division, Route 3, Box 90, Piney Flats, TN 37686, Tel: 1-800-251-7828, TELEX: 533090 CEMCO USA; Empl.: 160; *Sls. Mgr.:* John P. Lipscomb

COLUMBUS INSTRUMENTS, 950 N. Hague Ave., Columbus, OH 43204, Tel: 614-488-6176, TELEX: 246514; *Sls. Mgr.:* Jan Czekajewski

COMAIR ROTRON, A KLI Company, 12 North Street, Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496, TWX: 510-247-1941, FAX: 914-246-1176; FSC No.: 5Y921; Empl.: 800; *Dist. Mgr.:* Richard T. Bagg

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Phoenix, Westrep ... 602-997-8899
CA Anaheim, Westrep ... 213-404-3881
CA San Diego, Hadden Assocs. ... 619-565-9444
CA Santa Clara, Westrep ... 408-988-8833
CO Littleton, Lange Sls., Inc. ... 303-795-3600
FL Altamonte Springs, Semtronics ... 305-831-3233
FL Clearwater, Semtronics ... 813-461-4675
GA Norcross, Montgomery Mktg., Inc. ... 404-447-6124
IL (Northern), Sumer, Inc. ... 312-991-8500
IN Ft. Wayne, Frank J. Campisano Co. ... 219-486-6443
IN Indianapolis, Frank J. Campisano ... 317-253-7651
IA Cedar Rapids, S & O Sls. ... 319-363-7331
MD Columbia, L. D. Lowery, Inc. ... 301-381-0225
MA Chelmsford, J. E. Boeing Co. ... 617-256-5800
MI Southfield, Rathsburg Assocs., Inc. ... 313-559-9700
MN Mendota Hgts., G-II Sls., Inc. ... 612-454-3086
MO Bridgetown, Cen Tech, Inc. ... 314-291-4230
MO Raytown, Cen Tech, Inc. ... 816-358-8100
NJ Springfield, F. F. Sylvester Assocs. ... 201-376-3324
NY Saugerties, Comair Rotron, Inc. ... 914-246-3615
NC Cary, Montgomery Mktg., Inc. ... 919-467-6319
OH Cincinnati, Frank J. Campisano Co. ... 513-574-7111
OH Cleveland, Components, Inc. ... 216-243-9200
OK Tulsa, Ammon & Rizos Co. ... 918-663-8788
OR Beaverton, Evergreen Mktg. Grp. ... 503-643-8020
PA Broomall, L. D. Lowery, Inc. ... 215-356-5300
TX Austin, Ammon & Rizos Co. ... 512-454-5314
TX Houston, Ammon & Rizos Co. ... 713-781-6240
TX Richardson, Ammon & Rizos Co. ... 214-644-5591
UT Salt Lake City, Lange Sls., Inc. ... 801-487-0843
WA Seattle, Evergreen Mktg. Grp. ... 206-633-3160
WI Brookfield, Sumer, Inc. ... 414-784-6641
PR Hato Rey, Semtronics ... 809-766-0700
Can Hamilton, Ont., Cartwright/Southall Assocs., Inc. ... 416-528-0294
Can Montreal, PQ, McIntyre Agencies Ltd. ... 514-731-9617

Local Distributors

CA Garden Grove, Richey/Western Elctrns. ... 714-895-0060
IL Chicago, Newark Elctrns. ... 312-784-5100
MI Livonia, RS Elctrns. ... 313-525-1155
MN Minneapolis, Indl. Comps., Inc. ... 612-831-2666
NY Buffalo, Summit Distrs., Inc. ... 716-887-2800
NY Melville, Arrow/Kierulff Elec. Grp. ... 516-391-1510
NY Westbury, Schweber Elctrns. ... 516-334-7474
PA Philadelphia, Almo Elctrns., Inc. ... 215-698-4000
TX Dallas, Hall-Mark Elctrns. ... 214-553-4300
TX Ft. Worth, Allied Elctrns. ... 817-336-5401
WA Bellevue, Almac Elctrns. Corp. ... 206-643-9992
Can Montreal, Que., Preico Elctrns., Ltd. ... 613-726-1800
Can Scarborough, Ont., Carsten Elctrns. ... 416-495-7705
Can Willowdale, Ont., Electrosonic ... 416-494-1666

COMARK CORP., 93 W St., P. O. Box 474, Medfield, MA 02052, Tel: 617-359-8161, FAX: 617-359-2267; Empl.: 35

COMATEL USA, INC., 22 Eagle Rd., Commerce Pk., Danbury, CT 06810, Tel: 203-797-9445, TELEX: 643-011, FAX: 203-790-9298; *Sls. Mgr.:* Tim Papp

COMCLOK, INC., 1142 N. Gilbert St., Anaheim, CA 92801, Tel: 714-991-1580, 800-333-9825, FAX: 714-491-9825; Empl.: 27; *Sls. Mgr.:* Herb Plumhoff ... **A•1358**

Local Sales Offices & Reps

CA Arcadia, HMC ... 818-447-0958
CO Denver, Electrophase ... 303-296-0443
MA Malden, J-K Assocs. ... 617-321-2922
OR Portland, SPS Elctrns. ... 503-297-6919
TN McMinnville, B & D Mktg. ... 615-473-7155
TX Dallas, Bradenco ... 214-352-3554

Local Distributors

CA Sunnyvale, Target Elctrns. ... 408-734-5611

COMDATA CORP., 7900 N. Nagle Ave., Morton Grove, IL 60053, Tel: 312-470-9600, TELEX: 4931765

COMLINEAR CORP., 4800 Wheaton Drive, Fort Collins, CO 80525, Tel: 303-226-0500, TELEX: 45-0881; FSC No.: 62839; Empl.: 100; *Sls. Mgr.:* John Perzow

COMMUNICATION CABLES & CONNECTORS, The Dutton Co., 8255 Black Run Rd., Nashport, OH 43830, Tel: 614-828-2468; Empl.: 30; *Sls. Mgr.:* Don Ritterbusch; *Dist. Mgr.:* Don Ritterbusch

COMMUNICATIONS INSTRUMENTS, INC., P.O. Box 520, Hwy. 74 East, Fairview, NC 28730, Tel: 704-628-1711, TELEX: 577436; FSC No.: 58614; Empl.: 450; *Sls. Mgr.:* R. McClinton ... **B•1386-1393**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. Assoc. ... 205-883-9630
AL Huntsville, Time Elctrns. ... 205-721-1133
AZ Phoenix, CPS Assocs. ... 602-246-1097
AZ Tempe, Time Elctrns. ... 602-967-2000
CA Anaheim, Time Elctrns. ... 714-937-0911
CA Chatsworth, Time Elctrns. ... 818-998-7200
CA Long Beach, R D & D Sls. Engrg. ... 213-988-1116
CA San Diego, Time Elctrns. ... 619-586-1331
CA Santa Clara, Ross Mktg. ... 408-988-8111
CA Sunnyvale, Time Elctrns. ... 408-734-9888
CA Torrance, Time Elctrns. ... 213-320-0880
CO Denver, AKI Entprs. ... 303-388-4488
CO Englewood, Time Elctrns. ... 303-799-8851
CT Cheshire, Time Elctrns. ... 203-271-3200
CT Torrington, Phoenix Sls. ... 203-496-7709
FL Ft. Lauderdale, Time Elctrns. ... 305-974-4800
FL Orlando, Time Elctrns. ... 305-841-6565
FL Oviedo, Conley & Assocs. ... 305-365-3283
GA Atlanta, ElectroAir ... 404-351-3545
GA Norcross, Time Elctrns. ... 404-448-4448
IL Arlington Hts., MB Sls. ... 312-392-9499
IL Wood Dale, Time Elctrns. ... 312-350-0610
IN Ft. Wayne, Denton Mktg. ... 219-486-0665/1264
IA Cedar Rapids, C. H. Horn & Assocs. .. 319-393-8703
KS Lenexa, Midwest Tech. Sls. ... 913-888-5100
MD Coumbia, Time Elctrns. ... 301-964-3090
MD Ellicott City, Doss Elctrns. ... 301-465-1336
MA Needham, Component Technlg., Inc. .. 617-449-8490
MA Peabody, Time Elctrns. ... 617-532-6200
MI Grosse Pointe Park, Greiner Assocs., Inc. ... 313-499-0188
MN Bloomington, Time Elctrns. ... 612-532-1250
MN North Mankato, El Sls. ... 507-345-5786
MO St. Louis, Time Elctrns. ... 314-391-6444
NJ Pine Brook, Time Elctrns. ... 201-582-4611
NY E. Syracuse, Time Elctrns. ... 315-432-0355
NY East Rockaway, HLJ Comp. Tech. 516-599-2999
NY Hauppauge, Time Elctrns. ... 516-273-0100
NY Syracuse, M. M. Hare Co. ... 315-457-6859
NC Charlotte, Time Elctrns. ... 704-522-7600
NC Raleigh, Godwin Assocs. ... 919-878-8000
OH Cleveland, Arthur H. Baier Co. ... 216-461-6161
OH Dayton, Arthur H. Baier Co. ... 513-276-4128
OH Dublin, Time Elctrns. ... 614-761-1100
OR Beaverton, Quest Mktg., Inc. ... 503-641-7377
OR Portland, Time Elctrns. ... 503-684-3780
PA King of Prussia, Time Elctrns. ... 215-337-0900
TX Austin, Time Elctrns. ... 512-339-3051
TX Carrolton, Time Elctrns. ... 214-241-7441
TX Georgetown, Semco ... 512-863-2620
TX Houston, Time Elctrns. ... 713-530-0800
UT Salt Lake City, Time Elctrns. ... 801-973-8181
WA Bellevue, Quest Mktg. ... 206-747-9424
WA Redmond, Time Elctrns. ... 206-882-1600
Can Montreal, Que., Empro Sls. Co. ... 514-341-6420
Can Richmond Hill, Ont., Renmark Elctrns., Ltd. (Off. No. 1) ... 416-881-8844

Local Distributors

AL Huntsville, Time Elctrns. ... 205-721-1133
AZ Tempe, Time Elctrns. ... 602-967-2000
CA Anaheim, Time Elctrns. ... 714-937-0911
CA Chatsworth, Time Elctrns. ... 818-998-7200
FL Orlando, T & T Prods., Inc. ... 305-857-2282
MD Baltimore, Electronic Component Sls., Inc. ... 301-358-1900

COMMUNICATION TECHNIQUES INC., 36 Route 10, East Hanover, NJ 07936, Tel: 201-884-2580, TWX: 710-986-8265; FSC No.: 53213; *Sls. Mgr.:* Louis R. Trummel

COMPAC™

FAX: 516-585-3534

COMPAC, 1320-13 Lincoln Ave., Holbrook, NY 11741, Tel: 516-585-3400; FSC No.: 62099; Empl.: 35; *Sls. Mgr.:* Peter C. Rao ... **B•1677; C•1022-1025**

Local Sales Offices & Reps

GA Atlanta, EMA Inc. ... 404-448-1215
TX Dallas, Talo Products ... 214-644-6010
SC Greenville, EMA Inc. ... 803-233-4637
CA Westlake Village, CAL-Rep. ... 818-991-1940
AL Huntsville, EMA Inc. ... 205-837-7363
AZ Scottsdale, Territorial Mktg. ... 602-994-8665
CA Sunnyvale, ERI ... 408-996-8858,
IL Palatine, R-Tek ... 312-459-6170
IL Prospect Heights, R-Tek, Inc. ... 312-459-6170
IN Ft. Wayne, R-Tek, Inc. ... 219-432-8783
MA Haverill, L-K Assoc. ... 617-373-1313
MO St. Louis, Abrams & Assocs. ... 314-569-0447
NJ Sicklerville, Brown & Assocs. ... 609-629-2254
NC Raliegh, EMA Inc. ... 919-847-8800
VA Fairfax, Schibley Assocs. ... 703-591-3008

Local Distributors

CA Cupertino, Elctrn. Resources ... 408-996-8858

COMPACT POWER COMPANY, 17282 Orange Drive, Yorba Linda, CA 92686, Tel: 714-996-5826; *Sls. Mgr.:* Charles Lindberg ... **D•2090**

COMPACT SOFTWARE, INC., 483 McLean Boulevard, Paterson, NJ 07504, Tel: 201-881-1200, TELEX: 130073, FAX: 201-881-8361; FSC No.: 43304; *Sls. Mgr.:* Jerry Brocklehurst

COMPAR, D.G.W. Electronics Corporation, 85 Spy Ct., Markham, Ontario, Canada L3R 4Z4, Tel: 416-475-8500, TELEX: 06-966600, FAX: 416-475-4158

COMPEX CORP., Taunton Professional Park, 238 Taunton Blvd., Medford, NJ 08055, Tel: 609-596-9388, FAX: 609-596-3482; Empl.: 24

Local Sales Offices & Reps

CA North Hollywood, Crown Elctrns., Inc. ... 213-877-3550
CA Saratoga, E. Reid Miller, Corp. ... 408-257-6927
NH Amherst, Callahan Assocs. ... 603-883-9000
NJ Englewood, Cooper Assocs. ... 201-871-4985
NJ Morrestown, Stern Assocs. ... 609-234-0661
OH Lancaster, Cain-Forlaw Co., Inc. ... 614-654-4800
TX Dallas, Texas Avionics ... 214-363-6324
Can Neapean, Ont., Intrade Canada, Inc. ... 613-727-1272

COMPLEXX SYSTEMS, INC., Astrocom Corp., 4930 Research Dr., Huntsville, AL 35805, Tel: 205-830-4310; Empl.: 30; *Sls. Mgr.:* Kent Johnson; *Dist. Mgr.:* Bob Clacys

COMPLIANCE DESIGN INC., 593 Massachusetts Ave., Boxboro, MA 01719, Tel: 617-264-4668, TWX: 317-632-DASH, FAX: 617-263-7086; *Sls. Mgr.:* Harry Davis

COMPONENT GENERAL, INC., 13620 Wright Cir., Tampa, FL 33626, Tel: 813-855-6655, FAX: 813-855-2761; Empl.: 30; *Sls. Mgr.:* James A. Cook

Local Sales Offices & Reps

CA	Palo Alto, Mollard Mktg.	415-961-0456
DC	Washington, M. Lader Co.	202-296-2497
MA	Andover, Bee Assoc.	617-475-2124
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, R. H. Burton	816-763-5385
NY	Buffalo, Ed Westgren Assoc.	716-632-0011
NY	New Rochelle, Robert Diamond Inc.	914-632-2828
PA	Lafayette Hill, M. Lader Co.	215-825-3177
PA	Murrysville, Pittsburgh Sls. Assoc.	412-327-3268
EXP	CT, New Canaan, Control Devices	203-966-7311

COMPONENT MFG. SVC., INC., 1 Component Park, W. Bridgewater, MA 02379, Tel: 508-580-0111, FAX: 508-559-9893; Empl.: 600; *Sls. Mgr.:* Scott Allen; *Dist. Mgr.:* Wayne Douglas ..... **C•1304**

COMPONENT RESEARCH CO. INC., 1655-26 St., Santa Monica, CA 90404, Tel: 213-829-3615, TWX: 910-343-6864; FSC No.: 12517;Multiple; Empl.: 230; *Sls. Mgr.:* Sylvia Kellerman ..... **A•1031-1069**

COMPONENTS CORP., 6 Kinsey Pl., Denville, NJ 07834, Tel: 201-627-0290, FAX: 201-361-5801; FSC No.: 26364; Empl.: 20; *Sls. Mgr.:* W. H. Gordon ..... **C•1306-1307, 1703**

Local Sales Offices & Reps

CA	Laguna Niguel, SMC Sls.	714-240-8309
CA	Santa Cruz, LeRep	408-458-0667
FL	Orlando, EAB, Inc.	305-898-7444
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
MN	Hopkins, S. J. Collins & Assocs.	612-933-7661
NJ	New Brunswick, Synergy Sls.	201-828-5090
OH	Worthington, The Dynel Co.	614-436-9452
OR	Beaverton, LeRep	503-626-7978
TX	Dallas, deForest Sls. Co.	214-349-3290
EXP	France, Charles Thayer	33-50.73.69.13
Can	Mississauga, Ont., T. W. Wilson Sls.	416-677-8200

Local Distributors

AZ	Tempe, Control Design Supp.	602-829-7981
CA	Anaheim, Bisco Inds.	714-635-0380
CA	Anaheim, Control Design Supp.	213-802-2429
CA	Los Angeles, Strassner Sls. Co.	213-242-8823
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	San Carlos, Control Design Supp.	415-592-4808
CA	San Jose, Bisco Inds.	408-435-8980
FL	Altamonte Springs, Control Design Supp.	305-788-3220
GA	Stone Mtn., Control Design Supp.	404-979-3502
IL	Franklin Pk., Bisco Inds.	312-451-1230
IL	Genoa, Control Design Supp.	815-784-6519
IN	Indianapolis, Control Design Supp.	317-788-0551
IA	Marion, Control Design Supp.	319-373-2923
MA	Northboro, Papi Supp. Co.	617-393-3127
MA	Woburn, Bisco Inds.	617-938-8590
MN	Minneapolis, Control Design Supp.	612-721-1628
MO	St. Louis, Control Design Supp.	314-426-3150
NJ	Englewood, QC Elctrns.	201-569-0975
NY	Mt. Vernon, QAR Indl. Elctrns.	914-699-2224
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Centerville, Industrial Prods. Distbg.	513-435-2086
PA	Malvern, Control Design Supp.	215-296-0150
TX	Arlington, Bisco Inds.	817-640-7046
TX	Dallas, Control Design Supp.	214-358-0489
WI	New Berlin, Control Design Supp.	414-784-1016

COMPONENTS DIV., Sangamo Weston, Inc., Box 128, Pickens, SC 29671, Tel: 803-878-6311, TELEX: 57-0441, TWX: 810-397-2496; FSC No.: 00853; *Sls. Mgr.:* Bob Hand

COMPONENT SPECIALTIES CORP., 9143 E. La Rosa Dr., Temple City, CA 91780, Tel: 213-283-0015, FAX: 818-287-7189; FSC No.: 28984; Empl.: 45; *Sls. Mgr.:* D.R. Heins

COMPUCART, Versa Tec Corp., 107 N. Rome Ave., Tampa, FL 33606, Tel: 800-237-9024, 813-251-2431; Empl.: 25

COMPU-MECH INC., 5242 Angola Rd., Toledo, OH 43615, Tel: 419-535-6702, TWX: 510-601-7362, FAX: 419-535-0805; *Sls. Mgr.:* John Stanley III

COMPUMOTOR CORPORATION, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244

COMPUTALKER, Compuvoice, Inc., 1119 Colorado Ave., Ste. 115, Santa Monica, CA 90401, Tel: 213-393-7781; Empl.: 1; *Sls. Mgr.:* Lloyd Rice; *Dist. Mgr.:* Lloyd Rice

COMPUTER AVIONICS, See CAC Microcircuits, Inc.

COMPUTER CABLE & PRODS., INC., Vertex Computer Cable & Products

COMPUTER COMPONENTS INC.

FAX: 914-738-6706

COMPUTER COMPONENTS, INC., 629 Fifth Ave., Pelham, NY 10803, Tel: 914-738-1611; FSC No.: 12965; Empl.: 25; *Sls. Mgr.:* John Hunsicker; *Dist. Mgr.:* John Hunsicker ..... **B•1394**

COMPUTER CONVERSIONS CORP., 6 Dunton Ct., E. Northport, NY 11731, Tel: 516-261-3300, TWX: 510-226-0448, FAX: 516-261-3308; FSC No.: 51086; Empl.: 100; *Sls. Mgr.:* S. J. Renard ..... **D•1144-1145**

Local Sales Offices & Reps

CA	N. Hollywood, Crown Elctrns.	213-877-3550
CA	San Carlos, Cymatix	415-592-8076
IL	Hoffman Estates, Bu-Nell Engrg. Co.	312-843-8600
IL	Westmont, GnH Sls.	312-654-2535
IN	Mishawaka, Engrd. Sls.	219-255-5111
IA	Hoffman Estates, Bu-Nell Engrg.	312-843-8600
MA	Brookline, Technology Prod. Grp.	617-731-0858
MI	Newport, Industrial Sensors, Inc.	313-289-3374
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Moravia, Electrotech Sys.	315-497-1598
NC	Kanapolis, Bass & Assocs.	704-933-1762
OH	Cincinnati, Rilco	513-271-0630
PA	Ingoma, Greye Glass	412-366-6664
TX	Humble, Automated Dynamics	713-852-9500

COMPUTER DESIGN & APPLICATIONS INC., 411 Waverly Oaks Rd., Waltham, MA 02154, Tel: 617-647-1900, TELEX: 232-2240; *Sls. Mgr.:* Thomas Goliash

COMPUTER DEVICES, 749 Middlesex Turnpike, Nutting Lake, MA 01865, Tel: 617-663-4980, TELEX: 949398; Empl.: 60; *Sls. Mgr.:* Sandra R. Clark; *Dist. Mgr.:* Dick Leeman

COMPUTER DYNAMICS SALES, 107 S. Main St., Greer, SC 29651, Tel: 803-877-8700; *Sls. Mgr.:* Bruce Alexander

COMPUTER INSTRUMENTS, 100 Madison Ave., Hempstead, NY 11550, Tel: 516-483-8200, TWX: 510-222-4189, FAX: 516-483-8327; Empl.: 50; *Sls. Mgr.:* B. Peskin

COMPUTER MAINTENANCE CORP., 405 Murray Hill Pkwy, East Rutherford, NJ 07073, Tel: 201-896-0707, TELEX: 132-158; Empl.: 105; *Sls. Mgr.:* Arthur Young

FAX: 818-882-0492

COMPUTER OPTICAL PRODUCTS, INC., Sub. of Hathaway Corp., 9321 Eton Ave., Chatsworth, CA 91311-6910, Tel: 818-882-0424, TELEX: 18-33-73-UD; Empl.: 50; *Sls. Mgr.:* Neal Hinkle ..... **B•1883**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-533-5165
CA	Santa Clara, Fahmer-Miller Assocs.	408-727-9800
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Wethersfield, Underwood Sls., Corp.	203-563-3046
FL	Maitland, EIR, Inc.	305-660-9600
IL	Addison, Vikeland Sls.	312-832-8425
IN	Fort Wayne, Denton Mktg.	219-486-0665
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	St. Paul, Vikeland Sls.	612-645-4647
NC	Research Triangle Park, DHR Mktg.	919-781-1961
OH	Cincinnati, Stegman-Blaine Mktg., Inc.	513-729-1969
OH	Cleveland, Stegman-Blaine Mktg., Inc.	216-475-1515
OH	Vandalia, Stegman-Blaine Mktg., Inc.	513-890-7975
OR	Beaverton, General Elctrns.	503-641-5288
TX	Austin, R.F. Kimball Co., Inc.	512-443-5284
TX	Houston, R.F. Kimball Co., Inc.	713-840-0590
TX	Richardson, R.F. Kimball Co., Inc.	214-231-3447
UT	Layton, Dynatech, Inc.	801-546-4837
VA	Vinton, DHR Mktg.	804-359-8803
WA	Renton, General Elctrns.	206-228-9505

COMPUTER PERIPHERALS INC., 2635 Lavery Ct., Ste. 5, Newbury Pk., CA 91320, Tel: 805-499-5751, 800-854-7600, TELEX: 759299CPI, FAX: 805-498-8848; Empl.: 50; *Dist. Mgr.:* Mike Krunic

COMPUTER POWER INC., 124 W. Main St., High Bridge, NJ 08829, Tel: 201-638-8000, 800-526-5088, TELEX: 847481; FSC No.: 3643; Empl.: 185; *Sls. Mgr.:* J. Robert Hoeffler; *Dist. Mgr.:* J. Robert Hoeffler

COMPUTER PRODUCTS™ POWER CONVERSION

FAX: 305-971-7526

COMPUTER PRODUCTS INC., Power Conversion, 2900 Gateway Drive, Pompano Bch., FL 33069-4803, Tel: 305-974-5500; FSC No.: 62125; Empl.: 1900; *Sls. Mgr.:* Norm S. Berkowitz; *Dist. Mgr.:* Edward N. Bennett ..... **D•1096-1098, 1496, 1639-1674**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech Sls. Engrg.	205-880-0592
AZ	Scottsdale, Summit Sls.	602-998-4850
CA	Los Angeles, Wiley Co.	213-666-1611
CA	Ontario, Bytewide Mktg., Inc.	416-675-1868
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Criterion Mfrs. Reps.	408-988-6300
CO	Aurora, Electrodyne	303-695-8903
NC	Raleigh, Electromech Sls. Engrg. Co.	919-790-0104
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Atlanta, Electro-Mech Sls. Engrg.	404-447-6478
IL	Itasca, Janus, Inc.	312-250-9650
IN	Indianapolis, SAI Mktg. Corp.	317-545-1010
IA	Boise, Cascade Comps.	208-343-9886
KS	Leawood, Dy-tronix, Inc.	913-339-6333
KS	Wichita, Dy-tronix, Inc.	316-838-0884
MD	Columbia, Professional Reps.	301-381-7460
MA	Norwood, MPS Elctrns.	617-769-8700
MA	Woburn, Alpha Omega Sls.	617-933-0237
MI	Fenton, SAI Mktg. Corp.	313-750-1922
MN	Minneapolis, Stan Clothier Co.	612-944-3456
MO	Bridgeton, Dy-tronix, Inc.	314-291-4777
NJ	Hasbrouch Hgts., Comp-Tech. Sls.	201-228-7400
NM	Albuquerque, Summit Sls.	505-343-9886
NY	Binghamton, Empire Tech. Assocs.	607-772-0651
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Empire Tech	716-425-3775
NY	Skaneateles, Empire Tech	315-685-5703
NC	Raleigh, Zucker Assocs., Inc.	919-782-8433
OH	Columbus, SAI Mktg. Corp.	614-451-0778
OH	Dayton, SAI Mktg. Corp.	513-435-3181
OH	Shaker Hgts., SAI Mktg. Corp.	216-751-3633
OK	Tulsa, Ammon & Rizos	918-663-8788
OR	Beaverton, Micro Sls.	503-645-3754
PA	Erdenheim, Omni Sls., Inc.	215-233-4600
TN	Jonesville, Electromech Sls. Engrg. Co.	615-753-2964
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
UT	Salt Lake City, Electrodyne, Inc.	801-264-8050
WA	Bellevue, Micro Sls., Inc.	206-451-0568
WI	Milwaukee, Janus, Inc.	414-542-7575
Can	Lachine,Quebec, Bytewide Mktg., Inc.	514-636-4121
Can	Ottawa, Ont., Bytewide Mktg.	613-728-0031
Can	West Vancouver B.C., Blakewood Elctrns. Sys., Inc.	604-261-8099

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Marshall Inds.	205-881-9235
AL	Huntsville, Schweber Elctrns.	205-895-0480
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Phoenix, Schweber Elctrns.	602-997-4874
AZ	Tempe, Anthem/Lionex	602-966-6600
AZ	Tempe, Bell Inds.	602-996-7800
AZ	Tempe, Marshall Inds.	602-968-6181
CA	Canoga Park, Schweber Elctrns.	818-999-4702
CA	Chatsworth, Anthem/Lionex	818-700-1000
CA	Chatsworth, Marshall Inds.	818-407-4100
CA	El Monte, Marshall Inds.	818-459-5500
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	Gardena, Schweber Elctrns.	213-327-8409
CA	Irvine, Anthem/Lionex	714-768-4444
CA	Irvine, Marshall Inds.	714-458-5395
CA	Irvine, Schweber Elctrns.	714-863-0200/213-537-4321

CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Marshall Inds. 408-943-4600
CA Milpitas, Power Systems Distrs. 408-263-1063
CA Mtn. View, Bell Inds. 415-960-1440
CA N. Hollywood, B. J. Wolfe Entprs. 213-877-5518
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Roseville, Bell Inds. 916-969-3100
CA Sacramento, Anthem/Lionex 916-922-6800
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Anthem/Lionex 619-546-7893
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Marshall Inds. 619-578-9600
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Anthem/Lionex 408-295-4200
CA San Jose, B. J. Wolfe Entprs. 408-731-3433
CA San Jose, Schweber Elctrns. 408-432-7171
CA Sunnyvale, Bell Inds. 408-734-8570,408-773-1100
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Englewood, Anthem/Lionex 303-790-4500
CO Englewood, Schweber Elctrns. 303-799-0258
CO Thornton, Marshall Inds. 303-451-8383
CO Wheat Ridge, Bell Inds. 303-424-1985
CT Danbury, Schweber Elctrns. 203-748-7080
CT Meriden, Anthem/Lionex 203-237-2282
CT Wallingford, Marshall Inds. 203-265-3822
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Deerfield Bch., Bell Inds. 305-421-1997
FL El Monte Springs, Marshall Inds. 305-841-1878
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL Ovieda, Aztech Elctrns. 305-365-2241
FL Pompano Bch., Schweber Elctrns. 305-977-7511
FL St. Petersburg, Marshall Inds. 813-576-1399
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Marshall Inds. 404-923-5750
GA Norcross, Schweber Elctrns. 404-449-9170
IL Elk Grove, Bell Inds. 312-640-0474
IL Elk Grove, Schweber Elctrns. 312-364-3750
IL Elk Grove Vl, Anthem/Lionex 312-640-6066
IL Schaumburg, Marshall Inds. 312-490-0155
IL Urbana, Bell Inds. 217-328-1077
IN Fort Wayne, Bell Inds. 219-424-2433
IN Indianapolis, Bell Inds. .. 317-845-0737,317-299-5487
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Lexena, Marshall Inds. 913-492-3121
KS Overland Park, Schweber Elctrns. 913-492-2922
MD Columbia, Anthem/Lionex 301-381-0040
MD Columbia, Aztech Elctrs. 301-995-6800
MD Gaithersburg, Marshall Inds. 301-840-9450
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Wilmington, Anthem/Lionex 617-657-5170
MA Wilmington, Jaco Elctrns. 617-273-1860
MA Wilmington, Marshall Inds. 617-658-0810
MA Winchester, Bell Inds. 617-729-5800
MI Ann Arbor, Bell Inds. 313-971-9093
MI Livonia, LWC Distrs. 313-464-7700
MI Livonia, Marshall Inds. 313-525-5850
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MN Plymouth, Marshall Inds. 612-559-2211
MO Bridgeton, Marshall Inds. 314-291-4650
MO Earth City, Schweber Elctrns. 314-739-0526
NH Hudson, Bell Inds. 603-882-1133
NH Manchester, Schweber Elctrns. 603-625-2250
NJ Fairfield, Anthem/Lionex 201-227-7960
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Fairfield, Schweber Elctrns. 201-227-7880
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NM Albuquerque, Bell Inds. 505-292-2700
NY Farmingdale, Bell Inds. 516-752-9303
NY Hauppauge, Anthem/Lionex 516-273-1660
NY Hauppauge, Jaco Elctrns. 516-273-5528
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 607-798-1611
NY Rochester, Marshall Inds. 716-235-7620
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, Resco/Raleigh 919-781-5700
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beechwood, Schweber Elctrns. 216-464-2970
OH Dayton, Bell Inds. 513-435-6765
OH Dayton, Marshall Inds. 513-236-8088
OH Dayton, Schweber Elctrns. 513-439-1800
OH Solon, Marshall Inds. 216-248-1788
OH Westerville, Marshall Inds. 614-891-7580
OK Tulsa, Norvell Elctrns. 918-254-8606
OK Tulsa, Schweber Elctrns. 918-622-8000
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Anthem/Lionex 503-643-1114
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-241-4115
PA Horsham, Anthem/Lionex 215-443-5150
PA Horsham, Schweber Elctrns. 215-441-0600
PA Norristown, Century Elctrn. Comps. 215-631-5400
PA Pittsburg, Schweber Elctrns. 412-963-6804
PA Pittsburgh, Marshall Inds. 412-963-0441
TN Nashville, Bell Inds. 615-367-4400
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Norvell Elctrns. 512-837-5555
TX Austin, Schweber Elctrns. 512-339-0088
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Norvell Elctrns. 214-233-0020
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Marshall Inds. 713-895-9200
TX Houston, Norvell Elctrns. 713-777-1666
TX Houston, Schweber Elctrns. 713-784-3600
TX Richardson, Bell Inds. 214-690-0466
UT Salt Lake City, Anthem/Lionex 801-973-8555
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Marshall Inds. 206-747-9100
WA Redmond, Anthem/Lionex 206-881-0850
WA Spokane, Almac Elctrns. 509-924-9500
WI Brookfield, Marshall Inds. 414-797-8400
WI New Berlin, Schweber Elctrns. 414-784-9020
WI Waukesha, Bell Inds. 414-547-8879
Can Brampton, Ont., Zentronics 416-451-9600
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Calgary, Alta., Zentronics 403-272-1021
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Montreal, Que., Zentronics 514-737-9700
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Ottawa, Ont., Zentronics 613-226-8840
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Richmond, B.C., Zentronics 604-273-5575
Can Saskatoon, Saskatchewan, Zentronics 306-955-2202
Can Ste. Foy, Que., Future Elctrns. 418-682-5775
Can Vancouver, B.C., Future Elctrns. 604-294-1166
Can Winnipeg, Mani., Future Elctrns. 204-786-7711
Can Winnipeg, Mani., Zentronics 204-694-1957

COMPUTER SYSTEM ASSOCS., 7564 Trade St., San Diego, CA 92121, Tel: 619-566-3911, TELEX: 333693, FAX: 619-566-0581; Empl.: 15; *Sls. Mgr.:* Bill Reed; *Dist. Mgr.:* Bill Reed

COMPUTER SYSTEM PRODUCTS, 14305 21st Ave. N., Minneapolis, MN 55447, Tel: 612-476-6866, 800-422-2537, FAX: 612-476-6966; Empl.: 50; *Sls. Mgr.:* Tom Quanbeck; *Dist. Mgr.:* Tom Quanbeck

COMPUTER TERMINAL SYSTEMS, INC., 75 Mall Drive, Commack, NY 11725-5703, Tel: 516-864-5260, TELEX: 291411, FAX: 516-864-5878; Empl.: 50; *Sls. Mgr.:* Paul Onish

COMPUTERWARE, INC., 8480-I Tyco Rd., Vienna, VA 22180, Tel: 703-821-8200; Empl.: 18; *Sls. Mgr.:* Betsy Henderson

COMPUTERWISE, 302 N. Winchester, Olathe, KS 66062, Tel: 913-829-0600, TELEX: 705337; Empl.: 20; *Sls. Mgr.:* William W. Brown; *Dist. Mgr.:* William W. Brown

COMPUTROL, MODCOMP, an AEG Co., 15 Ethan Allen Hwy., Ridgefield, CT 06877, Tel: 203-544-9871, TELEX: 643358, FAX: 203-544-8833; Empl.: 85; *Sls. Mgr.:* C. R. Wolfe

COMPUTRON DISPLAY SYSTEMS, Xcel Corporation, 3100 New York Drive, Pasadena, CA 91107, Tel: 818-791-5600, TELEX: 67-5485, TWX: 910-588-3794; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1055**

COMSPEC INC., 10700 Hammerly, Suite 120, Houston, TX 77043, Tel: 713-461-4487, FAX: 713-461-8846; Empl.: 15; *Sls. Mgr.:* T. A. Paine; *Dist. Mgr.:* T. A. Paine

comstron corporation

FAX: 516-756-1167

COMSTRON CORP., 10 Hub Dr., Melville, NY 11747, Tel: 516-756-1100, TWX: 310-497-3525; Empl.: 120 ..... **A•1359, 1639; D•1234-1235**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 305-682-7317
AZ Phoenix, Tech. Mktg. Specialists 602-582-4800
CA Anaheim, Blair Assocs. 714-220-1201
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CA Woodland Hills, Southern CA Tech. Sls. 818-704-9087
CO Denver, Tech. Mktg. Specialists 303-691-5620
FL Longwood, Southern Mktg. Assocs. 305-682-7317
FL Satellite Bch., Southern Mktg. Assocs. 305-777-8629
GA Marietta, Southern Mktg. Assocs. 404-565-0603
IL Arlington Hgts., Dytec Central 312-394-3380
IN Indianapolis, Dytec Central 317-297-5988
KS Lenexa, Dytec South 913-888-0215
MD Rockville, Creative Mktg. 301-251-4100
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Lexington, R. J. Sickles 617-862-5100
MA Lexington, R.J. Sickles Assocs. 617-862-5100
MN New Hope, Baltz Assocs. 612-546-8520
MO Maryland Hgts., Dytec South 314-739-0665
NJ Teaneck, Sci. Dvcs. East 201-837-1004
NM Albuquerque, Tech. Mktg. Specialists 602-582-4800
NY Melville, Carnes Assocs. 516-694-1600
NY Whitney Pt., TAE-Rep 607-692-3705
NC Greensboro, Southern Mktg. Assocs. 919-282-6001
PA Horsham, Pennsylvania Sci. Dvcs. 215-956-0700
PA Springhouse, Pennsylvania Sci. Dvcs., Inc. 215-643-3335
WI Brookfield, Dytec Cen. 414-792-0320
WI Brookfield, Dytec Central, Inc. 414-792-0320
Can Ottawa, Ont., AIM Elctrns. 613-722-8286

COMTECH MICROWAVE CORP., Comtech Corp., 63 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-4646, TELEX: 221-234 CMTCH; FSC No.: 31196; *Sls. Mgr.:* J. Tardi

COM/TECH SYSTEMS, INC., 10 Halyard Rd., Valley Stream, NY 11581-2813, Tel: 516-791-1175; Empl.: 10

COMTEC INFORMATION SYSTEMS, INC., 53 John St., Cumberland, RI 02864, Tel: 401-724-8500, TWX: 710-387-1171; Empl.: 60; *Sls. Mgr.:* R. A. Hamilton

CONAP, INC., 1405 Buffalo St., Olean, NY 14760, Tel: 716-372-9650, TWX: 510-245-2769; Empl.: 120

CONCEPT INDUSTRIES, App-Rep, Inc., 3641 San Gabriel River Pkwy., Pico Rivera, CA 90660, Tel: 213-699-0918, 800-255-2666, FAX: 213-692-8947; Empl.: 25; *Sls. Mgr.:* Rosemary Martinez; *Dist. Mgr.:* Kathy Sawyer

CONCORD ELECTRONICS CORPORATION, 30 Great Jones St., New York, NY 10012, Tel: 1-212-777-6571, TWX: 710-581-4930, FAX: 1-212-995-0161; FSC No.: 18310; Empl.: 225; *Sls. Mgr.:* Josie Wheaton ..... **C•1308-1309, 1704**

CONDENSER PRODUCTS, 2131 Broad St., Brooksville, FL 34609, Tel: 904-796-3561, FAX: 904-799-0221; Empl.: 30; *Sls. Mgr.:* Bill Mason

CONDOR INC.
D.C. POWER SUPPLIES

FAX: 805-487-8911

CONDOR D.C. POWER SUPPLIES, INC., 2311 Statham Pkwy., Oxnard, CA 93033, Tel: 805-486-4565,, TWX: 910-333-0681; Empl.: 250; *Sls. Mgr.:* Dan Horan, VP Mktg.; *Dist. Mgr.:* Deborah Perez ..... **D•1676-1677**

Local Sales Offices & Reps

AZ Phoenix, CPS Assocs. Inc. 602-246-1097
CA Brea, Masco Elctrns. 714-529-0866
CA San Jose, QCI Assocs. 408-432-1070
CO Denver, AKI Entprs. 303-388-4488
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Schaumberg, Engrg. Prods. 312-882-7640
IN Greenfield, Engrg. Prods. 317-894-7156
IA Cedar Rapids, Palatine 319-365-8071
MA Taunton, Focus Elctrns. Sls., Inc. 617-824-3840
MI Southfield, L. H. Dickelman 312-353-8210
MN Edina, Engrg. Prods. 612-835-9022
MO Blue Springs, Palatine 816-229-4007
NJ Medford, Comp. Consits. 609-654-5300
NY Pittsford, C. W. Beach 716-586-3200
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Cincinnati, Stegman Blaine 513-729-1969
SC Greenville, RF Sls. 803-234-6931
TX Dallas, M Rep 214-349-5523

Can N. Vancouver, BC, Jerome & Francis 604-986-1286

Local Distributors

AL Huntsville, T.E. Southeast 205-830-0808
AZ Phoenix, Aerospace S.W. 602-582-2779
CA Anaheim, Pacesetter Elctrns. 714-779-5855
CA Bakersfield, Kern Elec. 805-327-5151
CA Costa Mesa, FLW 714-751-7512
CA Hayward, FLW 415-786-9070
CA Orange, Milgray 203-795-0711
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, Sierra West 408-747-1188
CO Westminster, Future Elctrns. 303-650-0123
FL Ft. Lauderdale, Allied 305-486-0500
FL Winter Pk., Milgray 305-647-5747
GA Decator, Allied 404-377-3555
IL Elgin, Allied 312-697-8200
IL Schaumberg, Engrg. Prods. 312-882-7640
KS Overland Pk., Milgray 913-236-8800
MD Columbia, Milgray 301-621-8169
MD Columbia, Vantage 301-621-8555
MD Marlow Hgts., Allied 301-423-0161
MD Wheaton, Brimberg Sls. 301-946-2760
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, Allied 617-942-0150
MI Ann Arbor, McNaughton-McKay 313-995-9515
MI Madison Heights, McNaughton-McKay 313-399-7500
MN Eden Prarie, Cassidy 612-944-0100
MN Edina, Engrg. Prods. 612-835-9022
MN Minneapolis, Aerospace Comp. Prod. 612-884-4725
NJ Marlton, Milgray 609-983-5010
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NY Buffalo, Summit Distr. 716-887-2800
NY Commack, Vantage 516-543-2000
NY Mineola, Allied 516-248-2360
NY Yonkers, Kintronics 914-968-7736
NC Raleigh, Allied 919-876-5845
OH Cleveland, Milgray 216-447-1520
OR Portland, Eoff 503-222-9411
TX Dallas, Cypress Elctrns. 214-869-1435
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Richardson, Future Elctrns. 214-436-2437
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Seattle, Allied 206-547-2827
WA Vancouver, Eoff 206-694-7504
Can Toronto, Ont., Duncan Inst. Ltd. 416-742-4448

CONDOR PACIFIC INDS., INC., 8053 Deering Ave., Canoga Park, CA 91304, Tel: 818-347-8331, TELEX: 65-1442, FAX: 818-713-0162; FSC No.: 24321; Empl.: 70

CONDOR SYSTEMS, INC., 2133 Branham Lane, San Jose, CA 95124, Tel: 408-371-9580, TELEX: 184819 Systems SANTA, FAX: 408-371-9589; FSC No.: 62065; Empl.: 150; *Sls. Mgr.:* Don Strandberg; *Dist. Mgr.:* Ed Brown

CONDUCTIVE RUBBER TECHNLG., 121 Gray Avenue, Santa Barbara, CA 93101, Tel: 805-965-6511, TELEX: 658-305, FAX: 805-963-2652

CONDUCTIVE SYSTEM, INC., R.D. No. 1, Box 1040, Rte. 5 South, Amsterdam, NY 12010, Tel: 518-843-5740, ESYLNK: 7105410104, FAX: 518-843-5829; *Sls. Mgr.:* John Severinsen

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs. 415-941-0660
CT Danbury, D. Setter 203-792-9446
GA Atlanta, Hi-Tech Sls. 404-641-8977
MD Baltimore, Bernie White & Co. 301-484-5400
MO St. Charles, Hayes Elec. 314-922-6607
NJ E. Windsor, Warren Engrg. Co. 609-443-3894
NY Amsterdam, Conductive Sys., Inc. 518-843-5740
NY Rochester, Canavan-Scanlon 716-424-1830
NY Syracuse, Canavan-Scanlon 716-424-1830
TX Dallas, Scanlon, Hughes & Assocs. ... 214-739-2888
Can Downsview, Ont., HAR-TECH 416-665-7290

CONEXCO INTERNATIONAL, 175-20 Hillside Avenue, Jamaica, NY 11432, Tel: 718-523-4100, TELEX: 230629 CONEX, TWX: 668657 CONEX, FAX: 718-291-1803; *Sls. Mgr.:* Mike Costello

CONFORMING MATRIX, Box 5126, Pt. Pl. Sta., Toledo, OH 43611, Tel: 419-729-3777; Empl.: 35

CONKLIN INSTRUMENT CORP., West Rd., Pleasant Valley, NY 12569, Tel: 914-635-2136, FAX: 914-635-2510; Empl.: 75; *Sls. Mgr.:* Steven Muise, VP Mktg.; *Dist. Mgr.:* Steven Muise, VP Mktg.

CONNECT-AIR INTERNATIONAL, INC., 50 37th St. N.E., Auburn, WA 98002, Tel: 206-939-4880, FAX: 206-939-4882; Empl.: 50; *Sls. Mgr.:* Ron Jones

CONNECTICUT HARD RUBBER CO., See CHR Inds.

CONNECTICUT MICROWAVE CORP., 106 Powder Mill Rd., Box 389, Canton, CT 06019, Tel: 203-693-4247; FSC No.: 50974; Empl.: 10; *Sls. Mgr.:* Michael DePalo

FAX: 312-539-3825

CONNECTOR CORP., 6025 N. Keystone Ave., Chicago, IL 60646, Tel: 312-539-3108, TWX: 910-221-6059; *Sls. Mgr.:* Diane Racana ..... **C•1310-1311**

CONNECTOR INDUSTRIES OF AMERICA DIV., Microdot Mfg., 639 N. Wayne, Cincinnati, OH 45215, Tel: 513-733-3680; FSC No.: 32076; Empl.: 35; *Sls. Mgr.:* K. C. Neal

FAX: 312-851-5040

CONNOR-WINFIELD CORP., 1865 Selmarten Rd., Aurora, IL 60505, Tel: 312-851-4722, TELEX: 270244; FSC No.: 21022; Empl.: 35; *Sls. Mgr.:* John Hoag ..... **A•1360-1363**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs. 205-881-9362
CA Agoura Hills, C.D.H. Assocs. 818-707-1970
CA Los Altos, Frauman Assocs. 415-941-0660
FL Melbourne, Reynolds & Assocs. 305-259-7000

CONOLOG CORP., 5 Columbia Rd., Somerville, NJ 08876, Tel: 201-722-8081, TELEX: 833281, TWX: 710-480-9340

CONRAC DISPLAY PRODUCTS GROUP, A Mark IV Industries Co., 1724 S. Mountain Ave., Duarte, CA 91010, Tel: 818-303-0095, TWX: 910-584-5913, FAX: 818-303-5484; Empl.: 450; *Sls. Mgr.:* William Ems, Dir. of Broadcast Sls.; *Dist. Mgr.:* Scott Newton, Dir. of Var. Sls.

Local Sales Offices & Reps

CA Berkeley, General Elctrns. Sys. 415-527-7700
CA Lawndale, Omega Video 213-679-9021
CO Bailey, Scientific Sys. 303-838-4615
GA Atlanta, Elctrn. Equip. 404-873-5842
IL Elk Grove Vlg., Swiderski Elctrns. 312-364-1900
KY Edgewood, Midwest Corporation 606-331-8990
MA Woburn, QSI Sys. 617-938-1403
MN Burnsville, Emmons Assocs. 612-890-8920
NY New York, L. Matthew Miller Assocs. .. 212-741-8011
PA Philadelphia, Lerro Elec. 215-223-8200
TX Dallas, MZB & Assoc. 214-233-5535
VA Arlington, Robert Slye Elctrns. 703-525-7272
WA Seattle, North-West Inds. 206-722-7400

CONSOLIDATED CONTROLS, 15 Durant Ave., Bethel, CT 06801, Tel: 203-743-6721, TELEX: 969615, TWX: 710-456-0446; FSC No.: 02750; Empl.: 926; *Sls. Mgr.:* A.F. Jakubauskas

Consolidated electronic wire & cable

FAX: 312-455-8837

CONSOLIDATED ELECTRONIC WIRE & CABLE, 11044 King St., Franklin Park, IL 60131-1412, Tel: 312-455-8830, TWX: 910-227-1705; FSC No.: 73612; Empl.: 85; *Sls. Mgr.:* Karl Rankin; *Dist. Mgr.:* Steve Boynton ..... **C•1828-1835**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls., Inc. 205-533-1735,
CA Downey, Mgt. Mktg. & Sls. 213-560-5584,
CA Los Gatos, Featherstone Sls. Co. 408-356-3243,
CA Pacifica, Featherstone Sls. Co. 415-355-3172,
CA San Diego, Mgt. Mktg. & Sls. 619-569-8611,
CT Hartford, Tulimieri Assocs. 203-525-3077,
FL Melbourne, Phoenix Comps. 305-723-4414,
GA Norcross, Elctrn. Sls., Inc. 404-448-6554,
IL Franklin Pk., Con. Elec. Wire & Cable 312-455-8830,
IL Highland Pk., Bransky Sls. 312-433-2375
IN Bloomington, Repptronics 812-334-0383
IA Cedar Rapids, R. W. Kunz & Assocs. .. 319-396-5386
KS Prairie Village, R. W. Kunz & Assocs. .. 913-648-3535
MI Warren, Burcaw Co. 313-573-4605
MN Minneapolis, Microelectronic Sls. 612-829-0948
MO St. Louis, R. W. Kunz & Assocs. 314-966-4977
NM Albuquerque, C.T. Carlberg & Assocs. 505-888-3883
NY Buffalo, NRM Mktg. Group 716-634-4300
NY Skaneateles, NRM Mktg. Group 315-685-8991
NY Whitestone, Jack Brown Elctrns. 718-767-1917,
NC Cary, Elctrn. Sls., Inc. 919-467-8486,
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
OR Milwaukie, Comtec Intl. 503-654-6626
PA Birchrunville, Jadelectronic Assocs. 215-296-3800,
TX Dallas, SW Mktg. Inc. 214-341-8631,
TX Houston, SW Mktg. Inc. 713-537-8166,
UT Salt Lake City, Advanced Control Equip. 801-972-9377,
WA Bellevue, Comtec Intl. 206-453-1188,

CONSOLIDATED RESISTANCE CO. AMERICA, 222 Lake Ave., Yonkers, NY 10701, Tel: 914-YO3-5900; Empl.: 20

CONSOLINK CORP., 1275 S. Sherman Dr., Longmont, CO 80501, Tel: 303-651-2014, TWX: 910-320-0786; Empl.: 40; *Sls. Mgr.:* Dan Zec; *Dist. Mgr.:* Gary Peck

Local Sales Offices & Reps

AZ Scottsdale, Digital Bus. Sys., Inc. 602-991-9831
CA Irvine, Western Gralex 800-854-8385
CO Englewood, B.C. Assocs. 303-694-3999
IL Rolling Meadows, Commodore 1, Inc. 312-394-5441
IA Des Moines, Beams 515-255-1148
MI Southfield, Robert Milsk Co., Inc. 313-354-3310
NY Saugerties, Beckrep 914-246-3031
Can British Columbia, CTron 604-432-9990

Local Distributors

CO Longmont, P.C. Peripherals 303-772-5370, 800-272-7355
CO Rolling Meadows, Commodore I, Inc. 312-394-5441
FL Deerfield, Richard Young Computers 305-426-8100,800-325-0136
FL Melbourne, Data Link Ready, Inc. 305-676-0500
MD Baltimore, Control Cable, Inc. 301-298-4411
MI Troy, Lyben Computer Sys. 313-589-3442
MT Great Falls, Inner City Dists. 406-727-6366
NY Hauppauge, Manchester Equip. Co. ... 516-435-1199
OH Painesville, Xponet, Inc. 216-354-6617
PA Exton, Bell Atlantic Bus. Supp. 215-265-6601
PA Pittsburgh, South Hill Elctrns. 412-921-9000

CONTACT, INC., 5 Elm Ave., Hudson, NH 03051, Tel: 603-883-7708; FSC No.: M07015; Empl.: 11; *Sls. Mgr.:* R. Reid; *Dist. Mgr.:* R. Reid

CONTACT EAST, 335 Willow St. S., P.O. Box 786, N. Andover, MA 01845, Tel: 617-682-2000, TELEX: 383088, FAX: 617-688-7829; *Sls. Mgr.:* Richard Sullivan

CONTACT ELECTRONICS, INC., 30 Plymouth St., Fairfield, NJ 07006, Tel: 201-575-7660, 800-221-1451, TELEX: 130-216; Empl.: 50; *Sls. Mgr.:* Thomas E. Bodnar; *Dist. Mgr.:* Jaime N. Korosler

CONTINENTAL ELECTRONICS, Division of Varian Associates, Inc., P.O. Box 270879, Dallas, TX 75227, Tel: 214-381-7161, TELEX: 73-398; FSC No.: 52151; Empl.: 480; *Sls. Mgr.:* R. L. Floyd, Domestic Broadcast

CONTINENTAL SPECIALTIES CORP., See Global Specialties Corp.

CONTINENTAL WIRE & CABLE, Gulton Rd., P. O. Box 1863, York, PA 17405, Tel: 717-792-2644, TELEX: 84-0437; Empl.: 250; *Sls. Mgr.:* Edward W. Holland III; *Dist. Mgr.:* Shirley A. Eisenhart

CONTOURS INC., 290 Pratt St., Meriden, CT 06450, Tel: 203-237-8331; FSC No.: 033501; *Sls. Mgr.:* Richard Nokes

CONTRAVES GOERZ CORP., 610 Epsilon Dr., Pittsburgh, PA 15238, Tel: 412-967-7700, TELEX: 86-6237, TWX: 710-664-2082; FSC No.: 51261; *Sls. Mgr.:* Henry M. Voss; *Dist. Mgr.:* Ronald L. Ekas

CONTROL CABLE, INC., 7261 Ambassador Rd., Baltimore, MD 21207, Tel: 301-298-4411, FAX: 301-265-1646; FSC No.: 510124759; Empl.: 90; *Sls. Mgr.:* Greg Jones; *Dist. Mgr.:* Greg Jones

CONTROL CONCEPTS CORP., P.O. Box 1380, Binghamton, NY 13902-1380, Tel: 607-724-2484, TELEX: 62224380, FAX: 607-722-8713; Empl.: 41; *Sls. Mgr.:* Pat Gillette, VP Sls.; *Dist. Mgr.:* Fred Zack

CONTROL DATA CORP., P.O. Box O, Minneapolis, MN 55440, Tel: 1-800-828-8001 Operator 82, In MN 612-921-4400, FAX: 612-853-6748; Empl.: 6623; *Sls. Mgr.:* J. Repp; *Dist. Mgr.:* R. L. Kamps

CONTROL DISPLAYS, INC., 3075 Advance Lane, P.O. Box 227, Colmar, PA 18915, Tel: 215-822-3383, FAX: 215-997-1232; FSC No.: 27878; Empl.: 65; *Sls. Mgr.:* L. Rodrigue ..... **B•1010, 1046, 1813**

CONTROL ELECTRONICS, Neurotech Corp., 139 Florida St., Farmingdale, NY 11735, Tel: 516-694-0125, FAX: 516-694-0133; FSC No.: 95924; Empl.: 60; *Sls. Mgr.:* Harold Goldstein; *Dist. Mgr.:* Barbara Kilroy .... **A•1534**

Local Sales Offices & Reps

CA	Sherman Oaks, R.T. Assocs.	213-788-7588
FL	Melbourne, VPI	305-768-9349
FL	Tampa, VPI	813-832-2041
IL	Chicago, Electro-Tech Mktg. Assoc.	312-676-3151
MD	Ellicott City, VPI	301-461-2525
MA	Malden, JK Assocs.	617-321-2922
PA	Montgomeryville, Rufo Sys. Comp.	215-368-8495
TX	Dallas, Texas Avionics Co.	214-363-6324
WI	Brookfield, Electro-Tech Mktg. Assocs.	414-785-9554
EXP	FL, Hallandale, Emec	305-925-6366

CONTROL ENGRG., INC., 1686 Riverdale St., West Springfield, MA 01089, Tel: 413-781-1330; Empl.: 7; *Sls. Mgr.:* Mark Kimball

CONTROLEX, INC., Francestown Turnpike, New Boston, NH 03070, Tel: 603-487-5512, TELEX: 174094 FNB PETERBORO on TRT; Empl.: 7

CONTROLEX/EANCO, See Fincor

CONTROL INDS. INC., 530 Burnside Ave., Inwood, NY 11696, Tel: 212-471-9800; Empl.: 40

CONTROL LASER CORP., 7503 Chancellor Dr., Orlando, FL 32809, Tel: 305-438-2500, TELEX: 514215; Empl.: 130; *Sls. Mgr.:* Bob Sigman, VP Sls./Mktg.

CONTROLLED ENVIRONMENTAL EQUIPMENT CORP., 3 Delta Drive, Westbrook, ME 04092, Tel: 207-854-9126, TELEX: 62903721; Empl.: 10; *Sls. Mgr.:* M. F. Peck

FAX: 313-528-0411

CONTROLLED POWER CO., 1955 Stephenson Hwy., Troy, MI 48083, Tel: 313-528-3700, 1-800-521-4792, TWX: 810-2323401; Empl.: 160; *Sls. Mgr.:* Reggie Peck ..... **D•2085-2089**

CONTROL LOGIC, See Hancock Electronics Corp.

CONTROL MODULE, 380 Enfield St., Enfield, CT 06082, Tel: 203-745-2433, TELEX: 643167; Empl.: 160; *Sls. Mgr.:* D. Penn

CONTROL-O-MATION, INC, 7300 W. Huron River Dr., Dexter, MI 48130, Tel: 313-426-3935, FAX: 313-426-4335; Empl.: 65; *Sls. Mgr.:* Dennis Salamin

CONTROL PRODUCTS, INC., 280 Ridgedale Ave., E. Hanover, NJ 07936, Tel: 201-887-9400, FAX: 201-887-5083; FSC No.: 81901; Empl.: 62; *Sls. Mgr.:* J. R. Nile

CSI

FAX: 818-709-8546

CONTROL SCIENCES, INC., 9509 Vassar Ave., Chatsworth, CA 91311, Tel: 818-709-5510, TELEX: 4970496(CSI); FSC No.: 53317; Empl.: 20; *Sls. Mgr.:* Rhod Zimmerman ..... **D•1147-1151**

Local Sales Offices & Reps

AZ	Tempe, Hannah-Hill	602-431-1771
CA	San Ramon, Tech. Consits.	415-830-0829
CO	Broomfield, Hannah-Hill	303-424-0108
CT	Asonia, Pace Assocs.	203-732-8756
IN	Ft. Wayne, J & B Engrg.	219-483-2813
MN	St. Paul, Northstar Motion & Control	612-770-5311
MO	Peculiar, PEM Sales	816-884-4784
MO	St. Louis, PEM Sales	314-427-7200
NY	Victor, A & D Devices	716-924-9171
PA	Media, Homer Smith Sls.	215-543-2434
NY	Albertson, DOL Engrg.	516-294-9071
TX	Dallas, McDonald Assocs.	214-238-1858
UT	Salt Lake City, Hannah-Hill	801-364-0606

CONTROLS DIVISION, Ametek, Inc., 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-6900, TELEX: 29-1769, FAX: 215-355-2937; Empl.: 100; *Sls. Mgr.:* R. Thomas Guinn

CONTROLS UNLIMITED, INC., 4823 North Ridge Rd., Perry, OH 44081, Tel: 216-259-2500, FAX: 216-259-5015; Empl.: 35

CONTROL TECHNOLOGY CO., INC., 41-16 29th St., Long Island City, NY 11101, Tel: 718-361-2133, FAX: 718-361-2253; FSC No.: 14545; Empl.: 35; *Sls. Mgr.:* H. Cooper ..... **D•2172-2173**

Local Sales Offices & Reps

CA	Claremont, W. Roth & Assocs.	714-621-1019
Can	Montreal, Que., Control Tech. Elctrns. CTC Canada, Ltd.	514-733-3279

CONTROL TECHNOLOGY, INC., 8200 N. Classen Blvd., Ste. 101, Oklahoma City, OK 73114, Tel: 405-840-3163; *Sls. Mgr.:* Charles Weddington; *Dist. Mgr.:* Charles Weddington

CONVER CORP., 916 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-739-9111, TWX: 910-338-2036, ESYLNK: 62024309, FAX: 408-739-9116; Empl.: 40; *Sls. Mgr.:* Robert Lloyd; *Dist. Mgr.:* Karen Clendening

CONVERSION EQUIP. CORP., 330 W. Taft Avenue, Orange, CA 92665, Tel: 714-637-2970; Empl.: 50; *Sls. Mgr.:* Patrick M. D'Acre

CONVERTER CONCEPTS INC

FAX: 608-429-9241

CONVERTER CONCEPTS, INC., Industrial Pkwy., Pardeeville, WI 53954, Tel: 608-429-2144, TWX: 910-280-2630; Empl.: 125; *Sls. Mgr.:* William A. Pearson ..... **D•1678-1685**

Local Sales Offices & Reps

AZ	Tempe, Cantec Sls.	602-345-1276
CA	Hayward, Pacific Mktg.	415-887-1620
CA	Irvine, Groh Assocs.	714-837-9871
CA	San Diego, Groh Assocs.	619-453-7572
FL	Boca Raton, Perrott Assocs.	305-792-2211
FL	Clearwater, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assoc.	305-298-7748
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MI	Grand Rapids, JFCO	616-949-1020
MI	Lake Orion, JFCO	313-693-2053
MN	Minneapolis, Microelectronic Sls.	612-829-0948
MO	Kansas City, Abrams & Assocs.	816-561-9234
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	Syracuse, Pi-Tronics	315-455-7346
OH	Cleveland, JFCO	216-238-5905
OH	Vandalia, JFCO	513-890-8322
PA	Glenside, Koebert Assoc.	215-887-2310
PA	Pittsburgh, JFCO	412-823-5400
TX	Austin, Tesco	512-834-8374
TX	Dallas, Tesco	214-553-1200
WA	Kirkland, Northwest Comp. Sls.	206-828-4838
WV	Inwood, Koebert Assocs.	304-229-8401
Can	Nepean, Ont., Electro-Source, Inc.	613-726-1452
Can	Rexdale, Ont., Electro-Source, Inc.	416-675-4490
Can	Vancouver, BC, Davetek Mktg.	604-430-3680

CONVEX CORP., P.O. Box 17225, Dulles Intl. Airport, Washington, DC 20041, Tel: 703-661-8900; Empl.: 24

THE COOL-AMP CONDUCTO-LUBE CO., 8603 S.W. 17th Avenue, Portland, OR 97219, Tel: 503-244-2230; Empl.: 7; *Sls. Mgr.:* Marian Bomber

COONER WIRE CO., 9186 Independence Ave., Chatsworth, CA 91311, Tel: 818-882-8311, TELEX: 353734 Cooner Wire UD, TWX: 818-709-8281; *Sls. Mgr.:* Steven W. Smith

COOPER TOOLS, PO Box 30100, Raleigh, NC 27622, Tel: 919-781-7200, TELEX: 579497

C0-ORD SWITCH DIV., See LVC Inds., Inc.

COORS CERAMICS CO., 600 Ninth St., Golden, CO 80401, Tel: 303-278-4000, TELEX: 4322017; Empl.: 1700

COOSOL, INC., 3013 Harbor Blvd., Costa Mesa, CA 92626, Tel: 714-545-2216; Empl.: 20; *Sls. Mgr.:* A. Solomonian; *Dist. Mgr.:* Jim Cook

CORBY INDUSTRIES, INC., 1501 E. Pennsylvania St., Allentown, PA 18103, Tel: 215-433-1412, TELEX: 847318 CORBYUHL; Empl.: 15

CORCOM, INC., 1600 Winchester Rd., Libertyville, IL 60048, Tel: 312-680-7400, TWX: 910-687-1058; FSC No.: 05245; Empl.: 1000; *Sls. Mgr.:* Dale Van Scoyk, Dir. OEM Sls.; *Dist. Mgr.:* Greg Dec ..... **A•1640-1641; C•1313**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell Assocs.	205-883-5110
AZ	Phoenix, I.S.D.S.	602-971-6250
CA	Anaheim, Westrep	714-527-2822
CA	Mountain View, Straube Assocs.	415-969-6060
CA	San Diego, Westrep	619-566-6580
CO	Westminster, Straube Assocs.	303-426-0890
CT	Madison, Conti-Younger Assocs.	203-245-1136
CT	Norwalk, Wincor Sls.	203-348-7444
FL	Maitland, E.I.R. Inc.	305-660-9600
FL	Oldsmar, E.I.R. Inc.	813-786-2156
FL	Plantation, E.I.R. Inc.	305-791-8243
FL	Plantation, E.I.R. Inc.	305-581-6905
GA	Norcross, Robert O. Whitesell Assocs.	404-449-9190
ID	Boise, Cascade Comps.	208-343-9886
IL	Glendale Hgts., Beta Technlg. Sls. Inc.	312-790-9886
IN	Ft. Wayne, Robert O. Whitesell	219-432-5591
IN	Indianapolis, Robert O. Whitesell	317-359-9283
IN	Kokomo, Robert O. Whitesell	317-457-9127
KS	Overland Pk., Spectrum Sls.	913-648-6811
KY	Peewee Valley, Robert O. Whitesell	502-241-1441
MD	Ellicott City, Marketing Technlg.	301-465-5944
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grand Rapids, Robert O. Whitesell	616-942-5420
MI	Southfield, Robert O. Whitesell	313-559-5454
MI	St. Joseph, Robert O. Whitesell	616-983-7337
MN	Edina, Mel Foster Co.	612-941-9790
MO	Hazelwood, Spectrum Sls.	314-731-5151
NJ	Paramus, Win-Cor Sls.	201-967-0242
NY	Manhasset, Win-Cor Elctrn. Sls.	516-627-9474
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Raleigh, Zucker Assoc.	919-782-8433
OH	Cincinnati, Robert O. Whitesell	513-521-2290
OH	Cleveland, Robert O. Whitesell	216-447-9020
OH	Columbus, Robert O. Whitesell	614-888-9396
OH	Dayton, Robert O. Whitesell	513-298-9546
OR	Beaverton, Jas. J. Backer Co.	503-627-0775
PA	Pittsburgh, Robert O. Whitesell	412-963-6161
PA	Trevose, Professional Svc. Assoc.	215-245-0513
TN	Knoxville, Robert O. Whitesell	615-694-9476
TN	Nashville, R. O. Whitesell Assocs.	615-352-4760
TX	Austin, K & H Sls.	512-339-7950
TX	Plano, K & H Sls.	214-423-6520
UT	Salt Lake City, Straube Assocs.	801-263-2640
WA	Seattle, Jas. J. Backer Co.	206-285-1300
WI	Milwaukee, Beta Technlg. Sls. Inc.	414-543-9288

Local Distributors

AL	Huntsville, Pioneer	205-837-9300
AZ	Phoenix, Cetec/Future Elec.	602-968-7140
AZ	Phoenix, Marshall Inds.	602-968-6181
CA	Chatsworth, Cetec/Future Elec.	818-700-0914
CA	Irvine, Cetec/Future Elec.	714-250-4141
CA	Irvine, Marshall Ind.	714-458-5395
CA	Irvine, Schweber	714-863-0200

CA Milpitas, Marshall Ind. 408-942-4600
CA San Diego, Cetec/Future Elec. 619-278-5020
CA San Diego, Marshall Ind. 619-578-9600
CA San Diego, Schweber 619-450-0454
CA San Jose, Schweber 408-432-7171
CO Thornton, Marshall Ind. 303-451-8444
CT E. Haven, J.V. Elctrns. 203-499-2457
FL Altamonte Springs, Pioneer 305-834-9090
FL Deerfield Beach, Pioneer 305-771-7520
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns. 305-849-6060
GA Atlanta, Marshall Ind. 404-923-5750
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Village, Pioneer/Chicago ... 312-437-9680
IL Palatine, OHM Elctrns. 312-359-5500
IN Indianapolis, Marshall 317-297-0483
IN Indianapolis, Pioneer 317-849-7300
KS Lenexa, Marshall 913-492-3121
MD Baltimore, Resco/Baltimore 301-529-0500
MD Beltsville, Resco/Washington 301-937-9100
MD Gaithersburg, Pioneer 301-921-0660
MA Newton, Greene Shaw 617-969-8900
MA Norwood, Gerber Elctrns. 617-769-6000
MA Wilmington, Marshall Ind. 617-658-0810
MI Livonia, Pioneer 313-525-1800
MN Eden Prairie, Pioneer/Twin Cities 612-944-3355
MN St. Paul, Gopher Elctrns. 612-483-3322
NJ Bellmawr, Mid Atlantic Elctrns. Corp. .. 609-931-5303
NJ Fairfield, Marshall Inds. 201-882-0320
NY Buffalo, Summit Distrs. 716-887-2800
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NY Mt. Vernon, QAR Indl. Elctrn. Sls. 914-699-2224
NY Rochester, Simcona 716-328-3230
NY Rochester, Summit Distrs. 716-334-8110
NC Charlotte, Pioneer 704-527-8188
NC Raleigh, Resco 919-781-5700
OH Cleveland, Pioneer 216-587-3600
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Dayton, Pioneer 513-236-9900
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
PA Horsham, Pioneer 215-674-4000
PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
PA Pittsburgh, Pioneer 412-782-2300
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Pioneer 512-835-4000
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Pioneer 214-386-7300
TX Houston, Marshall Inds. 713-895-9200

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TX Houston, Pioneer 713-988-5555
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Marshall Inds. 206-747-9100
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORD ELECTRONICS INCORPORATED

FAX: 516-935-0780

CORD ELECTRONICS, INC., 177 Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-935-3640, TELEX: 475-8020; Empl.: 34; *Sls. Mgr.:* Barry Miller/David Baum ..... **A•2068; B•1114; C•1836; D•1025-1027, 2164**

Local Sales Offices & Reps
AL Huntsville, Glen White Assocs. 205-533-2002
AZ Phoenix, Syntech 602-893-7776
CA Fountain Valley, Sy Prevulsky Assocs. 714-547-5177
CA San Diego, Pathfinder Elctrn. Reps. ... 619-578-2555
CA Sunnyvale, Power Supp. Comps. 408-737-1333
CT Ridgefield, J-Square Mktg. 203-438-3081
FL Coral Springs, HAI Elctrns. 305-752-7520/50
GA Norcross, Glen White Assocs. 404-441-1447
IL Elgin, RHI Sls. Corp. 312-888-0099
IA Bettendorf, Weisler & Assocs., Inc. 319-344-0566
MA S. Easton, Intek Sls. 617-238-9283
MI Adrian, Elctrn. Salesmasters, Inc. 517-263-2500
MI Livonia, Elctrn. Salesmasters, Inc. 313-421-2520
MN Minneapolis, O.E.M. Elctrl. Sls., Inc. 612-559-2448
MS Jackson, Doby Assocs. 601-981-1138
MO Ellisville, Weisler & Assocs. 314-394-4543
MO N. Kansas City, Weisler & Assocs. 816-421-1679
NM Alburquerque, Syntech 505-266-7951
NY Jericho (Downstate), J-Square Mktg., Inc. 516-935-3200
NC Raleigh, Glen White Assocs. 919-848-1931
OH Beachwood, Elctrn. Salesmasters 216-831-9555
OR Portland, Elctrn. Mktg. Grp. 503-684-5935
TN Gray, Glen White Assocs. 615-477-8850
TX Dallas, Weisler & Assocs. 214-437-2386
TX Houston, Weisler & Assocs. 713-467-1847
WA Spokane, Elctrn. Mktg. Grp. 509-922-2718

CORECO, INC., 555 St-Thomas Street, Longueuil, Quebec, Canada J4H 3A7, Tel: 800-361-4997, 514-651-3100, TELEX: 76001120 COR UC; Empl.: 23; *Sls. Mgr.:* Pat Urbain

CORLUND ELECTRONICS CORP., 3543 Old Conejo Rd., Ste. 101, Newbury Park, CA 91320, Tel: 805-499-6877, FAX: 818-706-8986; Empl.: 45; *Sls. Mgr.:* Mike Perry

CORMAN TECHNOLOGIES INC., 75 Bathurst Dr., Waterloo, Ontario, Canada N2V 1N2, Tel: 519-884-4430, FAX: 519-884-0204; *Sls. Mgr.:* Bill Lochead; *Dist. Mgr.:* Bill Lochead

CDE CORNELL DUBILIER

FAX: 617-996-3830

CORNELL-DUBILIER ELCTRNS./SANGAMO WESTON COMPS. DIV., 1605 E. Rodney-French Blvd., New Bedford, MA 02741, Tel: 617-996-8561, TWX: 310-671-1800; Empl.: 5000; *Sls. Mgr.:* Anthony M. Cavuto, VP Sls.; *Dist. Mgr.:* Rex Easterly ..... **A•1070**

Local Sales Offices & Reps
AL Huntsville, Advanced Comps. Mktg. 205-881-5493
AZ Tempe, EDS, Inc. 602-438-1547
CA Agoura Hills, Cornell Dubilier Elect. ... 818-707-3696
CA Granada Hills, C & N Assocs. 818-895-2431
CA Los Altos, Ewing-Foley 415-941-4525
CA Roseville, Ewing-Foley 916-969-2672
CA San Diego, CK Assocs. 619-279-0420
CO Westminster, Western Region Mktg. .. 303-430-8883
CT New Haven, Coakley, Boyd & Abbett 203-239-6217
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
FL Ft. Lauderdale, QXI, Inc. 305-978-0120
FL Orlando, QXI, Inc. 305-423-3682
FL St. Petersburg, QXI, Inc. 813-894-4556
GA Norcross, Advanced Comps. Mktg. 404-448-7025
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
KS Overland Pk, Electri-Rep 913-649-2168
MD Baltimore, Faion Lott & Co. 301-744-4611
MA Needham Hgts., Coakley, Boyd & Abbott 617-444-5470
MA New Bedford, Cornell Dubilier Elctrns. 617-996-8561
MI Brighton, A.P. Assocs. 313-229-6550
MI Farmington Hills, R. C. Merchant & Co., Inc. 313-476-4600
MI St. Joseph, R. C. Merchant & Co., Inc. 616-983-7378
MN Bloomington, P.W.C. Inc. 612-831-5999
MO St. Louis, Electri-Rep 314-993-4421
NJ Wayne, Cornell Dubilier 201-256-2000
NY Camillus, Cornell Dubilier Elctrns. 315-488-5822
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Charlotte, Prime Comps., Inc. 704-522-1150
NC Raleigh, Prime Comps., Inc. 919-850-9866
OH Dayton, Lyons Corp. 513-278-0714
OH Richfield, Lyons Corp. 216-659-9224
OR Portland, Northwest Mktg. 503-620-0441
TN Chatanooga, Indl. Mktg. & Sls. 615-894-2219
TX Austin, Southwestern Tech. Sls. 512-440-0499
TX Dallas, Southwestern Tech. Sls. 214-243-0180
UT Salt Lake City, Western Mktg. 801-486-1646
WA Bellevue, Northwest Mktg. 206-455-5846
PR San Juan, E.T.S., Inc. 809-720-1300
Can N. Vancouver, B.C., Arwin Tech. Sls. .. 604-980-4557
Can Ottawa, Ont., Source Elctrns. 613-564-0151
Can Rexdale, Ont., Source Elctrns. 416-675-6235

Local Distributors
AZ Phoenix, Arizona Comps. 602-269-5655
CA Chatsworth, Shelley-Ragon 818-998-3333
CA Milpitas, California Capacitors 408-262-6000
CA Sunnyvale, Arrow Elctrns. 408-745-6630
CO Denver, Integrated Elctrns. 303-292-6121
CO Lakewood, Acacia Sls. 303-232-2882
CT Wallingford, Arrow Elctrns. 203-265-7741
FL Orlando, Hammond Elctrns. 305-849-6060
IL Chicago, Newark Elctrns. 312-784-5100
IA Cedar Rapids, Arrow Elctrns. 319-395-0197
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MA Newton, Green Shaw Co. 617-969-8900
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Minneapolis, Stark Elctrns. 612-332-1325
MO St. Louis, Arrow Elctrns. 314-567-6888
NJ Clifton, J-Mar Elctrns. 201-772-0242
NY Hauppauge, Jacp Elctrns. 516-273-5500
NY Rochester, Arrow Elctrns. 716-427-0300
NC Raleigh, Arrow Elctrns. 919-876-3132
OH Cleveland, Pioneer/Cleveland 216-587-3600
PA McKean, Advacom, Inc. 814-476-7774
TX Dallas, Hall Mark Elctrns. 214-343-5000
UT Salt Lake City, Arrow Elctrns. 801-972-0404
WA Bellevue, Bell Inds. 206-747-1515
WI Milwaukee, Marsh Elctrns. 414-475-6000

CORNELL-DUBILIER ELCTRNS., Wayne Interchange, Plaza 1, Wayne, NJ 07470, Tel: 201-256-2000; *Sls. Mgr.:* A. Cavuto

CORNELL MANUFACTURING, An Elgin Co., 25 Ramland Road, Orangeburg, NY 10962, Tel: 914-365-0400, TELEX: 13-1572, FAX: 914-359-6809; Empl.: 50; *Sls. Mgr.:* Lou Schnur

CORNING GLASS WORKS, Corning Elctrns., Houghton Pk., Bldg. A-2, Corning, NY 14830, Tel: 607-974-8725, TELEX: 932481; Empl.: 8000; *Sls. Mgr.:* Graham Wells; *Dist. Mgr.:* Betsey Murray

CORNING GLASS WORKS, Materials Business, Main Plant, MP 21-3, Corning, NY 14831, Tel: 607-974-9000, TELEX: 932498; Empl.: 30000; *Sls. Mgr.:* Bryan Lanahan; *Dist. Mgr.:* Richard J. Maxa

Local Distributors
CA Los Angeles, Leed Plastics Corp. 213-746-5984
CA Santa Clara, San Jose Delta Assocs., Inc. 408-727-1448
IL Addison, Circle Fabrication, Inc. 312-543-4440
NJ Palisades Pk., Duramic Prods., Inc. 201-947-8313
NJ Washington, Accuratus Ceramic Corp. 201-689-0880
OH Cincinnati, Astro Met Assocs., Inc. 513-772-1242
TX Houston, EGC Corp. 713-447-8611
WI Germantown, Tech. Prods., Inc. 414-255-7355
Can Ontario, Johns Sci. 416-699-1731

CORNING GLASS WORKS, Telecommunications Products Division, MP-RO-03, Corning, NY 14831, Tel: 607-974-7741, TELEX: 932498; Empl.: 28,000

CORTEC, INC., 15811 Chemical La., Huntington Bch., CA 92649, Tel: 714-897-2529, FAX: 714-897-2170; Empl.: 35

CORTRON DIV., See ITW Cortron,Illinois Tool Works

CORTRON DIV., See ITW Cortron, Illinois Tool Works

COSAR CORPORATION, 10375 Brockwood Rd., Dallas, TX 75238, Tel: 214-340-4584, 800-527-1207, TELEX: 506973; FSC No.: 20891; Empl.: 50; *Sls. Mgr.:* Jerry Jarka

COSMO CORPORATION, 3239 W. 14th St., Cleveland, OH 44109, Tel: 216-861-5594; Empl.: 500; *Sls. Mgr.:* B. Gordon

COST EFFECTIVE SYSTEMS, INC., Two LeMans Pl., Pine Brook, NJ 07058, Tel: 201-575-5514, TELEX: 4944668; *Sls. Mgr.:* Phyllis Gross

COTO CORPORATION

FAX: 401-942-0920

COTO CORPORATION, 55 DuPont Drive, Providence, RI 02907, Tel: 401-943-2686, TWX: 710-381-8016; Empl.: 200; *Sls. Mgr.:* Harvey Smith, Natl. Sls. Mgr.; *Dist. Mgr.:* Harvey Smith ..... **B•1395**

Local Sales Offices & Reps

AL	Owens Cross Rds., cmrCross Assocs.	205-883-5991
AZ	Phoenix, Spectrum Mktg. Assocs., Inc.	602-890-9000
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Newport Bch., Forbes Pacific Inc.	714-722-6174
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Sls.	303-480-9991
CT	Warren, RI, Wm. Poisson & Assocs.	401-245-0260
DE	Hunt Valley, Eagle Sls. Corp.	301-666-3930
DC	Hunt Valley, Eagle Sls. Corp.	301-666-3930
FL	Deerfield Bch., Jack Krutek Assocs.	305-427-4202
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-846-6383
NY	Great Neck, MOS Mktg. Assocs.	516-487-3966
NY	N. Syracuse, Advanced Comps. Corp.	315-699-2671
OR	Tigard, LD Elctrns.	503-829-3146
PA	Huntington Valley, Omega Elctrn. Sls.	215-947-4135
RI	Warren, Wm. Poisson & Assocs.	401-245-0260
TX	Austin, Richmar Elctrns. Corp.	512-251-7582
TX	Plano, Richmar Elctrns.	214-867-8224
UT	Ogden, Spectrum Mktg. Assocs. Inc.	801-972-8552
WA	Snohomish, LD Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883
WI	Butler, Richmar Elctrns.	414-781-1730
Can	Pointe Claire, Que., A. R. Gray Assocs.	514-694-6378

Local Distributors

AL	Huntsville, Allied Elctrns.	800-433-5700
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Saratoga, Testco Inc.	408-253-1900
CO	Denver, Spectrum Distrbn.	303-480-9991
FL	Pompano, Allied Elctrns.	305-486-0500
GA	Norcross, Allied Elctrns.	404-377-3555
IL	Elgin, Allied Elctrns.	312-697-0126
MA	Wilmington, Allied Elctrns.	617-942-0150
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-876-5845
OK	Tulsa, Altair Co.	918-252-5781
OR	Saratoga, Testco, Inc.	800-621-0854 (ext 285)
SC	Raleigh, Allied Elctrns.	919-876-5845
TX	Austin, Altair Co.	512-837-4970
TX	Dallas, Allied Elctrns.	214-553-4370
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
WA	Saratoga, Testco, Inc.	800-621-0854 (ext 285)
EXP	TX/Ft. Worth, Allied Elec./Exp. Svcs.	817-336-5401

COTRONICS, 3379 Shore Pkwy., Brooklyn, NY 11235, Tel: 718-646-7996, FAX: 718-646-3028; Empl.: 15; *Sls. Mgr.:* Alan Marks

COVER CRAFT CORP., See Amherst International Corp., Cover Craft Div.

COVOX, INC., 675 D Conger St., Eugene, OR 97402, Tel: 503-342-1271, FAX: 503-342-1283; Empl.: 25; *Sls. Mgr.:* M. R. Stewart

CPS, INC., 1362 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-8980, TELEX: 35-7450, FAX: 408-734-8993; FSC No.: 31640; Empl.: 30; *Sls. Mgr.:* Clifford Gaw ... **D•1686**

Local Sales Offices & Reps

GA	Roswell, Electro Comp Sls., Inc.	404-992-2344
MA	Burlington, Intersell	617-273-3844
NH	Concord, CPS, Inc.	603-225-7795
NM	Albuquerque, West Faul & Assocs.	505-881-0995
NY	Hartsdale, Spectrum Sls., Inc.	914-472-8600

CP TECHNOLOGY, INC., 21143 Christensen Drive, Cupertino, CA 95014, Tel: 408-996-8069; Empl.: 6

CRAIG SYSTEMS CORP., Hanson Industries, 10 Industrial Way, Amesbury, MA 01913-4848, Tel: 617-388-5662, TWX: 710-347-0590; FSC No.: 81902; Empl.: 400; *Sls. Mgr.:* Roger Chouinard; *Dist. Mgr.:* Roger Chouinard

CRAMER COIL & TRANSFORMER CO., INC., 401 Progress Dr., Saukville, WI 53080, Tel: 414-284-9425, FAX: 414-377-4028; Empl.: 70; *Sls. Mgr.:* Patti Lincoln

CRAMER CO., Mill Rock Rd., Old Saybrook, CT 06475, Tel: 203-388-3574, TELEX: 966-453; Empl.: 210; *Sls. Mgr.:* G. Willis; *Dist. Mgr.:* E. Latourette

CREARE INC., Etna Rd., P.O. Box 71, Hanover, NH 03755, Tel: 603-643-3800, TELEX: 953101, FAX: 603-643-4657; Empl.: 90

CMS

FAX: 213-493-3553

CREATIVE MICRO SYSTEMS, 3822 Cerritos Ave., Los Alamitos, CA 90720, Tel: 213-493-2484; Empl.: 24; *Sls. Mgr.:* Margaret E. Prossen ..... **D•1110**

CRESTRONICS DIV., APPLIED ELECTRO TECHNLG., See STI-Crestronics Div.

CROMEMCO, Dynatech Corp., 280 Bernardo Ave., P.O. Box 7400, Mountain View, CA 94039-7400, Tel: 415-964-7400, TWX: 910-379-6988, FAX: 415-969-3350; Empl.: 135; *Sls. Mgr.:* J. C. Depew, VP Sls.; *Dist. Mgr.:* Tom Keating

CROMPTON INSTRUMENTS, 2763 Higgins Road, Elk Grove Village, IL 60007, Tel: 312-593-1107, TELEX: 210295, FAX: 312-439-5474; FSC No.: 53498; *Sls. Mgr.:* Wayne Bordelon

CROMPTON INSTRS., Hawker Siddley, 2763 Old Higgins Rd., Elk Grove Village, IL 60007, Tel: 312-593-1107, TELEX: 210295, FAX: 312-439-5747; Empl.: 38; *Sls. Mgr.:* Wayne Bordelon

CROSS BROTHERS, INC., 5255 Sheila St., Los Angeles, CA 90040, Tel: 213-266-2000, FAX: 213-266-2106; Empl.: 17; *Sls. Mgr.:* Steven S. Krause

CROSS ELECTRONICS, 100 Commonwealth Dr., Warrendale, PA 15086, Tel: 412-776-1591; Empl.: 35; *Sls. Mgr.:* L. R. Craig

CROSSPOINT, Div. of Info-Lite, 422 Cliff St., Fairview, NJ 07022, Tel: 201-941-4455, FAX: 201-941-4919; FSC No.: FSCM 52116; Empl.: 13; *Sls. Mgr.:* Joseph M. Cartelli; *Dist. Mgr.:* Joseph M. Cartelli ..... **B•1678**

Local Sales Offices & Reps

CA	No. Hollywood, Crown Elctrns.	213-877-3550
CA	Redwood City, Caltronic Assocs.	415-365-2545
CT	Weston, CJA Assoc.	203-226-4317
MI	Plymouth, Leading Edge Sls. Corp.	313-420-3344
NY	Syracuse, Lenard Co.	315-479-9191
OH	Cleveland, A.S.A.	216-232-4946
OH	Dayton, Mohawk Intronics	513-434-8873

CROUZET CONTROLS, INC., 1083 State Pkwy., Schaumburg, IL 60173, Tel: 312-843-2200, TELEX: 210 219, FAX: 312-310-8330; Empl.: 18; *Sls. Mgr.:* Benoit Delcourt ..... **B•1201, 1679**

Local Sales Offices & Reps

CA	San Marino, Motion Control of So. CA	818-796-0189
CA	San Ramon, C. F. M. Sls.	415-866-1705
CO	Denver, Ralph R. Pence & Assocs.	303-936-3464
FL	Clearwater, Gen. Controls, Inc.	813-791-1903
IN	South Bend, Emsco Sls. & Engrg. Co.	219-232-8561
IA	Bettendorf, Custom Controls Ltd.	319-355-4787
MA	Taunton, Electro-Kinetics	617-880-0182
MA	Wellesley, Electro Kinetics	617-235-9415
MA	Wenham, Electro-Kinetics	617-468-4166
MN	Minneapolis, Dr. Beck-Hays Assocs.	612-835-3610
MO	Webster Grove, Schutz & Assocs. Ind. Sls., Inc.	314-962-2622
NY	Fairport, Tac Sls.	716-425-1070
NY	Plainview, Motion Control Sls.	516-756-5656
OH	Cincinnati, Bob Gilbert & Assocs.	513-761-4598
OH	Cincinnati, Bob Gilbert & Assocs.	513-574-1932
PA	Horsham, Jacobsen & Assocs.	215-674-2937
UT	Salt Lake City, Control Agency	801-328-4305
WA	Bellevue, Sea Inc.	206-883-4999
WA	Vancouver, Sea Inc.	206-573-5161
Can	St. Hubert, Que., Decofer	514-678-2252
Can	Toronto, Tienkay Inc.	416-736-1221

Local Distributors

CA	Los Angeles, Master Distr.	213-452-1229
CO	Colorado Springs, Summit Fasteners & Elec. Hdwe.	303-593-7700
FL	Hollywood, M.P. Assocs.	305-962-5751
FL	Lakeland, A. A. Elec.	813-665-6941
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Bell Inds.	317-634-8202

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- ANALOG & DIGITAL METERS
- NETWORK ANALYZERS
- SIGNAL GENERATORS
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- OSCILLOSCOPES
- CALIBRATORS
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IA Bettendorf, Custom Controls Ltd. 319-335-4787
MA Wellesley, Electro-Mechanical Distr. 617-235-1565
MI Comstock Park, Mor Elec. 616-784-1121
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NJ Edison, Howman Applied Control Prods. 201-797-3313
NJ Fair Lawn, Relay Specialties 201-797-3313
NY Commack, Monarch Comps. 516-499-1770
NC Asheville, Electric Supply Co. 704-255-8899
NC Gastonia, J.M.T. Elctrn. Supp. 704-867-4401
NC Winston-Salem, Kirkman Elctms. 919-722-9131
ND Bismarck, Border States Elec. 701-258-6060
OH Cincinatti, Hughes-Peters. 513-351-2000
OH Cleveland, Reserve Motion Control Sys. 216-826-0290
OH Columbus, Hughes-Peters. 614-294-5351
OH Dayton, Duellman Elctms. 513-461-5010
OK Tulsa, Radio Inc. 918-587-9123

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- A.C. Volts
- Resistance
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- Capacitance
- Frequency
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- NETWORK ANALYZERS
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- POWER SUPPLIES
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- CALIBRATORS
- TEMPERATURE
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- SOUND LEVEL
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PA Allentown, P. A. Peters. 215-434-5237
PA Philadelphia, Herbach & Rademan 215-426-1700
SC Greenville, Holder Elec. Supp. 803-271-7111
TX Ft. Worth, Swieco. 817-335-6521
WA Kent, Motors & Controls Corp. 206-872-8010
WA Seattle, Eicher-Richards Co. 206-523-7888
WI Waukesha, Powermation 414-542-2868
Can Mississauga, Ont., Tracan Elctms. Corp. 416-625-7752
Can St. Hubert, Que., Decofer 514-678-2252
Can Willowdale, Ont., PS Comps. 416-498-0214

CROVEN CRYSTALS, 500 Beech St., Whitby, ON, Canada L1N 5S5, Tel: 416-668-3324, FAX: 416-668-5003; FSC No.: 00809; Empl.: 250; *Sls. Mgr.:* R. McCormick ..... **A•1365**

Local Sales Offices & Reps

AZ Mesa, Sedco Sls. 602-461-9069
CA Northridge, R.L. Assocs. 818-701-0656
CA San Mateo, Melvin Sls. 415-349-7444
FL Palm Bay, Spartech Assocs. 305-727-8045
GA Norcross, Spartech Assocs. 404-446-7300
MA Milton, Naton Assoc. 617-698-0670
MO St. Charles, Hayes Elec. Sls. 314-946-6677
NY Melville, Carnes Assocs. 516-694-1600
OH Englewood, Clayton-Ellier Co. 513-836-3556
PA Glenside, Koebert Assocs. Inc. 215-887-2310
TX Euless, Fralia Co. & Assocs. 817-267-3577
VA Alexandria, Tech Reps Inc. 703-370-2600
WI Oconomowoc, Artmor Ltd. 414-367-8789

CROZIER METROLOGY LAB, 160 N. Bond St., Elk Grove, IL 60007, Tel: 312-934-5634; Empl.: 5; *Sls. Mgr.:* Richard D. Crozier

IOR CRYDOM
A DIVISION OF INTERNATIONAL RECTIFIER

FAX: 213-865-3318

CRYDOM COMPANY, 17215 Studebaker Rd., No. 328, Cerritos, CA 90701, Tel: 213-865-3536, TWX: 910-250-5756; Empl.: 350; *Sls. Mgr.:* James L. Jensen; *Dist. Mgr.:* James L. Jensen ..... **B•1396-1399**

Local Sales Offices & Reps

AL Huntsville, EMA, Inc. 205-830-4030
AR Ft. Smith, Electra Reps, Inc. 501-452-7822
CA Pleasanton, Sierra Sls. Engrg. 415-463-2250
CA Stockton, Sierra Sls. Engrg. 209-465-3968
CA Tustin, Morgan Johnson Co., Inc. 714-832-7282
FL Deerfield Bch., EMA Inc. 305-421-6830
FL Longwood, EMA, Inc. 305-682-1202
GA Roswell, EMA, Inc. 404-992-7240
ID Boise, N.R. Schultz Co. 208-377-8686
IL Elk Grove Village, Control Sls. 312-595-2110
IN Carmel, Technology Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technology Mktg. Corp. 219-432-5553
KY Louisville, Technology Mktg. Corp. 502-893-1377
MD Baltimore, McCourt & Comp., Inc. 301-944-8400
MA Woburn, Alpha Omega Sls. 617-933-0237
MI Livonia, Luebbe Sls. 313-477-3131
MN Eden Prairie, Electronic Innovators, Inc. 612-941-0830
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NY Binghamton, GEN-TECH Elctms. 607-648-8833
NY Liverpool, Gen-Tech Elctms. 315-451-3480
NY Penfield, Gen-Tech Elctms. 716-381-5159
NC Charlotte, EMA, Inc. 704-365-0547
NC Raleigh, EMA, Inc. 919-846-6888
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Cleveland Luebbe Sls. 216-333-0425
OH Columbus, Luebbe Sls. Co. 614-431-0474
OH Dayton, Luebbe Sls. Co. 513-294-0426
OR Beaverton, N.R. Schultz Co. 503-643-1644
PA Chestnut Hill, Deltatronics Inc. 215-248-0294
PA Pittsburgh, Luebbe Sls. Co. 412-364-0490
TX Austin, Electra Reps. 512-339-1163
TX Dallas, Electra Reps. 214-248-3852
UT Salt Lake City, Control Agy. 801-972-8787
VA Richmond, McCourt Co., Inc. 804-741-3253
WA Bellevue, N.R. Schultz Co. 206-454-0300
WI Thiensville, Control Sls. 414-242-4580

Local Distributors

AL Huntsville, Arrow Elctms. 205-837-6955
AZ Phoenix, Newark Elctms. 602-968-7411
AR Little Rock, Newark Elctms. 501-225-8130
CA Canoga Pk., Schweber 818-999-4702
CA Los Angeles, Kierulff Electronics 213-725-0325
CA Los Angeles, Master Distrs. 213-452-1229
CA Orange, Newark Elctms. 714-634-8224
CA S. San Francisco, Steven Engineering 415-588-9200
CA San Diego, Kierulff Elctms. 619-278-2112
CO Denver, Newark Elctms. 303-757-3351
CT Orange, Milgray Elctms. 203-795-0711
FL Deerfield Bch., Arrow Elctms. 305-429-8200
GA Norcross, Newark Elctms. 404-448-1300
HI Aiea, Newark Elctms. 808-487-8951
ID Boise, Newark Elctms. 208-342-4311
IL Chicago, R.S. Elctms. 312-364-4733
IL Elk Grove Vl, Kierulff Elctms. 312-250-0500
IL Schaumburg, Newark Elect. 312-784-5111
IN Indianapolis, Newark Elctms. 317-872-7070
IA Cedar Rapids, Newark Elctms. 319-393-3800
KS Overland Pk., Newark Elctms. 913-677-0727
KY Louisville, Peerless Elctms. 502-637-7674
LA Metarie, Newark Elctms. 504-838-9771
MD Baltimore, Arrow Elctms. 301-995-6002
MA Bedford, Schweber Elctms. 617-275-5100
MA Hingham, Sager Electric 617-749-6700
MI Livonia, RS Elctms. 313-525-1155
MI Livonia, Schweber Elctms. 313-525-8100
MI Oak Pk., Newark Elctms. 313-967-0600
MN Edina, Arrow Elctms. 612-830-1800
MO St. Louis, Arrow Elctms. 314-567-1164
NE Omaha, Newark Elctms. 402-392-1221
NH Salem, Sager Elctms. 603-698-1348
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Fairfield, Arrow Elctms. 201-575-5300
NJ Fairfield, Schweber Elctms. 201-227-7880
NM Albuquerque, Arrow Elctms. 505-243-4566
NY Buffalo, Summit Distrs. 716-884-3450
NY Farmingdale, Milgray Elctms. 516-391-3000
NY Melville, Arrow Elctms. 516-694-6800
NY Rochester, Schweber Elctms. 716-424-2222
NY Syracuse, Newark Elctms. 315-437-6611
NY Westbury, Schweber Electronics 516-334-7474
NC Raleigh, Newark Elctms. 919-781-7677
OH Cincinnati, Hughes Peters 513-351-2000
OH Cincinnati, Schlemmer Assocs., Inc. 513-522-8340
OH Cleveland, Newark Elctms. 216-391-9330
OH Columbus, Arrow Elctms. 614-885-8362
OK Tulsa, Newark Elctms. 918-832-7004
OR Portland, Radar Elect. 503-233-3901
PA Pittsburgh, Cam/RPC 412-782-3770
PA Pittsburgh, Newark Elctms. 412-343-9090
SC Columbia, Dixie Elctms. 803-779-5332
TN Memphis, The Genie Grp., Inc. 901-345-9595
TX Dallas, Kierulff Elctms. 214-840-0110
TX Houston, Newark Elctms. 713-782-4800
UT Salt Lake City, Kierulff Elctms. 801-973-6913
WA Bellevue, Arrow Elctms. 206-643-4800
WA Seattle, Radar Elect. 206-282-2511
WV Charleston, Newark Elctms. 304-345-6505
WI Milwaukee, Newark Elctms. 414-463-1100

CRYOMAGNETICS, INC., 739 Emory Valley Rd., Oak Ridge, TN 37830, Tel: 615-482-9551, TELEX: 883 945, FAX: 615-483-5891; *Sls. Mgr.:* D. Michael Coffey

CRYSTAL MARK, INC., Forslund Division, 613 Justin Avenue, Glendale, CA 91201, Tel: 818-240-7520, TELEX: 279974

CRYSTALOID ELECTRONICS, Box 628, Hudson, OH 44236, Tel: 216-655-2429, FAX: 216-655-2176; Empl.: 100; *Sls. Mgr.:* Sharon Weistler/Bill Jakubik

CRYSTEK CORP, P.O. Box 06135, Ft. Myers, FL 33906, Tel: 813-936-2109, TWX: 510-951-7448; FSC No.: 13454; Empl.: 60

CSB/USA, 1204 W. 7th St., Ft. Worth, TX 76102, Tel: 800-3CSB/USA, FAX: 817-332-6036 ..... **D•1446**

Local Sales Offices & Reps

CA Arcadia, Van Gott & Assocs. 818-445-9728
CA Los Altos, Frauman Assocs. 415-941-0660
FL Pompano Bch., HHP Assocs. 305-971-5750
IL Palatine, Technlg. Sls., Inc. 312-991-6600
IN Granger, Wolff Sls., Inc. 219-272-4388
MA Seekonk, Rudolph Mktg. Assocs. 617-399-6270
MI Grand Rapids, Stiles & Assocs. 616-531-7759
NY Franklin Sq., Cooper-Simon & Co., Inc. 516-489-0404
OH Lima, T.C. Co. 419-226-6952
TX Dallas, Electra Reps., Inc. 214-248-3852
WI Milwaukee, Technlg. Sls., Inc. 414-964-5015

CSI Capacitors

CSI CAPACITORS, CSI Technologies, 810 Rancheros Dr., San Marcos, CA 92069, Tel: 619-747-4000, TELEX: 697832; FSC No.: 10026; Empl.: 50; *Sls. Mgr.:* J. D. Kowalsky ..... **A•1071**

Local Sales Offices & Reps

AL Huntsville, Glenn Technical 205-883-2870
AZ Paradise Valley, Astrocom Mktg. 602-991-6646
CA San Jose, Comtech Mktg. 408-365-7474
FL Orlando, Glenn Tech. Sls. Co. 305-299-8700
IL Chicago, Esco Assocs. 312-298-5310
KY Louisville, K. W. Elctrn. Sls. 614-888-0483
MD Middletown, ST/Woolard 301-371-4500
MA E. Sandwich, Radco, Inc. 617-888-7397
NJ Leonia, Peter E. Schmitt Co. 201-944-2806
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Cazenovia, S. T. Woolard 315-655-8145
OH Dayton, K. W. Elctrn. Sls. 513-890-2150
OR Tigard, Components West 503-684-1671
PA Allison Pk., KW Elctrn. Sls. 412-487-4300
SC Pickens, S.T. Woolard 803-878-3830
TX Dallas, Cunningham Comps. 214-669-9706
TX Houston, Cunningham Comps. 713-461-4197
VA Lynchburg, ST/Woolard 804-528-5421
WA Redmond, Components West 206-885-5880
Can Richmond, BC, Macom Agencies 604-271-2661
Can Toronto, Ont., Anbak Sls. 416-253-0243

C-TEK INCORPORATED

C-TEK INC., 4 Railroad Ave., Wakefield, MA 01880, Tel: 617-246-1720, TELEX: 882485; Empl.: 15; *Sls. Mgr.:* John Vanaman; *Dist. Mgr.:* John Vanaman .... **D•1126-1127**

Local Sales Offices & Reps

AZ Phoenix, Thor Eng. 602-437-1463
CT Ansonia, R. H. Sturdy Co. 203-734-2186
IL Hillside, Cadre Tech. Reps. 312-449-3900
MA Wellesley Hills, R. H. Sturdy Co. 617-235-2330
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Minneapolis, Northstar Motion & Control 612-571-9600
MN St. Paul, Northstar Motion & Control .. 612-770-5311
NJ Sparta, E.S. Williams 201-729-4049
NY Pittsford, Controlled Motion Sls. 716-381-1933
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinatti, KCH Co. 513-931-1686
PA Paoli, Tyler Griffin 215-647-1550
VA Richmond, Jake Rudisill Assocs. 804-320-0201

Local Distributors

NY Clarence, Trott Elctrns. 716-634-8500
NY Pittsford, Trott Elctrns. 716-586-8251
NY Syosset, Motion Control Sls. 516-921-5656
NC Charlotte, Joyce Sls. 704-377-6901
WA Seattle, Eicher-Richards Co. 206-523-7888
Can Montreal, Premier Automation 514-684-6610

CTI ELECTRONICS, 955 Connecticut Avenue, Bridgeport, CT 06607, Tel: 203-366-9444, TWX: 710-465-6349, FAX: 203-254-3599; Empl.: 19 ..... **D•1079**

Local Sales Offices & Reps

AL Huntsville, Rakes Engrg. & Mktg. Corp. 205-533-3763
AZ Phoenix, Western Automation 602-973-2384
CA Laguna Hills, Western Automation 714-859-6988
CA San Diego, MACS 619-268-1199
CA San Jose, Motion Sys., Inc. 408-246-0641
CT Bridgeport, CTI Elctrns. 203-366-9444
FL New Port Richey, Spinney Assocs. 813-848-8578
GA Atlanta, Rakes Engrg. & Mktg. Corp. ... 404-447-6937
MO Blue Springs, A-Tronics Sls. & Engrg. Co. 816-224-2131
NH Manchester, Northeast Comps. 603-627-7242
NY New Hartford, PDQ Assocs. 315-793-3666
NY Roslyn Hgts., Travco Assocs. 516-621-3223
OH Columbus, McFadden Sls. 614-761-3177
PA Glenside, Wyncote Instrmn. Co. 215-572-6500
VA Reston, Delmarva Technlgs. 703-620-3555
WI Appleton, Vine Tech. Sls. 414-731-9873
WI Genoa City, Vine Tech. Sls. 414-279-3871

CTS CORPORATION

FAX: 219-294-5718

CTS CORPORATION, 905 West Blvd. North, Elkhart, IN 46514, Tel: 219-293-7511, TWX: 810-294-2167; Empl.: 6,500; *Dist. Mgr.:* George Greener ..... **A•1904-1910; B•1681**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs., Inc. 205-533-1730
AL Mobile, Interep Assocs., Inc. 205-478-1036
AZ Phoenix, Compass Mktg. & Sls., Inc. ... 602-996-0635
AZ Tucson, Compass Mktg. & Sls., Inc. ... 602-293-1220
CA Fremont, CTS Corp. 415-659-1704
CA Los Altos, Ewing & Foley 415-941-4525
CA S. Pasadena, CTS Corp. 213-682-1137
CO Dnever, ELCOM, Inc. 303-337-2300
CT Danbury, CTS Corp. 203-743-3681/1964
CT Wallingford, CompRep Assocs., Inc. 203-269-1145
FL Deerfield Bch., ElectroComp Assocs., Inc. 305-429-0802,800-468-4632
FL Longwood, ElectroComp Assocs., Inc. 305-429-0802
FL Palm Harbor, ElectroComp Assocs., Inc. 813-787-6669
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Northbrook, Dolin Sls. Co., Inc. 312-498-6770
IN Indianapolis, Elctrn. Reps., Inc. 317-894-1414
IA Cedar Rapids, Seltec Sls. Corp. 319-364-7660
KS Olathe, Advanced Tech. Sls., Inc. 913-782-8702
MD Lutherville, DGR, Inc. 301-583-1360
MA Westwood, CompRep Assocs., Inc. 617-329-3454
MI Farmington Hills, J. L. Montgomery Assocs., Inc. 313-489-0099
MN Minneapolis, Robert W. Marshall Co., Inc. 612-929-0457
MN Minneapolis, S & R Comp. Sls., Inc. ... 612-559-3090
MO St. Louis, Advanced Tech. Sls., Inc. 314-878-2921
NM Albuquerque, Compass Mktg. & Sls., Inc. 505-888-0800
NY E. Syracuse, Nycom, Inc. 315-437-8343
NY Jamaica, S-J Assocs., Inc. 718-291-3232
NC Raleigh, Zucker Assocs., Inc. 919-782-8433
OH Columbus, Baehr, Greenleaf & Assocs., Inc. 614-847-0220
OH Dayton, Baehr, Greenleaf & Assocs., Inc. 513-439-0724
OH Westlake, Baehr, Greenleaf & Assocs., Inc. 216-892-1770
OR Tigard, Vantage Corp. 503-620-3280
PA Evans City, Baehr, Greenleaf & Assocs., Inc. 412-776-2151
PA Trevose, P.S.A. Inc. 215-245-0513
TN Greenville, Interep Assocs., Inc. 615-639-3491/3492
TX Austin, Southern Sls. Mktg., Inc. 512-835-5822
TX Houston, Southern States Mktg., Inc. .. 713-960-9556
TX Richardson, Southern States Mktg., Inc. 214-238-7500
UT Salt Lake City, ELCOM, Inc. 801-485-7415, 801-486-4233
WA Bellevue, Vantage Corp. 206-455-3460
WI Milwaukee, Dolin Sls. Co., Inc. 414-482-1111
PR Caguas, CompRep Assocs., Inc. 809-746-6550
Can Streetsville, Ont., CTS of Canada, Ltd. 416-826-1141

Local Distributors

AL Huntsville, Arrow Elctrns., Inc. 205-837-6955
AL Huntsville, Bell Inds. 205-837-1074
AL Huntsville, Hall-Mark Elctrns. Corp. 205-837-8700
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Marshall Inds. 602-496-0290
AZ Tempe, Arrow Elctrns., Inc. 602-968-4800
AZ Tempe, Bell Inds. 602-966-7800
CA Canoga Pk., Hall-Mark Elctrns. Corp. .. 818-716-3300
CA Chatsworth, Arrow Elctrns., Inc. 818-701-7500
CA Chatsworth, Marshall Inds. 818-407-0101
CA Citrus Hgts., Hall-Mark Elctrns. Corp. .. 916-722-8600
CA El Monte, Marshall Inds. (Corp.) 818-459-5500
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Gardena, California Switch & Signal .. 213-538-9830
CA Irvine, Marshall Inds. 714-859-5050
CA Los Angeles, Bell Inds. 213-826-6778
CA Milpitas, Marshall Inds. 408-942-4600
CA Rancho Cordova, Marshall Inds. 916-635-9700
CA Rohnert Pk., First Source Elctrns. Corp. 707-586-0800
CA Roseville, Bell Inds. 916-969-3100
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Arrow Elctrns., Inc. 619-565-4800
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, Hall-Mark Elctrns. Corp. ... 619-268-1201
CA San Diego, Marshall Inds. 619-578-9600
CA San Jose, Hall-Mark Elctrns. Corp. 408-432-0900
CA San Jose, Rose Elctrns. 408-263-9700
CA Sunnyvale, Arrow Elctrns., Inc. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CA Torrance, Hall-Mark Elctrns. Corp. 213-217-8400
CA Tustin, Arrow Elctrns., Inc. 714-838-5422
CA Tustin, Hall-Mark Elctrns. Corp. 714-669-4100
CO Aurora, Arrow Elctrns., Inc. 303-696-1111
CO Denver, Integrated Elctrns. Co., Inc. ... 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CO Englewood, Indl. Elctrns., Inc. 303-694-9444
CO Thorton, Marshall Inds. 303-451-8444
CT Wallingford, Arrow Elctrns., Inc. 203-265-7741
CT Wallingford, Marshall Inds. 203-265-3822
CT Wallingford, Midan Elctrns., Inc. 203-265-2077
CT Wallingford, The Greene-Shaw Co., Inc. 203-265-3333
FL Clearwater, Hall-Mark Elctrns. Corp. ... 813-530-4543
FL Deerfield Bch., Arrow Elctrns., Inc. 305-429-8200
FL Deerfield Bch., Bell Inds. 305-421-1997
FL Ft. Lauderdale, Marshall Inds. 305-977-4880
FL Largo, Bell Inds. 813-541-4434
FL Orlando, Hall-Mark Elctrns. Corp. 305-855-4020
FL Orlando, Marshall Inds. 305-841-1878
FL Palm Bay, Arrow Elctrns., Inc. 305-841-2424
FL Pompano Bch., Hall-Mark Elctrns. Corp. 305-971-9280
GA Norcross, Arrow Elctrns., Inc. 404-449-8252
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Hall-Mark Elctrns. Corp. 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Elk Grove Vl., Bell Inds. 312-640-1910
IL Schaumburg, Arrow Elctrns., Inc. 312-397-3440
IL Shaumburg, Marshall Inds. 312-490-0155
IL Wheeling, Hawk Elctrns. 312-459-4030
IL Wooddale, Hall-Mark Elctrns. Corp. 312-860-3800
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Arrow Elctrns., Inc. 317-243-9353
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Bell Inds. (JIT Only) 317-299-5487
IN Indianapolis, Marshall Inds. 317-297-0483
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Bell Inds. 319-395-0730
KS Lenexa, Arrow Elctrns., Inc. 913-541-9542
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Columbia, Arrow Elctrns., Inc. 301-995-0003
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Newton, The Greene-Shaw Co., Inc. .. 617-969-8900
MA Wilmington, Marshall Inds. 617-658-0810
MA Woburn, Arrow Elctrns., Inc. 617-933-8130
MI Ann Arbor, Arrow Elctrns., Inc. 313-522-1040
MI Ann Arobor, Bell Inds. 313-971-9093
MI Grand Rapids, Arrow Elctrns. Inc. 616-243-0912
MI Livonia, Marshall Inds. 313-525-5850
MN Eden Prairie, Hall-Mark Elctrns. Corp. 612-941-2600
MN Edina, Arrow Elctrns., Inc. 612-830-1800
MN Minneapolis, Indl. Comps., Inc. 612-831-2666
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
MO St. Louis, Arrow Elctrns., Inc. 314-567-6888
NE Lincoln, Scott Elctrn. Supp. Corp. 402-466-8221
NH Manchester, Arrow Elctrns., Inc. 603-668-6968
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Marlton, Arrow Elctrns., Inc. 609-596-8000
NJ Mt. Laurel, Hall-Mark Elctrns. Corp. 609-235-1900
NJ Mt. Laurel, Marshall Inds. 609-234-9100
NJ Parsippany, Arrow Elctrns., Inc. 201-538-0900
NM Albuquerque, Arrow Elctrns., Inc. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Dists. 716-887-2800
NY Commack, Vantage Comps. 516-543-2000
NY Hauppauge, Arrow Elctrns., Inc. 516-231-1000
NY Hauppauge, Marshall Inds. 516-273-2424
NY Jamaica, Archer Indl. Dists., Inc. 718-291-3232
NY Johnson City, Marshall Inds. 607-798-1611
NY Melville, Arrow Elctrns., Inc. (Corp.) 516-694-6800
NY Melville, Semispecialists of America, Inc. (SAI) 516-293-2710
NY Mt. Vernon, QAR Indl. Elctrns. Sls., Inc. 914-699-2224
NY Rochester, Arrow Elctrns., Inc. 716-427-0300, 1-800-462-6422
NY Rochester, Marshall Inds. 716-235-7620
NY Rome, Rome Elctrns., Inc. 315-337-5400
NC Clifton, Vantage Comps., Inc. (Corp.) .. 201-667-1840
NC Raleigh, Arrow Elctrns., Inc. 919-876-3132
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
NC Raleigh, RESCO/Raleigh 919-781-5700
NC Winston Salem, Arrow Elctrns., Inc. 919-725-8711
OH Centerville, Arrow Elctrns., Inc. 513-435-5563
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Marshall Inds. 513-236-8088
OH Solon, Arrow Elctrns., Inc. 216-248-3990
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Solon, Marshall Inds. 216-248-1788
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Broken Arrow, Hall-Mark Elctrns. Corp. 1-800-327-9989
OK Tulsa, Arrow Elctrns., Inc. 918-665-7700
OR Beaverton, Arrow Elctrns., Inc. 503-684-1690
OR Beaverton, Marshall Inds. 503-644-5050
OR Lake Oswego, Bell Inds. 503-241-4115
OR Tualatin, Moore Elctrns. 503-692-5333
PA McKean, Advacom 814-476-7774
PA Monroeville, Arrow Elctrns., Inc. 412-856-7000
PA Philadelphia, PEI/Genesis 215-673-0400
PA Pittsburgh, Marshall Inds. 412-963-0441
TN Nashville, Bell Inds. 615-367-4400

TX Austin, Arrow Elctrns., Inc. 512-835-4180
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Austin, Marshall Inds. 512-837-1991
TX Austin, Southwest-Elctrns., Inc. 512-837-8971
TX Carrollton, Arrow Elctrns., Inc. 214-380-6464
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark Elctrns. Corp. 214-553-4300
TX Dallas, Hall-Mark Elctrns. Corp. (Corp.) 214-343-5000
TX Dallas, Southwest Elctrns., Inc. 214-234-3050
TX Houston, Arrow Elctrns. 713-530-4700
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
TX Stafford, S.W. Elctrns., Inc. 713-491-4900
TX Stafford, Southwest Elctrns., Inc. 713-491-4900
UT Salt Lake City, Arrow Elctrns., Inc. 801-972-0404
UT Salt Lake City, Bell Inds. 801-972-6969
UT Salt Lake City, Marshall Inds. 801-485-1551
WA Bellevue, Arrow Elctrns., Inc. 206-643-4800
WA Bellevue, Bell Inds. 206-747-1515
WA Bellevue, Marshall Inds. 206-641-6800
WI Brookfield, Arrow Elctrns., Inc. 414-792-0150
WI Brookfield, Marshall Inds. 414-797-8400
WI New Berlin, Hall-Mark Elctrns. Corp. 414-797-7844
WI Waukesha, Bell Inds. 414-547-8879
Can Mississauga, Ont., Arrow Elctrns. Canada Ltd. 416-672-7769
Can Montreal, Que., Arrow Elctrns. Canada Ltd. 514-735-5511
Can Quebec City, Que., Arrow Elctrns. Canada Ltd. 418-687-4231

CTS CORPORATION, Connector Division, 9210 Science Center Dr., New Hope, MN 55428, Tel: 612-533-3533, TWX: 910-576-2717; FSC No.: 16512; Empl.: 300; *Sls. Mgr.:* Steve Otto

'Refer to CTS Corp., Elkhart, IN, for sales offices & representatives & for distributor listings.'

CTS CORP., ELECTROMECHANICAL DIV., (Formerly Elkhart Div.), 1142 W. Beardsley Ave., Elkhart, IN 46514, Tel: 219-295-3575; *Sls. Mgr.:* R. G. Sumrak ..... **A•1904-1910; B•1681**

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AZ Phoenix, Faser Tech. Sls. 602-948-4404
AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA Los Altos, Cain-White & Co. 415-948-6533
CA Los Angeles, Midwin & Olifson 213-838-3455
CA San Diego, Midwin & Olifson, Inc. 619-571-0177
CA Tarzana, Midwin & Olifson 818-996-9093
FL Palm Bay, Spartech Assocs. 305-727-8045
GA Norcross, Spartech Assocs. 404-446-7300
IN Ft. Wayne, Corrao Marsh, Inc. 219-482-2725
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Merriam, Lorenz Sls., Inc. 913-384-6556
ME Ogunquit, Micronic Assocs. 617-933-2121, 207-646-9525
MD Burtonsville, Eastern Instrmn. 301-384-8500
MO University City, Lorenz Sls. 314-997-4558
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Teterboro, Technical Mktg. Assocs. ... 201-393-9330
PA Broomall, SWR Assocs. 215-353-6639
TX Dallas, McDonald Assocs. 214-239-3293
WI Brookfield, Oasis Sls., Inc. 414-782-6660
Can St. Laurent, Que., RF Microwave, Ltd. 514-335-2335

DAI-ICHI SHOJI OF AMER., INC., 150 Fifth Ave., Suite 845, New York, NY 10011, Tel: 212-691-9050, FAX: 212-807-1598; Empl.: 3; *Sls. Mgr.:* A. Takayama .... **B•1691; C•1321**

Local Sales Offices & Reps

NY New York, Dai-Ichi Shoji of America, Inc. 212-691-9050

DALE®

FAX: 402-563-6418

DALE ELECTRONICS, INC., Columbus Div., 2064 12th Ave., Columbus, NE 68601, Tel: 402-564-3131; FSC No.: 91637; Empl.: 2800; *Sls. Mgr.:* Darrell Smejkal; *Dist. Mgr.:* Jerry Jilek ..... **A•1925-1931; B•1047-1049**

Local Sales Offices & Reps

AL Huntsville, JWL Assocs. 205-883-1712
AZ Tempe, Dale Elctrns. Sls. 602-966-0291
CA Los Alamitos, Reed Elctrn. Mktg. 213-598-6676
CA Redwood City, J. S. Heaton Co. 415-367-9000
CA San Diego, Vishay District Office 619-690-5112
CO Colorado Springs, Dale Elctrns., Inc. Sls. 303-593-7529
CO Loveland, Dale Elctrns. Sls. 303-667-7500
FL Coral Springs, Graham Assocs., Inc. .. 305-755-6733
FL Lake Park, Graham Assocs. 305-622-4049
FL Melbourne, Graham Assocs. 305-773-6631
FL Winter Garden, Graham Assocs. 305-656-9369
GA Atlanta, JWL Assocs. 404-320-7643
IL Skokie, Indl. Reps. 312-967-8430
IN Fort Wayne, Scott Elctrns. 219-489-5690
IN Indianapolis, Scott Elctrns. 317-841-0010
KS Shawnee Mission, Dale Sls. 913-432-9140
MD Glen Burnie, Tri-Mark 301-761-6000
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MI Plymouth, Jay Mktg. Assocs. 313-459-1200
MN Bloomington, Merrill Franklin Co. 612-854-8020
NJ Fairlawn, Kaelber & Mack 201-797-7865
NY Commack, Kaelber & Mack 516-499-2924
NY Liverpool, Dale Elctrns. Sls. 315-457-1401
NC Pineville, JWL Assocs. 704-541-5750
NC Raleigh, JWL Assocs. 919-787-4826
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, LD Elctrns. 503-684-8221
PA Horsham, TMI 215-441-4300
TX Dallas, E. F. Aymond Co. 214-826-7620
TX San Antonio, E. F. Aymond Co. 512-675-8339
WA Snohomish, LD Elctrns. 206-568-0511
WA Spokane, LD Elctrns. 509-922-4883
WI Milwaukee, Indl. Reps. 414-259-0965

Local Distributors

AL Huntsville, Hamilton/Avnet 205-837-7210
AL Huntsville, Pioneer Technlgs. 205-837-9300
AZ Chandler, Hamilton/Avnet 602-961-6400
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Tempe, Acacia, Div. of Univar 602-894-2874
AZ Tempe, Shelley-Ragon, Inc. 602-894-2058
AZ Tempe, T.T.I. Inc. 602-431-1191
CA Chatsworth, Hamilton/Avnet 213-280-3954
CA Chatsworth, Hamilton/Avnet 818-700-6578
CA Chatsworth, Shelley-Ragon, Inc. 818-998-3333
CA Chatsworth, T.T.I., West 818-709-1010
CA Costa Mesa, Avnet Elctrns. 714-754-6021
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Culver City, Hamilton/Avnet 213-558-2111
CA Gardena, Hamilton Electro Sls. 213-217-6750
CA Gardena, Hamilton Electro Sls. 213-217-6700
CA Inglewood, Newark Elctrns. 213-671-7370
CA Irvine, Acacia Div. of Univar 213-971-2428
CA Milpitas, T. T. I, Inc. 408-946-5577
CA Ontario, Hamilton/Avnet 714-989-8816
CA Sacramento, Hamilton/Avnet 916-920-3150
CA San Diego, Acacia Div. of Univar 619-565-4365
CA San Diego, Hamilton/Avnet 619-571-7536
CA San Diego, Shelley-Ragon, Inc. 619-453-7133
CA San Diego, T.T.I., Inc. 619-587-4888
CA San Jose, Shelley-Ragon, Inc. 408-432-0600
CA Sunnyvale, Acacia Div. of Univar 408-745-7200
CA Sunnyvale, Hamilton/Avnet 408-743-3558
CO Commerce City, Waco Elctrns. 303-289-4743
CO Denver, Newark Elctrns. 303-757-3351
CO Denver, T.T.I. Inc. 303-429-6806
CO Englewood, Hamilton/Avnet 303-740-1020
CO Englewood, Shelley-Ragon, Inc. 303-762-0670
CO Lakewood, Acacia Div. of Univar 303-232-2882
CT Danbury, Hamilton/Avnet 203-797-2854
CT Norwalk, Pioneer Std. 203-853-1515
CT Stratford, Electro/Comp. 203-375-5811
CT Stratford, T. T. I, Inc. 203-375-1400
FL Alamonte Springs, Pioneer Technlgs. 305-834-9090
FL Deerfield Beach, Pioneer Technlgs. ... 305-428-8877
FL Ft. Lauderdale, Hamilton/Avnet 305-979-5211
FL Largo, Lodan Elctrns. 813-586-2851
FL Orlando, T.T.I., Inc. 305-859-1000
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Tampa, Reptron Elctrns. 813-855-4656
FL Tampa, Shelley-Ragon, Inc. 813-623-6560
FL Winter Park, Hamilton/Avnet 305-628-3888
GA Norcross, Hamilton/Avnet 404-447-7523
GA Norcross, Pioneer Technlgs. 404-448-1711
GA Norcross, T.T.I., Inc. 404-662-0911
IL Bensenville, Hamilton/Avnet 312-860-8501
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove, Bell Ind. 312-640-1910
IL Elk Grove Village, Pioneer Std. 312-437-9680
IL Lombard, Shelley-Ragon, Inc. 312-629-8833
IL Palatine, Ohm Elctrns. 312-359-5500
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Bell Ind.,Graham Div. 219-423-3422
IN Indianapolis, Bell Ind., Graham Div. 317-875-8200
IN Indianapolis, Pioneer Std. 317-849-7300
IA Cedar Rapids, Dee Elctrns. 319-365-7551
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Park, Hamilton/Avnet 913-541-7924
KY Lexington, Hamilton/Avnet 606-259-1475
MD Baltimore, RESCO 301-529-0500
MD Beltsville, RESCO 301-937-9100
MD Columbia, Hamilton/Avnet 301-995-3526
MD Columbia, T. T. I., Inc. 301-995-1331
MD Gaithersburg, Pioneer Technlgs. 301-921-0660
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Lexington, Pioneer Std. 617-861-9200
MA Peabody, Hamilton/Avnet 617-596-7668
MA Wilmington, T.T.I. Inc. 617-658-4700
MA Woburn, Sterling Elctrns. 617-938-6200
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Grand Rapids, Pioneer Std. 616-698-1800
MI Grand Rapids, S-F Elctrn. Supp. 616-459-0216
MI Livonia, Hamilton/Avnet 313-522-4700
MI Livonia, Pioneer Std. 313-525-1800
MI Livonia, R-S Elctrns. 313-525-1155
MI Livonia, Reptron Elctrns. 313-525-2700
MI Oak Pk., Newark Elctrns. 313-967-0600
MN Eden Prairie, Pioneer-Std. 612-935-5444
MN Eden Prairie, T. T. I, Inc. 612-944-5080
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Minnetonka, Hamilton/Avnet 612-932-0670
MN Minnetonka, Pioneer Std. 612-935-5444
MN St. Paul, Shelley-Ragon, Inc. 612-642-2828

MO Earth City, Hamilton/Avnet 314-344-1254
MO Independence, Shelley-Ragon, Inc. 816-254-3410
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NJ Cherry Hill, Hamilton/Avnet 609-424-0117
NJ Cranford, G.S.I. Elec. 201-272-6400
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NY Woodbury, Pioneer Std. 516-921-8700
NC Charlotte, Pioneer Technlgs. 704-527-8188
NC Raleigh, Hamilton/Avnet 919-878-0819
NC Raleigh, RESCO 919-781-5700
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Hamilton/Avnet 216-831-3500
OH Cleveland, Pioneer Standard 216-587-3600
OH Columbus, T.T.I. Inc. 614-848-5770
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds., Military Div. 513-434-8231
OH Dayton, Hamilton/Avnet 513-439-6700
OH Dayton, Hamilton/Avnet 513-439-6730
OH Dayton, Pioneer Standard 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Solon, Hamilton/Avnet 216-349-5100
OH Valley View, Trexon Elctrns. 216-447-8860
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Hamilton/Avnet 918-252-7297
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Acacia Div. of Univar 503-646-3377
OR Lake Oswego, Hamilton/Avnet 503-635-8831
OR Portland, Radar Elec. 503-232-3404
PA Horsham, Pioneer Technlgs. 215-674-4000
PA McKean, Advacom 814-476-7774
PA Pittsburgh, Hamilton/Avnet 412-281-4150
PA Pittsburgh, Pioneer Std. 412-782-2300
PA York, E.C.I., Inc. 717-846-5334
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Pioneer Std. 512-835-4000
TX Dallas, Pioneer Std. 214-386-7300
TX Dallas, Shelley-Ragon, Inc. 214-349-2424
TX Dallas, Sterling Elctrns. 214-243-1600
TX Ft. Worth, T.T.I., Inc. 817-831-8300
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Lenert Co. 713-225-1465
TX Houston, Pioneer Std. 713-988-5555
TX Houston, Sterling Elctrns. 713-627-9800
TX Irving, Hamilton/Avnet 214-550-6111
TX Irving, Hamilton/Avnet 214-550-6155
TX Stafford, Hamilton/Avnet 713-274-9336
UT Salt Lake City, Hamilton/Avnet 801-974-9649
WA Bellevue, Hamilton/Avnet 206-453-5842
WA Redmond, Shelley-Ragon Inc. 206-883-2220
WA Redmond, T.T.I. Inc. 206-882-0291
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hamilton/Avnet 414-784-4510

DALE ELECTRONICS, INC., El Paso Div., P.O. Box 26728, El Paso, TX 79926, Tel: 915-592-3253; FSC No.: 91637; Empl.: 272; *Sls. Mgr.:* Douglas Wagenknecht; *Dist. Mgr.:* Jerry Jilek ..... **A•1914-1917; B•1840-1841**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Norfolk Div., 2300 Riverside Blvd., Norfolk, NE 68701, Tel: 402-371-0080; FSC No.: 91637; Empl.: 1200; *Sls. Mgr.:* Jim Filips; *Dist. Mgr.:* Jerry Jilek ..... **A•1918-1924, 1928-1931**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Specialty Div., P. O. Box 1179, Robbinsville, NC 28771, Tel: 704-479-6451; FSC No.: 69274; Empl.: 140; *Sls. Mgr.:* Larry Viar; *Dist. Mgr.:* Jerry Jilek ..... **A•1928-1931**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Tempe Div., 1155 W. 23rd St., Tempe, AZ 85282, Tel: 602-967-7874; FSC No.: 22929; Empl.: 139; *Sls. Mgr.:* Bob Klug; *Dist. Mgr.:* Jerry Jilek ..... **A•1388-1390, 2069**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE ELECTRONICS, INC., Yankton Div., E. Hwy. 50, Box 180, Yankton, SD 57078, Tel: 605-665-9301; FSC No.: 09969; Empl.: 400; *Sls. Mgr.:* John Elliot; *Dist. Mgr.:* Jerry Jilek .... **A•1232-1239, 2205-2209; C•1322-1324**

Refer to Dale Electronics, Inc., Columbus, NE for sales office and distributor information.

DALE WESTERN THERMISTOR DIVISION, See Dale Norfolk Division

DAMON ELECTRONICS DIV., 80 Wilson Way, Westwood, MA 02090, Tel: 617-329-2460, TWX: 710-348-6722, FAX: 617-329-0551; Empl.: 90; *Sls. Mgr.:* Edward J. Doherty ..... **A•1391**

Local Sales Offices & Reps
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA N. Hollywood, Jewett Co. 213-789-8103
CA Palo Alto, Tri-Rep 415-965-1822,
DC Washington, Stemler Assocs. 301-944-8262
FL Melbourne, Repcom 305-254-1877
MD Baltimore, Stemler Assocs. 301-944-8262
MA Waltham, Del Tech Sls. 617-890-1020
NJ Cherry Hill, Stemler Assocs. 609-966-4070
NJ Hackensack, T.M.A. Assoc. 201-342-4008
TX Ft. Worth, El-Tec Sls. 817-268-2896

D & B POWER, INC.

FAX: 516-586-5952

D & B POWER, INC., 204 N. Fehr Way, P.O. Box 40M, Bayshore, NY 11706, Tel: 516-586-5955; FSC No.: 54337; Empl.: 25; *Sls. Mgr.:* Gordon Best; *Dist. Mgr.:* Dan Hall ..... **D•1688-1689**

Local Sales Offices & Reps
CA Pasadena, Electro Mecha. Instrs. 818-795-7193
CA Santa Clara, SMI, Corp. 408-986-1610
KS Lenexa, Spectrum Sls. 913-492-3903
MA Sharon, Adcour, Inc. 617-784-8123
NY East Setauket, Edgerton Elctrn. 516-751-7089
NY Rochester, Technical Comp. Sls. 716-342-2406

Local Distributors
MA Shannon, Adcour, Inc. 617-784-8123

DMC DANIELS MANUFACTURING CORPORATION

FAX: 407-855-6884

DANIELS MANUFACTURING CORP., 6103 Anno Ave., Orlando, FL 32809, Tel: 407-855-6161, TELEX: 564321; FSC No.: 11851; Empl.: 180; *Sls. Mgr.:* Dave Kelly; *Dist. Mgr.:* Ralph R. Recht ..... **C•1759**

Local Sales Offices & Reps
CA San Diego, Cetinske Sls. Co. 619-487-3335
CA Yorba Linda, DMC Western Regional 714-996-5881
CO Englewood, Columbine Fab. 303-761-2121
CT Orange, DMC N.E. Regional Off. 203-799-2343
MD Port Tobacco, DMC N.E. Field Off. 301-934-8220
TX Bedford, DMC S.W. Regional Off. 817-283-2750
VA Virginia Beach, Summit Inds. & Marine 804-463-8820
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Can Ontario, Patlon Aircraft 416-624-5572

DAN-L INC., 229 Laurel Rd., E. Northport, NY 11731, Tel: 516-757-8000; FSC No.: 28327; Empl.: 22

DANMAR INDS., 9705 Lurline Ave., Chatsworth, CA 91311, Tel: 818-882-7979/5280; FSC No.: 31690; Empl.: 10; *Sls. Mgr.:* Mukund Patel

DANTEL, 2991 N. Argyle Ave., Fresno, CA 93727, Tel: 209-292-1111, TELEX: 35-5457, FAX: 209-292-9355; FSC No.: 56960; Empl.: 120; *Sls. Mgr.:* Dan Finch

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CA Sebastopol, Dantel, Inc. 707-823-8989
GA Atlanta, Dantel 404-297-0775
IN Ft. Wayne, Dantel 219-427-9148

DANTRONICS, INC., 3175 Hafner Ct., St. Paul, MN 55126, Tel: 612-484-2108; Empl.: 22

DASOFT DESIGN SYSTEMS, INC., 1827-B Fifth St., Berkeley, CA 94710, Tel: 415-486-0822, TELEX: 4945245; Empl.: 8

DATA, INC., 7702 Emerald Ave., Box 2071, Ft. Collins, CO 80525, Tel: 303-493-1222; Empl.: 3; *Sls. Mgr.:* Sharon Shilling; *Dist. Mgr.:* Sharon Shilling

D.A.T.A., INC., International Thomson Organization, P.O. Box 26875, San Diego, CA 92126, Tel: 619-578-7600, TWX: 910-322-1340; Empl.: 30; *Sls. Mgr.:* Allen Gressler

DATA CAPTURE TECHNOLOGY, Hathaway Corp., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-5366, TELEX: 796355; FSC No.: 7E812; Empl.: 30; *Sls. Mgr.:* Raymond Johnson

DATA CHECK CORPORATION, 9918 Via Pasar, San Diego, CA 92126, Tel: 619-578-0101, TWX: 910-335-1596; FSC No.: 55792; Empl.: 33; *Sls. Mgr.:* Bill Acosta

DATACHRON INC., 1150 E. Stanford Court, Anaheim, CA 92805, Tel: 714-385-1705, TELEX: 678401; FSC No.: 56259; Empl.: 16; *Sls. Mgr.:* Clyde Davis

Local Sales Offices & Reps
CA Palo Alto, Egbert Engrg. 415-326-1387
FL Titusville, Data-Time, Inc. 305-267-5600
NM Albuquerque, Rustco 505-292-2741

DATA CIRCUITS, Computer Logics Ltd., 6380 Viscount Road, Mississauga, Ontario, Canada L4Z 1H3, Tel: 416-672-3833, FAX: 416-672-3869; Empl.: 85; *Sls. Mgr.:* Rick Way; *Dist. Mgr.:* Rick Way

DATACOM, INC., Box 278, Ft. Walton Beach, FL 32548, Tel: 904-244-6121, TWX: 510-730-7693, FAX: 910-244-6344; Empl.: 50

DATACON, INC., 60 Blanchard Rd., Burlington, MA 01803, Tel: 617-273-5800, TELEX: 951651, FAX: 617-273-4809; Empl.: 275; *Sls. Mgr.:* Stephen J. Day

Local Sales Offices & Reps
AL Huntsville, Macro Mktg. Assocs. 205-883-9630
CA Chatsworth, DataCon 818-700-0600
CA Vista, Circuit Technlgs. 619-941-9718
CT Brookfield, M & M Assocs. 203-775-6888
FL Casselberry, Southern Elctrn. Sls. 305-332-4718
IL Hoffman Estates, Microtex 312-382-3001
IL Lisle, WG Controls 312-963-5954
IL Schaumburg, DataCon 312-529-7690
MD Baltimore, Rep-Tron 301-799-7490
NY Bohemia, DataCon 516-589-1100
NY Great Neck, F & F Metro 516-482-4080
NY Syracuse, Labtronics 315-455-7314
PA Newton Sq., Hagy Assocs. 215-459-0504

DATACOPY CORP., 1215 Terra Bella Ave., Mountain View, CA 94043, Tel: 415-965-7900, TELEX: 701994 DATACOPY UO; Empl.: 80; *Sls. Mgr.:* Charles Joseph

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DATA DELAY DEVICES, 3 Mount Prospect Ave., Clifton, NJ 07013-1915, Tel: 201-773-2299 ..... **A•1535-1549**

Local Sales Offices & Reps
AL Huntsville, Mountain Electro Prods. ... 205-533-0084
AZ Phoenix, Tech Sls., Inc. 602-246-1614
AR Coulomb Elec. 713-820-3210
CA El Toro, Martronix 714-858-0632
CA Mountain View, Weseloh/Swanson & Assocs. 415-961-0565
CT Dynamic Sls., Inc. 617-272-5676
DE Jack McCoy Assocs. 215-363-0350
FL Casselberry, Southern Elctrns. Mktg. .. 305-332-4718

GA Stone Mountain, Mountain Electro Prods., Inc. 404-448-5594
IN J. M. Finnegan & Co. 216-238-5905
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LA Coulomb Elec. 713-820-3210
ME Dynamic Sls., Inc. 617-272-5676
MA Burlington, Dynamic Sls., Inc. 617-272-5676
MI Spring Lake, Jim Finnegan & Co. 616-846-4980
MS Mountain Electro Prods. 404-448-5594
NH Dynamic Sls., Inc. 617-272-5676
NJ Medford, Jack McCoy Assocs. 609-953-0770
NY Pittsford, James E. Zimmmerman Sls. 716-381-3186
NC Durham, Mountain Electro Prods. 919-383-9839
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OK Coulomb Elec. 617-272-5676
PA Downingtown, Jack McCoy, Inc. 215-363-0350
PA Pittsburgh, Jim Finnegan & Co. 412-823-5400
RI Dynamic Sls., Inc. 617-272-5676
SC Mountain Electro Prods. 404-448-5594
TN Mountain Electro Prods, ... 404-448-5594
TX Houston, Coulomb Elec. 713-820-3210
VT Dynamic Sls., Inc. 617-272-5676
VA Jim Finnegan & Co. 216-238-5905
Can Ont, Source Elctrns. 416-675-6235

Local Distributors

CA Sunnyvale, Target Elctrns. 415-961-1170

DATA-DESIGN LABS., P.O. Box 711, 7925 Center Ave., Cucamonga, CA 91730, Tel: 714-987-2511; Empl.: 1100; *Sls. Mgr.:* M. L. Sneller

DATA DEVICE CORP., See ILC Data Device Corp.

DATA DISPLAY PRODUCTS, Box 91072, Los Angeles, CA 90009, Tel: 213-640-0442, FAX: 213-640-7639; FSC No.: 15513; Empl.: 27; *Sls. Mgr.:* Qamar Lodhie

DATA ENGINEERING, INC., 2515 N. State Rd. 7 Ste. 207, Margate, FL 33063, Tel: 305-971-0400

DATA GENERAL, 4400 Computer Dr., Westboro, MA 01581, Tel: 617-366-8911, TELEX: 920-329, TWX: 710-390-1217; Empl.: 17,000; *Sls. Mgr.:* Frank Keaney

DATA INSTRUMENTS, INC., 100 Discovery Way, Acton, MA 01720, Tel: 617-264-9550, TELEX: 200081; Empl.: 285; *Sls. Mgr.:* Ernest C. Lutfy ..... **B•1884**

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Local Sales Offices & Reps

AL Huntsville, FLW Southeast, Inc. 205-536-6207
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA San Carlos, Elctrn. Engrg. Assocs. 415-593-2189
CO Englewood, Dynatech, Inc. 303-773-2830
FL Orlando, FLW Southeast, Inc. 305-894-1100
GA Marietta, FLW Southeast, Inc. 404-424-1731
IL Addison, Robert Kanter 312-620-8701
MA Acton, Data Instrs., Inc. 617-264-9550
MA Acton, Dave Hannon 617-264-9550
MN S. St. Paul, Northport Engrg. 612-457-8000
MO Florissant, Delltron Co. 314-839-0033
MO Kansas City, Delltron Co. 816-436-6445
NM Albuquerque, Williams Assocs. 505-255-1638
NY Albany, Robert F. Lamb Co., Inc. 518-869-3355
NY Buffalo, The Robert F. Lamb Co. 716-827-1111
NY Rochester, Robert F. Lamb Co., Inc. ... 716-323-1250
NY Syracuse, Robert F. Lamb Co., Inc. 315-455-2469
NC Charlotte, Emco, Inc. 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Worthington, Bob Young 614-431-0412
OK Tulsa, Bauman Instr. Corp. 918-492-8086
PA Radnor, Pressure Prods. Inc. 215-688-7795
TN Memphis, FLW Southeast, Inc. 901-345-3563
TX Arlington, Collinsystems, Inc. 817-261-2703
TX Houston, Collinsystem Inc. 713-464-9428
UT Layton, Dynatech, Inc. 801-546-4837
WA Redmond, S.E.A. Sls. 206-883-4999
WA Vancouver, S.E.A. Sls. 206-573-5161
Can Woodbridge, Ont., Technel Engrg. Inc. 416-851-4244

Local Distributors

AL Decatur, MG Elctrns. & Equip. Co. 205-355-6121
CO Lafayette, Big Horn Instrmn. 303-665-4054
CT Meriden, Meriden Cooper 203-237-8448
GA Columbus, Wetherbee Elec. Supp. Inc. 404-568-0157
GA Smyrna, Plant Instrs. Co. 404-436-7393
IL Rockford, Power/mation 815-397-0510
IN Indianapolis, J. N. Fauver Co., Inc. 317-872-3060
MA Billerica, Eastronix 617-670-2400
MI Kalamazoo, North Cen. Engrg., Inc. ... 616-349-3010
MI Midland, North Cen. Engrg., Inc. 517-631-3274
MI Taylor, North Cen. Engrg., Inc. 313-942-942-0900
MN St. Paul, Power/mation 612-645-0781
MO Kansas City, ISL Corp. 816-587-5400
MO St. Louis, ISL Corp. 314-535-5760
NY Albany, KOM Lamb Inc. 518-382-1044
NY Buffalo, KOM Lamb Inc. 716-874-3530
NY Rochester, KOM Lamb Inc. 716-266-1868
NY Syracuse, KOM Lamb Inc. 315-455-7436
NC Charlotte, EMCO 704-372-8281
OH Sharonville, Production Resources, Inc. 513-777-0400
OH Twinsburg, The Stanley M. Proctor Co. 216-425-7814
OR Portland, Brancom Instr. 503-283-2555
UT Salt Lake City, Rust Automation Equip. 801-486-9865
WA Colbert, Brancom Instr. 509-466-9365
WA Seattle, Brancom Instr. 206-762-6050
WI Green Bay, Power/mation 414-496-0944
WI Waukesha, Power/mation 414-542-2868

DATA I/O CORP., 10525 Willows Rd. N.E., Redmond, WA 98073-9746, Tel: 206-881-6444, TELEX: 15-2167; Empl.: 550

DATAK CORP., 3117 Paterson Plank Rd., N. Bergen, NJ 07047, Tel: 201-863-7667; *Sls. Mgr.:* Theresa Pflueger ..... **C•1604, 1738, 1842**

Local Sales Offices & Reps

AL Birmingham, Henry W. Phillips Co., Inc. 205-979-3572
CA City of Industry, Don Forth Assocs. ... 818-333-8009
CA Foster City, Polach & Bensinger 415-578-8200
CO Denver, MKP Mktg., Inc. 303-759-5661
FL Lauderdale Lakes, Seacom Sls. Co., Inc. 305-486-0260
GA Roswell, Henry W. Phillips Co. 404-992-3070
IL Wheaton, Archie Joyner Assocs. 312-665-6222
IN Indianapolis, Elmarcon, Inc. 317-846-0221
MI Grand Blanc, Inter-Comm, Inc. 313-695-0666
MO Raytown, Marty Taraski Sls. 816-358-1442
NJ Willingboro, Austin Assocs. 609-871-9290
NY Farmington, Integrity Mktg. Co. 716-924-3671
NC Statesville, Henry W. Phillips Co., Inc. 704-876-0730
OH Novelty, L. W. Bennett & Assocs. 216-564-9772
PA Philadelphia, Instrmn. Specialties 215-742-0898
RI Coventry, Adams McGregor 401-726-1300
TX Dallas, J & J Sls. Co. 214-328-9739

Local Distributors

AL Birmingham, ACK Radio Supp. Co. 205-322-0588
AZ Tempe, Circuit Specialists 602-966-0764
AZ Tucson, Inland Elctrns. 602-889-5301
CA Berkeley, Al Lasher's Elec. 415-843-5915
CA Milpitas, Zack Elctrns. 408-942-5432
CA Pasadena, Dow Radio 818-793-1196
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Pace Elctrns. 805-497-7515
CO Denver, Gateway Elctrns. 303-458-5444
CT Greenwich, Wise Comps. 203-531-4880
CT Hartford, Hatry Elec. 203-527-1881
CT Wallingford, Tron Town U.S.A. 203-237-5598
DE Wilmington, Wholesale Elctrns. 302-656-9988
FL Miami, Elctrn. Equip. 305-871-3500
FL Orlando, Orlando Frame & Art 305-898-6271
GA Atlanta, Ack Elctrn. Supp. 404-351-6340
GA Atlanta, Specialty Distrb. Co. 404-873-2521
IL Berwyn, B-B & W, Inc. 312-749-1710
IL Mt. Prospect, Tri-State Elec. 312-255-0600
IL Niles, Joseph Elec. 312-297-4200
IL Peoria, Klaus Radio, Inc. 309-691-4840
IN Evansville, Hutch & Son 812-425-7201
IN Greenwood, Dick Smith Elctrns. 317-887-3425
IN Indianapolis, Bell Inds. 317-634-8202
IA Cedar Rapids, Deeco, Inc. 319-365-7551
KS Wichita, RSC 316-267-5213
KY Louisville, Peerless Elec. 502-637-7674
LA Lafayette, Ralph's 318-233-0105
LA New Orleans, Southern Radio Supp. .. 504-524-2343
MD Baltimore, A S I Elec. 301-265-5100
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA Needham, You-Do-It Elctrns. 617-449-1005
MA Norwood, Gerber Elec. 617-769-6000
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Norwest Elctrns. 313-261-4551
MN Minneapolis, Acme Elctrns. 612-338-4754
MO Kansas City, Elctrn. Supp. 816-931-0250
MO St. Louis, Gateway Elec. 314-427-6116
MO St. Louis, Van Sickle 314-621-5000
NE Lincoln, Scott Elec. Supp. 402-466-8221
NV Las Vegas, Hurley Elec. 702-384-5666
NV Reno, Elect. Distr. Co. 702-323-2766
NH Pelham, Radio Kit 603-635-2235
NH Pelham, Radiokit 603-635-2235
NJ Greenbrook, Greenbrook Elctrns. 201-968-3500
NJ Rahway, RSR Elctrns. 201-381-8777
NY Buffalo, Summit Distr. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Plainview, Kelvin Elctrns. 516-349-7620
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Cincinnati, URI Elec. 513-761-4030
OH Columbus, Hughes Peters 513-351-2000
OK Tulsa, Elctrn. Design 918-438-2349
OR Beaverton, Norvac Elec. 503-644-1025
OR Portland, Portland Radio Supp. 503-228-8647
PA Braddock, Leff Elctrns. 412-351-5000
PA Drexel Hill, Kass Elctrns. 215-449-2300
PA Philadelphia, A.C. Radio 215-462-9379
PA Reading, Barbey Elctrns. 215-376-6116
RI Providence, W. Dandreta & Co. 401-861-2800
SC Charleston, Wholesale Inds. Elctrns. .. 803-722-2634
TN Memphis, Bluff City Distr. 901-345-9500
TX Dallas, Electrotex Elect. Corp. of TX ... 214-234-0433
TX El Paso, Ideal Indl. Elec. Supp. 915-779-6647
TX Houston, Elctrn. Parts Outlet 713-784-0140
TX San Antonio, Altex Elctrns. 512-828-0503
UT Salt Lake City, Kimball Elec. 801-328-2075
UT Salt Lake City, Standard Supp. Co. 801-486-3371
VA Arlington, Arlington Elec. Whlse. 703-524-2412
VA Norfolk, Priest Elctrns. 804-855-0105
WA Seattle, Seattle Art 206-625-0711
WI Milwaukee, Indl. Elctrns. 414-276-1212

DATALINEAR, Sipex Corp., 491 Fairview Way, Milpitas, CA 95035, Tel: 408-943-1079; Empl.: 90

DATAMETRICS CORP., 8966 Comanche Ave., Chatsworth, CA 91311, Tel: 818-341-2901, TWX: 910-495-2009; FSC No.: 19059; Empl.: 275; *Sls. Mgr.:* Jim Foti

DATAMETRICS INC., 340 Fordham Road, Wilmington, MA 01887, Tel: 617-658-5410, TWX: 710-347-7672; Empl.: 150; *Sls. Mgr.:* A. W. Siff

FAX: 714-754-5407

DATAPOWER INC., Power Systems Div., 3545 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-754-4400, TWX: 910-595-1560; Empl.: 120; *Sls. Mgr.:* Bob Gomez; *Dist. Mgr.:* Edward Blackman ..... **D•1690-1692**

Local Sales Offices & Reps

AL Huntsville, Magaro & Assocs. 205-882-0827
CA San Jose, P & M Elctrns. 408-287-0402,
FL Orlando, Magaro & Assocs. 305-859-6546,
GA Atlanta, Magaro & Assocs. 404-451-8862
IL Schaumburg, Engrg. Prods. 312-882-7640,
IN Cicero, Engrg. Prods. 317-984-5226,
IA Iowa City, Engrg. Prods. 319-354-5344,
MD Upperco, Imagitron Sls. 301-374-5600,
MA Chelmsford, Interstate Sls. Assocs. 617-256-2287
MN Edina, Engrg. Prods. 612-835-9022
NJ Fairfield, G & A Sls. 201-575-8080
NY Rochester, Apex Assocs. 716-254-6050
NY Roslyn Hgts., Travco Assocs. 516-621-3233,
NC Greensboro, Magaro & Assocs. 919-294-4783
OH Wooster, Damar co. 216-264-0971,
OR Beaverton, Quest Mktg. 503-641-7377
TX Houston, Prime Tech. Sls. 713-894-4161,
TX Plano, GW Prods. 214-422-1746
UT Salt Lake City, Harris/CSI 801-467-2299,
WA Bellevue, Quest Mktg. 206-747-9424

DATA POWER, See Beaver Labs

DATA PRECISION CORP., Analogic Corp., Electronics Ave., Danvers, MA 01923, Tel: 617-246-1600, TELEX: 6817144; Empl.: 140; *Sls. Mgr.:* Jay Long

DATAPRINTER CORP., Printronix, 99 Middlesex St., Malden, MA 02148, Tel: 617-321-2400; Empl.: 175; *Sls. Mgr.:* Joseph Marolda, Corp. Sls. Mgr.

DATAPROBE, 170 Coolidge Ave., Englewood, NJ 07631, Tel: 201-569-6464, TELEX: 200679-PROB-UR, FAX: 201-894-0939; Empl.: 20; *Sls. Mgr.:* D. Weiss; *Dist. Mgr.:* S. Weiss

DATAPRODUCTS CORPORATION, 6200 Canoga Ave., Woodland Hills, CA 91365, Tel: 818-888-4014, TELEX: 67-4734; Empl.: 4200; *Sls. Mgr.:* Keith Bauserman; *Dist. Mgr.:* Keith Bauserman

DATAPRODUCTS NEW ENGLAND, INC., 50 Barnes Park North, Wallingford, CT 06492, Tel: 203-265-7151, FAX: 203-265-9101; Empl.: 450; *Sls. Mgr.:* Louis Jurgens

DATAQ INSTRUMENTS, INC., 825 Sweitzer Ave., Akron, OH 44311, Tel: 216-434-4284, TELEX: 6502817028

DATA RACE, INC., 12758 Cimarron Path, San Antonio, TX 78249, Tel: 512-692-3909, TELEX: 517659 RTS TX, FAX: 512-692-7632; Empl.: 28; *Sls. Mgr.:* Garrick C. Colwell

DATARAM CORP., P. O. Box 7528, Princeton, NJ 08543-7528, Tel: 609-799-0071, 800-822-0071, TWX: 510-685-2542, FAX: 609-799-6734; Empl.: 110; *Sls. Mgr.:* James D. Tropp

DATA RAY CORP., 452 Burbank Street, Broomfield, CO 80020, Tel: 303-469-5173, FAX: 303-466-9524; Empl.: 75; *Sls. Mgr.:* E. Yanagida

DATA RENTALS/SLS., INC, 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221; Empl.: 140; *Sls. Mgr.:* Steven Beaver, VP Mktg.

DATA SET CABLE CO., INC., 748 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-9684, TWX: 710-467-0668, FAX: 203-431-4657; *Sls. Mgr.:* T. Busch

DATASOUTH COMPUTER CORP., 4216 Stuart Andrew, P.O. Box 240947, Charlotte, NC 28224, Tel: 704-523-8500, TELEX: 6843018, FAX: 704-523-9298; Empl.: 160; *Dist. Mgr.:* Ann Vetas

DATA SPECIALTIES, INC., See Zebra Technologies Corp.

DATA TECH, DIV. OF PENRIL CORP., See Moisture Register Products Div., Aqua Measure Instrument Co.

DATA TECHNOLOGY, INC., 4 Gill St., Woburn, MA 01811, Tel: 617-935-8820, FAX: 617-935-9656; Empl.: 45; *Sls. Mgr.:* D. Skenderian

Local Sales Offices & Reps

CA Lomita, Tech Rep Assocs. 213-539-9070
CA San Jose, Motion Control 408-997-0544
CO Englewood, Thorson Rocky Mtn., Inc. 303-799-3435,
FL Melbourne, R-Rep Co. 305-725-6993
IL Elk Grove Vl, Carlson Elctrn. Sls. 312-956-8240
NY E. Rochester, A & D Dvcs. 716-385-2778
NY Hawthorne, Swedelco, Inc. 914-747-0101
NY Sidney, A & D Dvcs. 607-563-8488
OH Cincinnatti, Drivex Corp. 513-474-5100
TX Dallas, Blackburn Assocs. 214-750-8484,

DATATRAN CORP., 355 Yuma St., Denver, CO 80223, Tel: 303-778-0870, FAX: 303-778-0877; Empl.: 17; *Sls. Mgr.:* Cindi L. Kemper; *Dist. Mgr.:* Cindi L. Kemper

DATA TRANSLATION, INC., 100 Locke Dr., Marlboro, MA 01752, Tel: 508-481-3700, TELEX: 951646, FAX: 617-481-8620; FSC No.: 61867; Empl.: 230; *Sls. Mgr.:* Ellen Wirka

DATATROL, Division of Data Card Corporation, Brent Dr., Hudson, MA 01749, Tel: 617-568-1411; Empl.: 125; *Sls. Mgr.:* Howard Cantor

Distributor

DATATRONICS, LTD., P. O. Box 2839, Blue Jay, CA 92317, Tel: 714-336-3561, TWX: 910-595-1578 DATAN US LKARW 660, 682, 715, 718, 758, 774, 799, 813

DATATRONIC SYSTEMS CORP., Computer Sciences Div., Bx 44128 EEM/NMR, Panorama City, CA 91412-0128, Tel: 818-988-5290; Empl.: 150

DATA WORLD PRODUCTS, Second N.H. Tpke., Francestown, NH 03043, Tel: 603-588-3746; *Sls. Mgr.:* Stephen Berry

DATAWRAP, INC., 37 Water St., Wakefield, MA 01880, Tel: 617-246-5757; Empl.: 16; *Sls. Mgr.:* Tony Lockwood

DATEC, INC., 200 Eastowne Dr., Ste. 116, Chapel Hill, NC 27514, Tel: 919-929-2135; Empl.: 75; *Sls. Mgr.:* Walt Lovett

DA-TECH CORP., 141 Railroad Drive, Ivyland, PA 18974, Tel: 215-322-9410; Empl.: 110; *Sls. Mgr.:* Bradford W. Bentz

DATEL

FAX: 617-339-6356

DATEL, INC., 11 Cabot Blvd., Mansfield, MA 02048, Tel: 617-339-3000, TELEX: 95-1340, TWX: 710-346-1953; Empl.: 650; *Sls. Mgr.:* N. Renaud ..... **D•1153-1161**

Local Sales Offices & Reps

AL Hunstville, Electronic Mfrs' Agts. 205-830-4030
AZ Phoenix, Tech. Sls. 602-246-1614
CA Santa Ana, Datel 714-835-2751
CA Sunnyvale, San Jose 408-297-7944
CO Denver, Elcom, Inc. 303-337-2300
FL Coral Springs, H. A., Inc. 305-752-7520
GA Roswell, Electronic Mfrs' Agts. 404-992-7240
IL Hoffman Estates, Carvel Engrg. & Sls. 312-885-8800
IA Marion, Ensco-Rep, Inc. 319-377-8551
KS Wichita, Ensco-Rep Inc. 316-683-1070
MA Mansfield, Datel 617-339-3000
MI Auburn Hgts., Infinity, Inc. 313-853-9880
MN Edina, Carvel Engrg. & Sls. 612-835-7929
MO Maryland Heights, Ensco-Rep, Inc. 314-423-3935
NM Albuquerque, Cleveland Entprs. 505-265-7893
NY Babylon, Astrorep 516-422-2500
NY Clark Mills, KLM-Garner 315-853-6126
NY Pittsford, KLM-Garner 716-381-8350
OH Cleveland, Arthur Baier Co. 216-461-6161
OH Dayton, Arthur Baier Co. 513-276-4128
PA Pittsburgh, Arthur Baier Co. 412-367-7799
TX Carrollton, Tech. Mktg., Inc. 214-387-3601
TX Houston, Technical Mktg., Inc. 713-783-4497
TX Round Rock, Technical Mktg., Inc. 512-244-2291
UT Salt Lake City, Elcom, Inc. 801-485-7415
VA Arlington, H. J. Heffernan 703-522-6666
WI Sheboygan, Carvel Engrg. & Sls. 414-457-8800

Local Distributors

AL Huntsville, Schweber Elctrns. 205-895-0480
AZ Phoenix, Schweber Elctrns. 602-997-4874
CA Canoga Pk., Schweber Elctrns. 818-999-4702
CA Gardena, Schweber Elctrns. 213-327-8409
CA Irvine, Schweber Elctrns. 714-863-0200
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Schweber Elctrns. 619-450-0454
CA San Jose, Schweber Elctrns. 408-432-7171
CO Englewood, Schweber Elctrns. 303-799-0258
CT Danbury, Schweber Elctrns. 203-748-7080
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Pompano Bch., Schweber Elctrns. 305-977-7511
GA Norcross, Schweber Elctrns. 404-446-5842
IL Elk Grove Vl, Schweber Elctrns. 312-364-3750
IA Cedar Rapids, Schweber Elctrns. 319-373-1417
KS Overland Pk., Schweber Elctrns. 913-492-2922
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MI Livonia, Schweber Elctrns. 313-525-8100
MN Edina, Schweber Elctrns. 612-941-5280
MO Earth City, Schweber Elctrns. 314-739-0526
NJ Fairfield, Schweber Elctrns. 201-227-7880
NY Rochester, Schweber Elctrns. 716-424-2222
NY Westbury, Schweber Elctrns. 516-334-7474
NC Raleigh, Schweber Elctrns. 919-876-0000
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Dayton, Schweber Elctrns. 513-439-1800
OH West Chester, Arthur Baier Co. 513-779-2395
OH Worthington, Arthur Baier Co. 614-764-1144
OK Tulsa, Schweber Elctrns. 918-622-8003
PA Horsham, Schweber Elctrns. 215-441-0600
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Austin, Schweber Elctrns. 512-458-8253
TX Dallas, Schweber Elctrns. 214-661-5010
TX Houston, Schweber Elctrns. 713-784-3600
WI New Berlin, Schweber Elctrns. 414-784-9020

DATRON INSTRUMENTS, A Wavetek Company, Hurricane Way, Norwich, England, United Kingdom NR6 6JB, Tel: 603-404824, TELEX: 851975173, FAX: 603-483670

DATRON INSTRS., INC., 3401 SW 42nd Ave., Stuart, FL 33497, Tel: 305-283-0935, TELEX: 525724; FSC No.: 66-15b,66-23F,66 Part II SECT H, J; Empl.: 120; *Sls. Mgr.:* Irene Bugno

DATRON SYSTEMS, INC., 200 West Los Angeles Ave., Simi Valley, CA 93065-1650, Tel: 805-584-1717, TWX: 910-494-2787; FSC No.: 32255; Empl.: 122; *Sls. Mgr.:* Bruce Strean, VP Mktg.

DATUM INC., Timing/Aacom Divisions, 1363 S. State College Blvd., Anaheim, CA 92806-5790, Tel: 714-533-6333, TELEX: 4722045 (intl.), TWX: 910-592-1289; FSC No.: 31160; Empl.: 280; *Sls. Mgr.:* Charles Neumann ..... **D•1062, 1163**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. Ltd. 205-534-6020
CA Anaheim, Datum 714-533-6333
CA San Diego, M. Ficken 619-292-9392
CA Santa Clara, Ward/Davis Assocs. 408-245-3700
CO Denver, Vic Meyers Assocs. Inc. 303-629-9676
CT Mt. Carmel, Scientific Dvcs.- Connecticut 203-248-9361
FL Longwood, Southern Mktg. Assocs. Ltd. 305-682-7317
FL Satellite, Southern Mktg. Assocs. Ltd. 305-777-3587
GA Marietta, Southern Mktg. Assocs. Ltd. 404-565-0603
IL Des Plaines, Marsland Assocs. 312-298-2620
IN Indianapolis, Marsland Assocs. 317-293-5437
MA Waltham, Scientific Devices-New England 617-890-2252
MA Wayland, Daner-Hayes 617-655-0888
WI New Berlin, Marsland 414-786-6611
MN Minneapolis, Marsland Assocs. 612-545-4481
MO St. Louis, Marsland Assocs. 314-991-1399
NJ Haddonfield, G. L. Williams Assocs. ... 609-428-6060
NM Albuquerque, Vic Meyers Assocs. Inc. 505-884-6878
NC Greensboro, Southern Mktg. Assocs. Ltd. 919-282-6001
OH Centerville, Micro Sls. Corp. 513-433-8171
OH No. Olmsted, Micro Sls. Corp. 216-734-3080
OK Tulsa, Data Mktg. Assocs. 918-494-2711
TX Austin, Data Mktg. Assocs. 512-443-7722
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
TX San Antonio, Data Mktg. Assocs. 512-342-3031
UT Salt Lake City, Vic Meyers Assocs. Inc. 801-581-1760
MD Rockville, Creative Mktg. Assocs. 301-251-4100
WA Seattle, Comptronics 206-284-4842

DAVIDGE CORPORATION, 94 Commerce Dr., Buellton, CA 93427, Tel: 805-688-9598, TWX: 910-250-0233, ESYLNK: 62001250; *Sls. Mgr.:* Dean Davidge

THE DAVID HAFLER CO., Rockford Corp., 5910 Crescent Blvd., Pennsauken, NJ 08109, Tel: 609-662-6355, TELEX: 1561119, FAX: 609-662-9173; *Sls. Mgr.:* R. H. Tucker

DAVIDSON ELCTRN. DEV. CO., 113 E. 13th St., Erie, PA 16512, Tel: 814-454-6448; Empl.: 27

DAVIES, HARRY, MOLDING CO., 4920 Bloomingdale Ave., Chicago, IL 60639, Tel: 312-622-8966; FSC No.: 72512; Empl.: 113; *Sls. Mgr.:* Leo A. Sera; *Dist. Mgr.:* Leo A. Sera

DAVIS ELEC. CO., Box 38, Cape Girardeau, MO 63701, Tel: 314-335-5547; Empl.: 40

DAYCO PRODUCTS, INC., 333 W. First St., Dayton, OH 45401, Tel: 513-226-5923, TELEX: 288219, TWX: 810-459-1822; Empl.: 10000

DAYTRONIC CORP., Hawker Siddeley, 2589 Corporate Pl., Miamisburg, OH 45342, Tel: 513-866-3300, TWX: 810-473-2978, FAX: 513-866-3327; Empl.: 180; *Sls. Mgr.:* John A. Perkins

DBA SYSTEMS, INC., P.O. Drawer 550, Melbourne, FL 32902-0550, Tel: 305-727-0660, TELEX: 56-4383; Empl.: 740

D-B-DEVELOPMENTS, 7709 Kilbourne Rd., Rome, NY 13440, Tel: 315-339-1265; Empl.: 3

D-CEMCO, 3200 N. San Fernando Blvd., Burbank, CA 91504, Tel: 213-849-6341, TWX: 970-498-2228; Empl.: 50; *Sls. Mgr.:* Cliff Crowder

DCI INC., 14812 W. 117th Street, P.O. Box 215, Olathe, KS 66061, Tel: 913-782-5672, TELEX: 988700; FSC No.: 58677; Empl.: 15; *Sls. Mgr.:* Rob Steffens ..... **B•1054; D•1356**

Local Sales Offices & Reps

AL	Huntsville, Saber Assocs.	800-327-0853
AZ	Phoenix, J. Smith & Assoc.	602-267-0981
CA	Los Altos, XEL	415-969-1222,
CA	Los Angeles, Power Partners	213-215-0800,
CA	Redwood City, N-S Assocs.	415-851-2703
CO	Colorado Springs, J. Smith & Assoc.	303-597-5343
CT	Tolland, R. G. Assoc.	203-875-4201
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Lawrenceville, Saber Assocs.	800-327-0853
IL	Chicago, Commodore I	312-394-5441
IN	Indianapolis, Commodore I	317-636-3318
KS	Shawnee Mission, Vertec	816-737-0377
MA	Danvers, R. G. Assocs.	617-837-3290
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	St. Louis, Vertec	314-394-6242
NJ	Cherry Hill, Analectro, Inc.	609-424-2883
NJ	Parsippany, Analectro	201-386-9677
NM	Albuquerque, J. Smith & Assoc.	505-265-3406
NY	Latham, L-Tron	518-785-5032
NC	Clayton, Saber Assocs.	800-327-0853
OH	Dayton, Bradcor	513-294-5477
OH	Euclid, Bradcor	216-261-0888
TX	Richardson, Meas. Sys. & Sls.	214-644-4954
VA	Alexandria, Analectro	703-823-1703
Can	Montreal, Que., Morrison & Force Dvcs.	514-737-0072,

DEAK TECHNOLOGY, INC., See Elpaz Instruments, Inc.

DEARBORN WIRE & CABLE, INC., 250 W. Carpenter, Wheeling, IL 60090, Tel: 312-459-1000, 800-323-0198, TWX: 910-253-0343, FAX: 312-459-0170; FSC No.: 28105; Empl.: 90; *Sls. Mgr.:* Ray Grabowski; *Dist. Mgr.:* Donna Kudlicki

DE COURSEY ENGINEERING LABORATORY, 11828 W. Jefferson, Culver City, CA 90230, Tel: 213-EX7-9668; Empl.: 7

DEGUSSA CORP., 104 New Era Drive, So. Plainfield, NJ 07080, Tel: 201-757-6500, TELEX: 4754247, FAX: 201-757-8561; FSC No.: 630673043; *Sls. Mgr.:* David W. Molnar

Local Sales Offices & Reps

CA	Laguna Hills, Measure-Tech	714-859-3600
CA	Mtn. View, Gado	415-961-2222
CO	Littleton, Bennett Co.	303-933-1690
MA	Hudson, Electro-Svcs. Inc.	617-562-7798
NJ	Hohokus, Par Assocs.	201-444-6200
PA	Bethel Park, Advance Instr.	412-835-6200
PA	Doylestown, Scott Instrs.	215-348-8989
TN	Knoxville, Hile Controls of Tenn.	615-584-0208
VA	Chester, Hile Controls of VA	804-796-3001
WI	Milwaukee, Allan Engrg.	414-353-5070

DEI, 230 N. Market Pl., Escondido, CA 92025, Tel: 619-743-8344; Empl.: 30; *Sls. Mgr.:* Matt Pedote

DEK INC.

FAX: 312-377-0372

DEK INC., 3480 Swenson Ave., St. Charles, IL 60174, Tel: 312-377-2575; Empl.: 115; *Sls. Mgr.:* L. R. Pappone ..... **C•1843**

Local Sales Offices & Reps

CA	El Segundo, El Segundo Elec. Supp.	213-322-9365
CA	Santa Clara, Walter Assocs.	408-727-1200
CO	Denver, Grimes Mktg.	303-759-8969
CO	Englewood, Frontier, Carl Grimes	303-799-6063
FL	Plantation, Tropi-Tec	305-581-0101
MA	Andover, Richard Purinton, Inc.	617-475-7055
MN	Brooklyn Park, North Central Sls.	612-541-1539
NJ	East Orange, Willgold Sls.	201-678-7700
NY	Buffalo, Kopin Sls. & Mktg.	716-835-3957
OR	Milwaukee, Olympic Agencies	503-652-2104
TN	Paris, Southern States Indl. Sls.	901-642-0885
TX	Crowley, Service Assocs.	817-294-0850
VA	Richmond, Triangle Sls.	804-355-5864

Local Distributors

AZ	Tempe, PSN Distrs.	602-623-9800
CA	Freson, EPC Alarm Supp. Distr.	209-275-0206
CA	Gardena, EPC Alarm Supp. Co.	213-327-0001
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Santa Clara, Waltronic Sls.	408-727-1200
FL	Miami, EPC Alarm Supp. Co.	305-593-0004
GA	Tucker, C.I.D. Inc.	404-491-3143
IL	Addison, L-Comp	312-628-1400
IL	Downers Grove, Great Northern Wire & Cable	213-627-1777
IN	Indianapolis, PEI/Genesis	317-637-5571
KS	Wichita, L-Comp	314-291-6200
LA	Shreveport, Wholesale Elctrns.	318-222-2063
ME	Bangor, Industrial Comps.	207-942-2600
MD	Hanover, Vertex-Mid Atlantic	301-796-5000
MA	No. Wilbraham, Indl. Comps. Corp.	800-628-9646
MI	Lavonia, EPC Supp. Co.	313-591-9100
MN	St. Paul, Arden Indl. Prods.	612-483-6681
MO	Kansas City, L-Comp Kansas	816-221-2400
NJ	Kenilworth, Federated	201-272-0505
NY	Farmingdale, Vertex Elctrns.	516-293-9880
NY	Great Neck, T.W. Comcorp	314-569-2950
NY	Rochester, General Elec. Supp.	716-424-2820
NY	White Plains, Benefield Elec.	914-948-6660
OH	Cleveland, Vertex Wire & Cable	216-831-7140
OH	Columbus, Elctrn. Mktg.	614-299-4161
PA	Philadelphia, PEI/Genesis	215-568-7400
TX	Ft. Worth, Ft. Worth Wire & Cable	817-232-4100
TX	Houston, Litecomm Supp.	713-688-1447
UT	Salt Lake City, Coleman's Mining & Elec.	801-484-5238
VA	Leesburg, Elctrn. Wire & Cable	703-471-9430
WI	Waukeshaw, Cable Comps.	414-785-1060
Can	Toronto, Cords Canada Ltd.	416-787-1114

DELBERT BLINN CO., Box 2007, Pomona, CA 91769, Tel: 714-629-3900, FAX: 714-622-6218; Empl.: 6 ..... **A•2130**

Local Sales Offices & Reps

MD	Baltimore, Callas Elctrns.	301-744-7711
NY	Commack, Kaelber & Mack	516-499-2924
WA	Woodinville, W. J. Stulgis Co.	206-486-8539

Local Distributors

MN	Minneapolis, Stark Elctrns.	612-332-1325

DELCAP DIV., American Precision Industries, Inc., 270 Quaker Rd., E. Aurora, NY 14052, Tel: 716-652-3600, TELEX: 91-293, FAX: 716-652-4814; FSC No.: 99800; Empl.: 30; *Sls. Mgr.:* R. Sbert ..... **A•1073-1075, 1241**

DELCAP, Div. of American Precision Industries, Inc., 274 Sandusky Road, P. O. Box 38, Arcade, NY 14009, Tel: 716-652-3600, TELEX: 91-293; FSC No.: 5910; Empl.: 6; *Sls. Mgr.:* Denis Kohlhagen; *Dist. Mgr.:* Denis Kohlhagen

DELCO WIRE & CABLE, INC., 257 Rittenhouse Cir., Bristol, PA 19007, Tel: 215-785-0511, TELEX: 06-964523, TWX: 510-667-0968; *Sls. Mgr.:* T. Blick

DEL

FAX: 914-699-4005

DEL ELCTRNS. CORP., 250 E. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-699-2000, TWX: 710-562-0130; FSC No.: 01378; Empl.: 115 ..... **A•1072, 2210; D•1693-1697**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Los Alamitos, Power Specialists, Inc.	213-594-9418
CA	Mountain View, Leddy Assocs., Inc.	415-969-6313
CO	Wheatridge, Trembly Assocs.	303-421-8900
IL	Elmhurst, Scott Assocs.	312-279-5681
MA	Burlington, TriTek	617-272-4550
MI	Dearborn, Pitcher-Poulin	313-582-5450
MN	Burnsville, Allied Comps. Reps., Inc.	612-435-7876
NV	Las Vegas, Trembly Assocs.	702-739-9770
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	E. Syracuse, Nycom Inc.	315-437-8343
PA	Ardmore, Martin Assocs.	215-649-6332
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Trembly Assocs.	801-486-5292

DELEVAN DIV., American Precision Inds. Inc., 270 Quaker Rd., E. Aurora, NY 14052, Tel: 716-652-3600, TELEX: 91-293, FAX: 716-652-4814; FSC No.: 99800; Empl.: 300; *Sls. Mgr.:* Denis Kohlhagen ... **A•1241-1243**

Local Sales Offices & Reps

AL	Decatur, El Tech	205-353-7899
AZ	Phoenix, Toward Engrg.	602-955-3193
CA	Del Mar, Galaxie Sls. Int'l.	619-480-5540
CA	El Toro, Delevan	714-768-5522
CA	Freemont, Advanced Technlg. Sls.	415-651-6402
CA	Santa Ana, Galaxie Sls. Int'l.	714-541-5793
CO	Aurora, High Tech Assocs.	303-695-1990
CO	Englewood, Romulus	303-770-4888
FL	Hollywood, Askland Elctrn. Comps.	305-987-1074
IL	Downers Grove, Momak Sls.	312-963-6400
IN	Fort Wayne, Walter W. Bieberich	219-432-2537
IN	New Albany, Walter W. Bieberich	812-945-3187
IA	Cedar Rapids, C. Horn & Asst.	319-393-8703
KS	Parker, S. W. Wollard	913-898-6552
MD	Lutherville, D. A. Dougherty Sls. Co.	301-321-7890
MA	Sterling, Compatible Comps.	617-422-6762
MN	Mendota Hgts., G-II Sls.	612-454-3086
NJ	Bellmawr, TAI	609-933-2600
NY	Johnson City, Tech-Mark	607-729-6340
NY	Manhassett, Martech Assocs.	516-627-1151
NY	Mendon, Tech-Mark	716-624-3840
NY	Utica, Tech-Mark	315-733-0575
NC	Raleigh, Godwin	919-878-8000
PA	Pittsburgh, Convert & Newman	412-531-2002
TX	Irving, Kite Elctrn. Sls. Co.	214-986-0321
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Mississauga, J. G. Weiss Co. Ltd.	416-673-0011
Can	Nepean, J. G. Weiss Co. Ltd.	613-825-0545
Can	St. Laurent, J. G. Weiss Co. Ltd.	514-337-5022
Can	Vancouver, J. G. Weiss Co. Ltd.	604-873-1112
Can	Winnipeg, J. G. Weiss Co. Ltd.	204-949-1877

Local Distributors

CA	Fountain Valley, Comp. Center	714-979-0433
CA	Irvine, Integrated Elctrns.	716-837-9960
CA	Irvine, ITT Multicomponents	714-727-4001
CA	Santa Clara, WDG/Santa Clara	408-727-2500
CA	Stanton, Inductive Comps.	716-828-3420
FL	Ft. Lauderdale, Bros. Elec. of FL	800-331-8080
FL	Tampa, Passive Technlg.	813-623-1935
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Burlington, Compatible Comps.	617-270-9246
MA	Sterling, Compatible Comps.	617-422-6762
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NJ	Fairfield, CWPS	201-822-0997
NJ	W. Berlin, GCI	609-768-6767
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray/New York	516-420-9800
NY	Plainview, ACI Elctrns.	516-293-6630
PA	Norristown, Century Elctrn. Comp.	215-631-5400
TX	Fort Worth, Patco Supply	817-429-8596
Can	Burnaby B.C., R-A-E Indl. Elctrns. Ltd.	604-291-8866
Can	Don Mills, Ontario, Saynor Varah Elctrns.	416-445-0723
Can	Montreal, Quebec, Prelco Elctrns. Ltd.	514-389-8051
Can	Pointe-Claire Quebec, Future Elctrn.	514-694-7710

DELTA DESIGN, 5775 Kearny Villa Rd., San Diego, CA 92123-1111, Tel: 619-292-5000, TWX: 910-335-1215, FAX: 619-277-7884; Empl.: 170; *Sls. Mgr.:* Bob Williams

DELTA ELCTRNS., 145 Fayette St., Winston-Salem, NC 27101, Tel: 919-725-4122; Empl.: 55; *Sls. Mgr.:* L. E. Hancock

DELTA ELECTRONICS MFG. CORP., 416 Cabot St., Beverly, MA 01915, Tel: 617-927-1060, TELEX: 710-347-0631; FSC No.: 00795; Empl.: 210; *Sls. Mgr.:* S. J. Somerset; *Dist. Mgr.:* R. J. Cullinan

DELTA M CORPORATION, 525 Warehouse Rd., Oak Ridge, TN 37830, Tel: 615-483-1569; *Sls. Mgr.:* Eugene F. Szafranski

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FAX: 415-770-0122

DELTA PRODUCTS CORPORATION, 3823 Spinnaker Ct., Fremont, CA 94538, Tel: 415-770-0660, TELEX: 4992342 DELTAITTHY; Empl.: 15 Local/2000 Overseas; *Sls. Mgr.:* Elson Chang; *Dist. Mgr.:* Joe Desmond ... **A•1551, 1644-1645, 2211; D•1698-1699**

Local Sales Offices & Reps

AL	Huntsville, Technlg. Mktg. Assocs. Inc.	205-883-7893
CA	Newport Bch., Venture Tech. Sls.	714-646-6475
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CA	Solana Bch., Cook Entprs. Inc.	619-753-7272
CA	Walnut, Cook Entprs. Inc.	714-594-0091
CO	Wheatridge, Wescom Mktg.	303-422-8957
CT	North Haven, Kitchen & Kutchen	203-239-0212
GA	Atlanta, Technlg. Mktg. Assocs., Inc.	404-446-3565
FL	Largo, Technlg. Mktg. Assocs., Inc.	813-536-3796
FL	Melbourne, Technlg. Mktg. Assocs., Inc.	305-676-3776
FL	Orlando, Technlg. Mktg. Assocs., Inc.	305-857-3760
FL	Pompano Beach, Technlg. Mktg. Assocs., Inc.	305-977-9006
IL	Wheeling, United Prods. Co.	312-459-1222
MA	Burlington, Kitchen & Kutchen	617-229-2660
MN	Edina, Hanna Lind Ltd.	612-925-5700
NJ	Berkley Hgts., Cambridge & Allen Assocs.	201-464-0203
NY	Penfield, Tech. Assocs., Inc.	716-385-4240
NC	Charlotte, Robert W. Chapman & Co.	704-525-2421
OH	Shaker Hgts., Omega Sls., Inc.	513-434-5507
OH	University Hgts., Omega Sls.-Cleveland	216-751-9600
OK	Tulsa, Advance Tech. Sls.	918-664-0482
OR	Beaverton, Evergreen Mktg.	503-643-8020
SC	Greenville, Robert W. Chapman & Co.	803-288-8821
TX	Austin, Component Technlg.	512-474-8698
TX	Dallas, Ultra Rep	214-783-8831
TX	Houston, Component Technlg.	713-961-1262
TX	Houston, Texoma Tech. Sls.	713-462-1432
UT	Salt Lake City, Wescom Mktg.	801-269-0419
VA	Richmond, Glasscook Assocs.	804-740-0063
WA	Seattle, Evergreen Mktg.	206-633-3160
PR	San Juan, Elctrn. Tech. Sls.	809-720-1300
Can	Ontario, Componetics Ltd.	416-479-7200
Can	Quebec, Componetics Ltd. Que.	514-331-1498

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
CA	Anaheim, Tary Elctrns.	714-630-2464
CA	Buena Park, Cypress Elctrns.	714-521-5230
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	San Diego, Cypress Elctrns.	619-535-0011
CA	San Diego, Pyramid Elctrns.	619-271-5404
CA	San Diego, Sigma Elctrns.	619-565-2000
CA	San Jose, Compass Comp.	408-432-7575
CA	San Jose, Sierra West	408-435-7477
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Pyramid Elctrns.	408-727-9810
CO	Englewood, Industrial Elctrns.	303-694-9444
CO	Wheatridge, Added Value Elctrns.	303-422-1701
CO	Wheatridge, Cypress Elctrns.	303-431-2622
CT	Wallingford, Cronin Elctrn.	203-265-3134
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Tampa, Reptron	813-855-4656
GA	Norcross, Hammond Elctrns.	404-449-1996
MD	Beltsville, Pertricko Sls.	301-937-4960
MA		617-657-6523
MA	Needham, Cronin	617-449-5000
MA	Wilmington, JV Elctrns.	617-273-4300
MN	Minneapolis, Berquist Co.	612-835-2322
NH	Hudson, TNT Elctrns.	603-880-8300
NJ	Camden, General Radio	609-964-8560
NY	Mt. Vernon, Q.A.R. Indl.	914-699-2224
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cincinnati, Schuster	216-425-8134
OR	Beaverton, Cypress Elctrns.	503-641-2233
PA	Harrisburg, Pyttronics	215-643-2850
TX	Allen, Prime Distrbg. Co.	800-526-7478
TX	Dallas, Cypress	214-869-1435
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Kent, Pyramid Elctrns.	206-872-5800
Can	Mississauga, Ont., Prelco Elctrns.	416-678-0401
Can	Montreal, Prelco Elctrns.	514-389-8051
Can	Nepean, Ont., Prelco Elctrns.	613-726-1800

DELTA WIRE & CABLE CO., 1260 Neil Ln., North Chicago, IL 60064, Tel: 312-473-4990, FAX: 312-473-2425; Empl.: 12; *Sls. Mgr.:* Perry Stein

DELTEC CO., 12160 Gridley Rd., Norwalk, CA 90650, Tel: 213-929-1775, FAX: 213-868-4522; Empl.: 7; *Sls. Mgr.:* Dennis Orman

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DELTROL CONTROLS, 2745 S. 19th St., Milwaukee, WI 53215, Tel: 414-671-6800, TELEX: 26871; Empl.: 250; *Sls. Mgr.:* D. Uhen; *Dist. Mgr.:* D. Uhen ... **B•1400-1401, 1614-1617**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Tucson, Earl Clemick & Assocs.	602-749-4003
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	Santa Clara, Gagner-Toomey Assocs.	408-244-2200
CO	Boulder, Front Range Mktg.	303-443-4780
CT	Bloomfield, Wood Sls. Corp.	203-243-0457
FL	Deerfield Bch., Jack Krutek & Assocs.	305-427-4202
GA	Atlanta, JWL Assocs.	404-320-7643
IL	Glenview, E. J. McCaffrey & Assocs.	312-272-2820
IN	Wannamaker, Nationwide Comps.	317-872-7207
MA	Wakefield, Wood Sls. Corp.	617-245-8300
MI	Farmington Hills, W. R. Hummon & Assocs.	313-474-0661
MN	St. Paul, Kencotronics, Inc.	612-645-7717
MO	Ellisville, Weisler & Assocs.	314-394-4543
NY	Pt. Washington, Ashtec Inc.	516-767-0336
NY	Rochester, Omni Sls.	716-342-5270
NC	Pineville, JWL Assocs.	704-541-5750
OH	Willoughby, Nationwide Comps.	216-946-3226
OR	Portland, Control Dvcs. N.W.	503-659-3216
PA	Jeffersonville, Providence Mktg.	215-630-0629
TX	Houston, Weisler & Assocs.	713-467-1862
UT	Midvale, Front Range Mktg.	801-566-2500
WA	Bellevue, Control Dvcs. N.W.	206-451-8552
WI	Milwaukee, Werking Ind. Sls.	414-964-2225
Can	Chomedey, Que., Elcom GBM, Inc.	514-668-3361

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AL	Montgomery, Control Comps.	205-264-3325
AZ	Tempe, Control Design	602-829-7981
AR	Little Rock, Carlton-Bates Co.	501-562-9100
CA	Buena Park, Control Design	213-802-2429
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	Los Angeles, Electric Switches	213-660-1310
CA	San Jose, Consolidated Parts	408-435-1200
CA	Tustin, Western Switches	714-259-8144
CO	Denver, Integrated Elctrns.	303-292-6121
CT	New Haven, Hatry Elctrns.	203-787-5921
CT	Waterbury, Century Elec.	203-755-0405
FL	Altamonte Springs, Control Des.	305-788-3220
FL	Ft. Lauderdale, SE Elctrns.	305-563-4131
FL	Lakeland, Wes-Garde Comps.	813-644-7564
FL	Orlando, EMSCO	305-849-6362
GA	Atlanta, Georgia Control Ctr.	404-876-8833
ID	Pocatello, Kimball Elctrns.	208-232-2201
IL	Elk Grove Village, GBL/Gould Elctrns.	312-593-3220
IL	Genoa, Control Design	815-784-6515
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Iowa Radio Supp.	319-393-4510
IA	Davenport, Warren Radio	319-322-5301
IA	Dubuque, Miller Elec. Supp.	319-588-1469
IA	Marion, Control Des.	319-373-2923
IA	West Des Moines, Ramco Co.	515-225-6933
KS	Kansas City, Kornfield Thorp Elec.	913-321-7070
KS	Wichita, Kriz-Davis Co.	316-267-4354
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
MD	Aberdeen, Harco Elctrns.	301-838-7990
MA	Brighton, Interstate Elctrns. Equip.	617-782-9000
MA	Westborough, In Stock Prods.	617-870-5750
MI	Jackson, Fulton Radio Supp.	517-784-6107
MI	Madison Hgts., Galco Indl. Elctrns.	313-542-9090
MN	Minneapolis, Control Design	612-721-6555
MO	St. Louis, Van Sickle Radio Elctrns.	314-621-5000
NH	Keene, Tradesmen Elctrl. Supp.	603-352-1205
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Raritan, Masters Elctrn.	201-725-3533
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hempstead, Davis Elctrns.	516-483-9200
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Vestal, Wholesale Elec. Supp.	607-729-1526
ND	Fargo, WESCO	701-232-4446
ND	Minot, John Iverson Co.	801-852-4466
OH	Akron, AESCO Elctrns.	216-762-8818
OH	Wickliffe, Gateway Megatech	216-944-5801
OK	Ardmore, Ardmore Elec. Supp.	405-223-3571
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, Dunn Elec.	503-285-0214
PA	Erie, Rem Elctrns.	814-453-5626
PA	Malvern, Control Design	215-296-0150
PA	Philadelphia, Lindley Elec.	215-329-7005
SD	Aberdeen, Plainsco	605-225-7100
TN	Knoxville, CED	651-521-6262
TX	Dallas, Control Design	214-358-1441
TX	Longview, Matthews Elec. Supp.	214-753-5629
TX	Lubbock, R & R Elec. Co.	806-765-7727
TX	San Antonio, Blackburn Drives Controls	512-349-2621
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
VA	Glen Allen, Hermitage Distrs.	804-798-3830
VA	Staunton, Southern Elec.	703-886-6218
WA	Kent, Pyramid Elctrns.	206-872-5800
WI	Manitowoc, Englewood Elec.	414-684-6653
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	New Berlin, Control Design	414-784-1015

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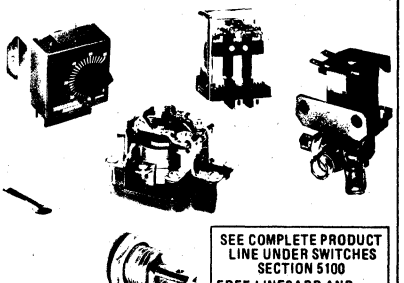

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DENNIS CHEMICAL, 2700 Papin St., St. Louis, MO 63103, Tel: 314-771-1800, FAX: 314-771-8399; Empl.: 70; *Sls. Mgr.:* Charles F. Seger III; *Dist. Mgr.:* Charles F. Seger III

DENNISON MFG. CO., 300 Howard St, Framingham, MA 01701, Tel: 617-879-0511, TELEX: 948-478; FSC No.: 5975;2310; Empl.: 8000; *Sls. Mgr.:* George Curtis; *Dist. Mgr.:* Don Malloy

DENSEPAC MICROSYSTEMS, INC., 7321 Lincoln Way, Garden Grove, CA 92641-1428, Tel: 714-898-0007, 800-64-CHIPS, TWX: 510-601-1045; Empl.: 50; *Sls. Mgr.:* Stephen J. Whyte

DENSITRON CORPORATION

FAX: 213-534-8419

DENSITRON CORPORATION, 2540 W. 237th St, Torrance, CA 90505, Tel: 213-530-3530, TWX: 910-349-6200; FSC No.: 62483; Empl.: 65; *Sls. Mgr.:* Robert Turner; *Dist. Mgr.:* Robert Turner ..... **B•1052-1053**

Local Sales Offices & Reps

AL	Huntsville, E.M.A.	205-536-3044
AL	Huntsville, Elctrn. Mktg., Inc.	205-837-7363
AZ	Phoenix, Chaparral Elctrn., Inc.	602-252-0897
CA	Irvine, Comp. Mktg. Assocs.	714-951-5950
CA	Laguna Hills, Comp. Mktg. Assocs.	714-951-6046
CA	Lomita, Comp. Mktg. Assocs.	213-326-1460
CA	San Mateo, Comp. Mktg. Assocs.	415-345-7373
CA	Solana Bch., Comp. Mktg. Assocs.	619-481-9310
CA	Tarzana, Comp. Mktg. Assocs.	818-705-4087
CO	Arvada, Delconec	303-422-7023
CT	W. Hartford, Nova Assocs. (M-R Tech. Sls.)	203-521-2101
FL	Margate, E.P.M. Corp.	305-977-0331
GA	Atlanta, Elctrn. Mktg. Assoc., Inc.	404-448-1215
GA	Decatur, E.A.B., Inc.	404-981-1600
IL	Northbrook, H. Benjamin & Assoc.	312-272-2900
IA	Marion, Ensco-Rep, Inc.	319-377-8551
KS	Wichita, Ensco-Rep, Inc.	316-683-1071
MA	Braintree, Nova Assocs.	617-848-9330
MI	Jenison, R.C. Nordstrom & Co.	616-457-5762
MI	Southfield, R. C. Nordstrom & Co.	313-559-7373
MN	Minneapolis, Electro-Serv	612-338-3475
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NJ	Cherry Hill, Metz-Benham Assocs., Inc.	609-424-0404
NY	Marcellus, J. G. Welch Assocs.	315-685-6280
NY	Mastic, Optimum Sls. Co.	516-589-4664
NY	Patchogue, Optimum Sls.	516-758-0644
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NY	Rochester, Mullahy-Welch Sls.	716-266-2798
NC	Raleigh, C-Tech Sls.	919-847-0202
NC	Raleigh, Elctrn. Mktg. Assoc., Inc.	919-847-8800
OH	Worthington, Dynel Corp.	614-436-9452
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
SC	Greenville, Elctrn. Mktg. Assoc., Inc.	803-233-4637
TX	Seagoville, Delta Comp., Inc.	214-287-6333
WA	Seattle, J. J. Assocs., Inc.	206-246-6619
Can	Scarborough, Ont., Comm. Dvcs.	416-439-6320

DERINGER MFG. CO., 1250 Townline Road, Mundelein, IL 60060, Tel: 312-566-4100, TWX: 910-685-4321, FAX: 312-566-5370; *Sls. Mgr.:* R. Davis

DESIGNATRONICS, INC., See Automatic Coil Corp., Sub. Designatronics, Inc.

DESIGN AUTOMATION, INC., 809 Massachusetts Ave., Lexington, MA 02173-3992, Tel: 617-862-8998, TELEX: 247346 SBSB UR; FSC No.: 4D417; Empl.: 8

DESIGN COMPONENTS, INC., 1 Kenwood Circle, Franklin, MA 02038, Tel: 617-528-7300, 800-341-4811, FAX: 617-520-1424; Empl.: 60; *Sls. Mgr.:* James Boyd

DESIGN TECHNOLOGY, 5710 Ruffin Rd., San Diego, CA 92123, Tel: 619-268-8194, TELEX: 503476; Empl.: 50; *Sls. Mgr.:* Pamela Hamilton; *Dist. Mgr.:* Michael Golden

DESPATCH INDUSTRIES, 619 S.E. 8th St, P.O. Box 1320, Minneapolis, MN 55440-1320, Tel: 612-331-1873, TELEX: 29-0704, TWX: 6288-5512; Empl.: 525; *Sls. Mgr.:* P. Olson

DETORONICS CORPORATION, 10660 E. Rush St., S. El Monte, CA 91733, Tel: 818-579-7130, TWX: 910-587-3436; FSC No.: 29867; Empl.: 45

DEUTSCH CO., Deutsch Fiber Optics Div., 7001 W. Imperial Hwy., Los Angeles, CA 90045, Tel: 213-649-1400; *Sls. Mgr.:* Ken Ahmad

DEUTSCH RELAYS, INC., 65 Daly Road, East Northport, NY 11731, Tel: 516-499-6000, TWX: 510-226-0233, FAX: 516-499-6000-254; Empl.: 400; *Sls. Mgr.:* Jack Riley; *Dist. Mgr.:* Steve Salonitis

DEVAR, INC., P.O. Box 589, Bridgeport, CT 06601, Tel: 203-368-6751, TELEX: 96-4234, FAX: 203-368-3747; Empl.: 80; *Sls. Mgr.:* T. W. Tomasko

DEVCO ENGINEERING, 36 Pier Lane West, Fairfield, NJ 07006, Tel: 201-CA8-0321, TELEX: 139-340; Empl.: 36

DEVELCO, INC., 175 Nortech Pkwy., San Jose, CA 95134-2306, Tel: 408-945-6500, TWX: 910-339-9295; Empl.: 50; *Sls. Mgr.:* W. J. Baker

DEXTER RESEARCH CTR., INC., 7300 Huron River Dr., Dexter, MI 48130, Tel: 313-426-3921, TELEX: 757075 DEXTER RES UD; Empl.: 22; *Sls. Mgr.:* Robert Toth Jr.

DEYOUNG MANUFACTURING, INC., 12920 N.E. 125th Way, Kirkland, WA 98034, Tel: 206-823-4798, FAX: 206-821-8633; FSC No.: 54937; Empl.: 70; *Sls. Mgr.:* Ted Johnson

DGH CORPORATION, P. O. Box 5638, Manchester, NH 03108, Tel: 603-622-0452, TWX: 510 601 6112; Empl.: 10

DIALIGHT CORP., North American Philips, 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400, TELEX: 244536; Empl.: 400; *Sls. Mgr.:* J. McNamara .. **B•1115-1124, 1692-1693; C•1413, 1415, 1553, 1709**

Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Shefler-Kahn Co.	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Pleasanton, Moulthrop Sls.	415-463-0450
CA	Santa Ana, Landa & Assocs.	714-543-7805
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, Panamtech, Inc.	305-587-3769
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Chicago, Dialight Corp.	312-991-3472
IN	Indianapolis, Elctrn. Reps.	317-894-1414
KS	Shawnee Mission, Lowell Kangas & Assocs.	913-631-3515
LA	Covington, Cartwright & Bean	504-892-1780
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Royal Oak, Hilltronics	313-435-0920
MN	Minneapolis, Professional Sales For Ind.	612-944-8545
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, Lowell Kangas & Assocs.	314-821-4050
NY	Liverpool, Gen-Tech	315-451-3480
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Earl & Brown Assocs.	503-643-5500
PA	Broomall, L.D. Lowery	215-356-5300
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Austin, Tesco	512-834-8374
TX	Garland, Tesco	214-681-1376
UT	Woodscross, Comp. Prods. Sls.	801-292-8882
WA	Redmond, Earl & Brown Assocs.	206-885-5064

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carleton-Bates Co.	501-562-9100
CA	Alhambra, Harper S.I.D.	213-289-0255
CA	Buena Pk., Cypress Elect.	213-744-0355
CA	Compton, Harper;S.I.D.	213-979-5090
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Garden Grove, Richey Western Elec.	714-895-0060
CA	Gardena, Bell Indus.	213-515-1800
CA	Gardena, Cal Switch & Signal	213-770-2330
CA	Inglewood, Newark Elctrns.	213-671-7378
CA	Roseville, Bell Inds.	916-969-3100
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	San Diego, Harper S.I.D.	714-560-8545
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Jose, Richey Western	408-432-7100
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Harper S.I.D.	408-988-6041
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Sun Valley, Richey Western Elec. Inc.	213-768-3800
CA	Sunnyvale, Arrow Elec.	408-745-6600
CA	Sunnyvale, Bell Indus.	408-734-8570
CA	Sunnyvale, Harper;S.I.D.	408-747-0333
CA	Sunnyvale, Time Elect.	408-734-9888
CA	Thousand Oaks, Bell Inds.	818-340-1940
CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Denver Elctrns.	303-757-3351
CT	Wallingford, Sager Elctrl. Supply	203-265-4600
FL	Ft. Lauderdale, Peerless Radio	305-973-4141
FL	Orlando, Hammond Elctrns.	305-849-6060
FL	Pompano Bch., Peerless Radio	305-973-4141
GA	Atlanta, Specialty Dist.	404-873-2521
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Peoria, Klaus Radio & Elect.	309-691-4840
IN	Ft. Wayne, Bell Inds./Graham Elctrn. Div.	219-423-3422
IN	Indianapolis, Bell Inds./Graham Elctrn. Div.	317-634-8202
IN	Indianapolis, PEI-Genesis	317-637-5571
IN	South Bend, PEI-Genesis	219-287-2911
KY	Louisville, P.I. Burks	502-589-3960
LA	Lafayette, Ralph's of Lafayette	318-234-0105
LA	New Orleans, Southern Radio Supp.	504-524-2343
MD	Gaithersburg, Pioneer Washington Elec.	301-948-0710
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MD	White Marsh, Resco/Baltimore	301-529-0500
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	W. Springfield, T.F. Cushing	413-788-7341
MA	Wilbraham, Ind'l. Comps.	413-596-3854
MI	Ann Arbor, Wedemeyer Elctrn. Supp.	313-665-8611
MI	Livonia, RS Elctrns.	313-525-1155
MI	Oak Park, Newark Elctrn.	313-967-0600
MN	St. Paul, Gopher Elctrns.	612-483-3322
MO	Kansas City, LCOMP	816-221-2400
MO	Kansas City, Walters Radio Supp.	816-531-7015
MO	Maryland Hgts., LCOMP	314-291-6200
NE	Lincoln, Scott Elctrn. Supp.	402-466-8221
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Kenilworth, Federated Purchaser	201-272-0505
NJ	Pennsauken, Resco Elctrns.	609-662-4000
NY	Buffalo, Summit Dists.	716-887-2800
NY	Elmsford, Ancar Elctrns. Supp.	914-592-7100
NY	Endwell, ASI Elect.	607-754-3823
NY	Hauppauge, Broadline Elec. Dists.	516-231-4123
NY	Long Island City, Dalis Indl. Elect.	718-361-1100
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Rochester, Summit Elctrns.	716-334-8110
NY	Rome, Rome Elctrns.	315-337-5400
NY	Woodbury, Pioneer Standard	516-921-8700
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Akron, Akron Elctrn. Supp.	216-762-8818
OH	Akron, Sun Radio	216-434-2171
OH	Cincinnati, Hughes-Peters	513-351-2000
OH	Cincinnati, URI Elctrns.	513-761-4030
OH	Cleveland, Pioneer-Cleveland	216-587-3600
OH	Columbus, Hughes-Peters	614-294-5351
OH	Dayton, Pioneer/Dayton	513-236-9900
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Solon, REPCO Elctrn.	216-248-8900
OH	Warren, REM Elctrns.	216-373-1300
OK	Tulsa, Norvell Elect.	918-254-8606
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Beaverton, Almac Elctrns.	503-629-8090
OR	Lake Oswego, Bell Inds.	503-635-6500
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Indus.	215-643-2850
PA	Philadelphia, Almo Elctrns.	215-698-4000
PA	Philadelphia, PEI-Genesis Elctrn.	215-673-0400
PA	Pittsburgh, Cam RPC Elect.	412-782-3770
PA	Reading, Barbey Elctrns.	215-376-7451
RI	Providence, Wm. Dandreta	401-861-2800
SC	Greenville, Emsco	803-233-4121
TN	Kingsport, Radio Elec. Supp.	615-247-8111
TN	Nashville, Carlton-Bates Co.	615-244-3562
TN	Nashville, Electra Dist.	615-256-0800
TX	Austin, Harrison Equip.	512-458-3555
TX	Austin, Norvell	512-837-5555
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Garland, Newark Elctrns.	214-487-8144
TX	Houston, Newark Elctrns.	713-782-4800
TX	Stafford, Harrison Equip.	713-879-2600
UT	Salt Lake City, Standard Supp.	801-486-3371
VA	Norfolk, Priest Elctrns.	804-855-0105
VA	Richmond, Sterling Elctrns.	804-226-2190
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Bell Inds.	206-747-1515
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Milwaukee, Indl. Elect.	414-276-1212
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WI	Waukesia, Bell Inds.	414-547-8879

DIAL PRODUCTS CO., 19-21 Cottage St., Bayonne, NJ 07002, Tel: 201-HE7-0720; Empl.: 100; *Sls. Mgr.:* Beverly Malen

DIAMOND MAGNETICS, 235 Tank Farm Rd., Ste. G, San Luis Obispo, CA 93401, Tel: 805-544-4019; Empl.: 20; *Sls. Mgr.:* Steven A. Maxwell

DIANACHART INC., 129 Hibernia Ave., Rockaway, NJ 07866, Tel: 201-625-2299; Empl.: 10; *Sls. Mgr.:* S. Byrom

DI/AN CONTROLS, INC., 944 Dorchester Ave., Boston, MA 02125, Tel: 617-288-7700; FSC No.: 06900; Empl.: 60; *Sls. Mgr.:* Robert D. Kodis

DIA-NETICS, INC., 18823 Napa St., Northridge, CA 91324, Tel: 818-886-2616; Empl.: 48

ELGAR

FAX: 619-458-0267

DIEGO POWER, 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-587-1925, TELEX: 211063 ELSD UR; Empl.: 250; *Sls. Mgr.:* Martin Sanders; *Dist. Mgr.:* Martin Sanders ..... **D•2098**

Local Sales Offices & Reps

IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MD	Wheaton, Brimberg Sls. Co.	301-946-2670
MA	Bedford, Eastronix	617-275-5775
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Minneapolis, Sector Engrg. Sls.	612-593-1809
NM	Albuquerque, Odyssey I	505-265-6645
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Dayton, Comtel Instrs.	513-426-5310
OK	Tulsa, Spectra Sls.	918-663-7188
PA	Pittsburgh, Comtel Instrs.	412-922-5720
TX	Houston, Spectra Sls.	713-747-2798
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, Datacom	206-285-2525
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280

DIELECTRIC COMMUNICATIONS, General Signal, Tower Hill Rd., Raymond, ME 04071, Tel: 207-655-4555, 800-341-9678, TELEX: 710-229-6890; FSC No.: 08441; Empl.: 270; *Sls. Mgr.:* Rolf Olsen

DIELECTRIC INSTRUMENT CORP., 761 Franklin Ave., Pittsburgh, PA 15221, Tel: 412-731-6566; Empl.: 5

DIELECTRIC LABS., Rte. 20 E., Cazenovia, NY 13035, Tel: 315-655-8710, TELEX: 882-691 Dielectric Labs., FAX: 315-655-8179; FSC No.: 55153; Empl.: 100; *Sls. Mgr.:* Gunter Vorlop

DIETZ DESIGN, INC., 100 Electronics Pkwy., Belton, MO 64012, Tel: 816-331-4911; Empl.: 75

DIGI-DATA CORP., 8580 Dorsey Run Rd., Jessup, MD 20794, Tel: 301-498-0200, TELEX: 87-580; Empl.: 40; *Sls. Mgr.:* Allen Grams

DIGIMETER INC., 512 Valley Way, Milpitas, CA 95035, Tel: 408-946-9090, FAX: 408-946-9190; Empl.: 3; *Sls. Mgr.:* Robert Klinger; *Dist. Mgr.:* Robert Klinger ..... **D•1360-1362**

DIGITAL COMMUNICATIONS ASSOCIATES, INC., 1000 Alderman Dr., Alpharetta, GA 30201, Tel: 404-442-4000, TELEX: 261375 DCA UR; Empl.: 1025; *Dist. Mgr.:* Jerry Buran

DIGITAL DATA SYSTEMS, 1551 N.W. 65 Ave., Plantation, FL 33313, Tel: 305-792-3290, TWX: 910-997-4751 (DIGITAL), FAX: 305-581-1325; FSC No.: 65136; Empl.: 20

DIGITAL DYNAMICS, INC., 275 Technology Circle, Scotts Valley, CA 95066, Tel: 408-438-6823; FSC No.: (S.I.C. Code – 3823); Empl.: 15; *Sls. Mgr.:* R. Palmer

DIGITAL ELECTRONICS, 31047 Genstar Road, Hayward, CA 94544-7831, Tel: 415-471-4700, TELEX: 172073 DIGELEC HYWD, FAX: 415-489-3500; *Sls. Mgr.:* John W. McKinney, Mktg. VP

DIGITAL EQUIP., One Iron Way, Marlborough, MA 01752

DIGITAL EQUIPMENT CORP., 33 Cabot Rd., Woburn, MA 01801, Tel: 800-225-5385

DIGITAL MEDIA, 11770 Warner Ave., Ste. 225, Fountain Valley, CA 92708, Tel: 714-751-1373; *Sls. Mgr.:* Ed Burg

DIGITAL PATHWAYS, INC., 201 Ravendale Dr., Mountain View, CA 94043, Tel: 415-964-0707, TWX: 910-379-5034, FAX: 415-961-7487; Empl.: 75; *Sls. Mgr.:* Robert Lewin

DIGITAL PRODUCTS, INC., 108 Water Street, Watertown, MA 02172, Tel: 617-924-1680, 800-243-2333, TELEX: 312345, FAX: 617-924-7814; Empl.: 90; *Sls. Mgr.:* Kay Waxman

DIGITAL RADIO CORP., 601 S. Pacific Coast Hwy., Redondo Beach, CA 90277, Tel: 213-316-9114; Empl.: 27; *Sls. Mgr.:* Arvin L. Perry

DIGITEC CORP., 959 Cheney Ave., Marion, OH 43302, Tel: 614-387-3444, TELEX: 3775688; FSC No.: 16152; Empl.: 45; *Sls. Mgr.:* Bruce Poplin; *Dist. Mgr.:* Bruce Poplin ..... **D•1363**

Local Sales Offices & Reps

AL	Adamsville, Southrep	205-674-3056
AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Bakersfield, AWC, Inc.	805-322-2416
CA	Huntington Beach, AWC	714-969-2468
CA	Santa Clara, Johnson Assocs.	408-984-4626
CO	Wheatridge, Trembly Assocs.	303-421-8900
FL	Clearwater, Structural Engrg./Testing Co.	813-442-7767
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
IA	Cedar Rapids, Marsland Assocs.	319-365-1908
LA	Baton Rouge, Process Meas. & Monitors, Inc.	504-927-9416
MD	Baltimore, Cavalier Controls, Inc.	301-337-8378
MA	Lexington, R. J. Sickles Assocs.	617-862-5100
MA	Needham, Carl Lueders & Co.	617-449-0345
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Cedar Grove, KLS	201-785-4450
NJ	Pennsauken, Scientific Reps., Inc.	609-662-5222
NM	Albuquerque, Fry-Gates	505-262-1525
NY	Parish, Glen Instrs.	315-625-4426
NY	Rochester, Glen Instrs.	716-338-7148
NC	Charlotte, Metrodyne, Inc.	704-563-2474
OH	Cleveland, Comtel-Instr.	216-442-8080
OH	Hillard, Comtel-Instr.	614-876-8305
OK	Tulsa, Ernie Graves Co., Inc.	918-584-4707
OR	Portland, Showalter Instrs., Inc.	503-629-9254
PA	Pittsburgh, Comtel-Instr.	412-922-5720
TN	Knoxville, J R B Controls, Inc.	615-588-2937
TX	Houston, Dixon Engrg., Inc.	713-644-8052
TX	Longview, Control Devices/Jack Fair Co.	214-759-6471
UT	Centerville, M.C. Squared, Inc.	801-298-3380
VA	Richmond, Cavalier Controls	804-271-5226
WA	Bellevue, Showalter Instrs., Inc.	206-746-7970
WI	New Berlin, Marsland Assocs., Inc.	414-786-6611
Can	Weston, Ont., Megatronix Corp.	514-878-8000

DIGITECH INDUSTRIES, INC., 66 Grove St., P.O. Box 547, Ridgefield, CT 06877, Tel: 203-438-3731, TELEX: 969-623; Empl.: 70

DIGITEK INC., Block & Co., Inc., 11807 N. Creek Pkwy. S., Bothell, WA 98011, Tel: 206-485-6571; Empl.: 16; *Sls. Mgr.:* Herb Vernon

DIGITRAN®

FAX: 818-791-9788

DIGITRAN DIVISION, Xcel Corporation, 3100 New York Dr., Pasadena, CA 91107, Tel: 818-791-5600, TELEX: 67-5485, TWX: 910-588-3794; FSC No.: 07126; Empl.: 300; *Sls. Mgr.:* R. Van Horn; *Dist. Mgr.:* Kathy Privett ..... **B•1055, 1694, 1814**

Local Distributors

AL	Huntsville, Comp. Distrs.	205-883-7501
AL	Huntsville, Powell Elec.	205-539-2731
AZ	Tempe, Powell Elctrns.	602-967-7538
AR	Little Rock, Comp. Distrs.	501-227-6278
CA	Cerritos, El-Com	213-404-2961
CA	Fullerton, Pyramid	714-773-0781, 213-691-0561
CA	San Diego, El-Com	619-578-0900
CA	San Jose, Powell Elctrns.	408-943-9020
CA	Santa Clara, Pyramid Elec.	408-727-9810
CT	Hamden, Impact Elctrns.	203-281-1331
FL	Ft. Lauderdale, Comp. Distrs.	305-971-4950
FL	Ft. Lauderdale, Powell Electr./Fla.	305-972-4300
GA	Norcross, Comp. Distrs.	404-441-3320
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IN	Indianapolis, Graham Elec.	317-634-8202
MD	Columbia, Powell Electr.	301-621-4070
MA	Canton, Impact Sls. Co.	617-821-1500
MA	West Borough, Powell Electrns.	617-336-6100
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MI	St. Clair Shores, Specialties Mfg.	313-771-2700
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NJ	Hasbrouck Hgts., Tory Sls.	201-288-5656
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NC	Raleigh, Comp. Distrs.	919-834-9465
OH	Cleveland, Pioneer-Cleveland	216-587-3600
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OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Tulsa, Norvell Elctrns.	918-663-1247
PA	Philadelphia, Powell Electr.	215-365-1900
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DILLON, W. C., & CO., National Controls, Inc., 1000 Armstrong Dr., Fairmont, MN 56031, Tel: 507-238-4461, TELEX: 756594; Empl.: 500; *Dist. Mgr.:* Randy Newlin

DILOG, 1555 S. Sinclair St., Anaheim, CA 92806, Tel: 714-937-5700, TELEX: 6836051, FAX: 714-978-2420; FSC No.: 95-3205555; Empl.: 105; *Sls. Mgr.:* Dennis Edwards; *Dist. Mgr.:* Steve Ferrari

DILWOL, 3325 North Service Rd., Burlington, Ontario, Canada L7N 3G2, Tel: 416-335-2343, FAX: 416-335-1809; *Sls. Mgr.:* J. R. Mattie

DIMCO-GRAY, 8200 S. Suburban Rd., Dayton, OH 45458, Tel: 513-433-7600, FAX: 513-433-0520; Empl.: 120; *Sls. Mgr.:* R. L. Woehrmyer

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Disc Instruments Subsidiary

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DISC INSTRUMENTS, Honeywell, 102 E. Baker St., Costa Mesa, CA 92626, Tel: 714-433-0343, TWX: 910-595-1987; Empl.: 150 ..... **B•1885-1887**

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OH Dayton, Kilroy Corp. 513-294-1235
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SC Mount Pleasant, Hilco, Inc. 803-884-0289
TX Dallas, Measurement Sys. & Sls., Inc. 214-243-5781
WA Redmond, Controltek Sls. 206-883-8844

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DISPLAYS, INC., Mifflin Countey Indl. Pk., Rte. 4, Box 6AAA, Lewistown, PA 17044, Tel: 717-242-2541, TELEX: 842540; Empl.: 65

DISPLAYTECH, INC., 2200 Central Ave., Boulder, CO 80301, Tel: 303-449-8933, FAX: 303-449-8934; Empl.: 13; *Sls. Mgr.:* Ann Perry

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DISPLEX, INC., North Hills Electronics, Inc., Alexander Place, Glen Cove, NY 11542, Tel: 516-671-4400, TELEX: 46-6886 NOHILL CI; Empl.: 12; *Sls. Mgr.:* Jay Mohr ..... **D•1700-1701, 2091**

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DOUGLAS RANDALL, 6 Pawcatuck Ave., Pawcatuck, CT 06379, Tel: 203-599-2075, FAX: 203-599-1754; Empl.: 125; *Sls. Mgr.:* D. Aves ..... **B•1402-1410**

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CT Yalesville, JMG-Glynn Connecticut 203-265-9452/2498
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NV Las Vegas, Trembly Assoc. 702-739-9770
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TX Houston, Butler & Land 713-896-0808

DOVA CONTROLS, 4052 148th Ave. N.E., Redmond, WA 98052, Tel: 206-881-7414, ESYLNK: 62027625, FAX: 206-881-2569; Empl.: 7; *Sls. Mgr.:* Lynn Myers

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DOW CHEMICAL CO., 2020 Dow Center, Midland, MI 48674, Tel: 517-636-1000, TELEX: 227455, TWX: 810-266-9490; Empl.: 51,300

DOW CORNING CORP., Box 0994, Midland, MI 48686-0994, Tel: 517-496-4000, TELEX: 227450, TWX: 810-266-9006; Empl.: 6,100

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IL Oak Brook, Duracell Inc. 312-954-2714

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GA Norcross, Applied Power Inc. 404-263-0421
IL Downers Grove, TDI 312-971-4360
MA Sharon, Adcour 617-784-8123
MI Brighton, Applied Power Inc. 313-229-6550
MN St. Paul, dc Battery Prods. 612-646-7478
MO Maryland Hgts., LComp 314-291-6200
NJ Clifton, Engrd. Assemblies Corp. 1-800-BATTERY
NY Commack, Bren-Tronices Inc. 516-499-5155
TX Houston, K-Tec Inc. 713-780-7770
WA Redmond, Energy Sls. Inc. 206-883-2343

DURAKOOL INC.
An American Electronic Components Company

FAX: 219-264-4681

DURAKOOL, INC., American Electronic Components, 1010 N. Main St., Elkhart, IN 46514, Tel: 219-264-1116, TELEX: 25-8482; Empl.: 230; *Sls. Mgr.:* Dave Deuel ..... **B•1696**

Local Sales Offices & Reps

CA Burlingame, Campbell & George 415-697-2965
CA Sunnyvale, Pass Assocs. 408-735-9040
CA Tustin, Morgan Johnson Co., Inc. 714-832-7782
CO Englewood, Harthun Assocs. 303-792-5050
FL Clearwater, J. J. Galleher Co. 813-461-7706
GA Atlanta, A. Brown Assocs. 404-455-1216
IN Mishawaka, Power Comps. of Midwest 219-256-6630
IA Davenport, Volco Co. 319-326-5233
KS Overland Park, R. Greene Co. 913-492-6886
LA Baton Rouge, L. Elliott Co. 504-272-2877
MA Hingham, Hingham Bay Corp. 617-740-1900
MI Novi, Advanced Controls & Technlg. .. 313-349-0260
MN Minneapolis, Volco Co. 612-933-6631
MS Corinth, World Dists. 205-533-9108
MO St. Louis, R. Greene Co. 314-994-0222
NE Omaha, Volco Co. 402-346-2203
NY Buffalo, Niagara Elec. Sls. Co. 716-825-3100
NY Wantagh, DONY Tech. Sls. 516-826-5550
NC Pineville, Mel Sls. 704-541-5750
OH Parma, Orr Assocs. 216-885-1324
OK Tulsa, L. Elliott Co. 918-663-4616
OR Portland, Branom Instr. Co. 503-283-2555
PA Narberth, Power Modules Inc. 215-668-0664
TN Brentwood, A. Brown Assocs 615-373-2068
TX Addison, L. Elliott Co. 214-239-8533
TX Midland, Lynn Elliott Co. 915-684-8414
TX Missouri City, L. Elliott Co. 713-499-1571
UT Salt Lake City, Western Controls 801-266-1500
WA Bothell, Temco N.W. 206-821-5434

Local Distributors

IN Mishawaka, Power Comps. of Midwest 219-256-6630
PA Narberth, Power Modules 215-839-1331

DURGIN & BROWNE, See Tridyne Process Systems, DBI Inds.

DVE/CALTRONIC CO., LTD., A Sub. of Dee Van Entrp. Co., Ltd., 407 S. Palm Ave., Alhambra, CA 91803, Tel: 818-289-0310

DY-4 SYSTEMS INC., 21 Credit Union Way, Nepean, Ontario, Canada K2H 9G1, Tel: 613-596-9911, TELEX: 053-4111, FAX: 613-596-0574; Empl.: 210; *Sls. Mgr.:* Mitch Robinson

DYLON, A DIV. OF LIKEN INDS. INC., 130 McCormick Ave., Ste. 112, Costa Mesa, CA 92626, Tel: 714-540-2205, TELEX: 295-603 PTBX-MLBX; Empl.: 10; *Sls. Mgr.:* A. Lichen

DYLON GRAPHITE CO., 124 First Avenue, Berea, OH 44017, Tel: 216-234-1600; Empl.: 35; *Sls. Mgr.:* K. A. Partee

DYMA ENGINEERING, Box 1535, Los Lunas, NM 87031, Tel: 505-865-6700; Empl.: 14; *Sls. Mgr.:* Wiley R. Cunningham; *Dist. Mgr.:* Thom Johnson

DYMEC, INC., 8 Lowell Ave., Winchester, MA 01890, Tel: 617-729-7870, 800-225-1151, TWX: 710-348-6596; Empl.: 50; *Sls. Mgr.:* J. Dennis Santucci

DYNACAST, Div. Coats & Clark Inc., 1401 Front Street, Yorktown Heights, NY 10598, Tel: 914-245-0060, TELEX: 6716096; Empl.: 150

DYNACIRCUITS INC., 11230 W. Addison, Franklin Park, IL 60131, Tel: 312-451-1700, FAX: 312-455-0191; *Sls. Mgr.:* Dan Ciesla (Western U.S.), Carl Morahan (Eastern U.S.)

DYNAGE/CONTROLS, INC., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3487, TELEX: 753243 (OAKLEAFINC); Empl.: 12; *Sls. Mgr.:* Sidney C. Oakleaf

DYNAGE/POWER & MAGNETICS, Division Of Oakleaf, Inc., P.O. Box 95, 551 Third Avenue, Canistota, SD 57012, Tel: 605-296-3462/3487, TELEX: 753243 (OAKLEAFINC); FSC No.: 9Y852; Empl.: 14; *Sls. Mgr.:* Sidney C. Oakleaf ..... **A•2212-2213; D•1702**

DYNALOY, INC., 7 Great Meadow La., Hanover, NJ 07936, Tel: 201-887-9270, TELEX: 642-033, FAX: 201-887-3678; FSC No.: 27908; Empl.: 19; *Sls. Mgr.:* Jay Parton

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, TWX: 910-595-2588, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMIC AIR ENGRG., INC., 620 E. Dyer Rd., Santa Ana, CA 92705-5697, Tel: 714-540-1000, TWX: 910-595-2588, FAX: 714-545-9145; FSC No.: 4140-6105; *Sls. Mgr.:* Carl A. Grisier

DYNAMICS, Div. of Waugh Controls Corp., 9001 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-998-8281, TELEX: 69-6171, FAX: 818-407-1320; Empl.: 100; *Sls. Mgr.:* Tony Mastroianni

DYNAMICS RESEARCH CORP., Encoder Division, 60 Concord St., Wilmington, MA 01887-2193, Tel: 617-658-6100, FAX: 617-658-0522; Empl.: 125; *Sls. Mgr.:* Dave Silva

DYNAMIC TIME SYSTEMS, INC., 1331 S. State, Provo, UT 84601, Tel: 801-377-9154; *Sls. Mgr.:* Graham Hawkins; *Dist. Mgr.:* Graham Hawkins

DYNAPAR, 1675 Delany Rd., Gurnee, IL 60031, Tel: 312-662-2666, TWX: 910-235-1865; Empl.: 150

DYNAPLEX INC., Interplex, 120-12 28th Ave., Flushing, NY 11354, Tel: 212-961-6750, TWX: 710-582-3048; *Sls. Mgr.:* Lester Zimmerman; *Dist. Mgr.:* Lester Zimmerman

DYNAPOWER CORPORATION

FAX: 313-553-9096

DYNAPOWER CORPORATION, Box 3180, Farmington Hills, MI 48333, Tel: 313-553-4300, TWX: 810-242-8804; Empl.: 75 ..... **D•1703-1706**

DYNATECH COMPUTER POWER, INC., 5800 Butler Ln., Scotts Valley, CA 95066, Tel: 408-438-5760, TELEX: 887-247, FAX: 408-438-5793

DYNATECH CORP., 1225 E. Wakeham Ave., P.O. Box 1019, Dept. E, Santa Ana, CA 92702, Tel: 714-558-8755, TWX: 910-595-1951; Empl.: 340; *Sls. Mgr.:* Rick Burbank

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DYNISCO, 10 Oceana Way, Norwood, MA 02062, Tel: 617-769-6600, TELEX: 174-292; FSC No.: 15687; Empl.: 153; *Sls. Mgr.:* Warden B. Hunt

DYTRONICS CO., See Ryan Intl. Corp.

DZUS FASTENER, 425 Union Blvd., W. Islip, NY 11795, Tel: 516-669-6000, TELEX: 71-4974043; FSC No.: 72794; Empl.: 100; *Sls. Mgr.:* Victor Cappetta

EAGLE

EAGLE, P.O. Box 911, Fallbrook, CA 92028, Tel: 619-728-6000 ..... **A•1647**

EAGLE MAGNETIC COMPANY, INC., P.O. Box 24283, Indianapolis, IN 46224, Tel: 317-297-1030, FAX: 317-299-1323; Empl.: 44; *Sls. Mgr.:* Robert Jackson ..... **C•1747**

EAGLE PICHER ELECTRONICS DIVISION

FAX: 417-776-2257

EAGLE-PICHER INDUSTRIES, INC., P.O. Box 130, Bethel Road, Seneca, MO 64865, Tel: 417-776-2256, TWX: 910-774-4533; FSC No.: 3L498; Empl.: 400; *Sls. Mgr.:* H. M. York; *Dist. Mgr.:* H. M. York ..... **D•1450-1451**

Local Sales Offices & Reps

AL	Huntsville, L & D Inc.	205-837-1469
AZ	Scottsdale, S.W. Sls.	602-391-3180
AR	Hot Springs, Automation Supp. Inc. (ASI)	501-767-5444
CA	Anaheim, Spectrum Assocs.	714-630-6977
CA	San Jose, O'Donnell Assocs.-North	408-263-6500
CT	Bloomfield, Zaslow Sls. Co.	203-242-7781
FL	Longwood, NSL Assocs., Inc.	305-629-5226
GA	Atlanta, L & D Inc.	404-395-7079
ID	Elk Grove Vl., Parcom, Inc.	312-228-6360
IA	Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Westboro, Zaslow Sls. Co.	617-393-8150
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs., Ltd.	402-788-2536
NH	Londonderry, Zaslow Sls. Co.	603-432-8907
NM	Albuquerque, WJM Sls.	505-268-9499
NY	Massapequa Pk., HC Assocs.	516-541-0262
NY	Morrisville, Naylor Elec. Co.	315-684-9620
NC	Raleigh, L & D Inc.	919-876-5301
OH	Dayton, Lyons Corp.	513-278-0714
OR	Beaverton, William J. Purdy Co.	503-641-9373
PA	Exton, Kiley Elec. Co.	215-363-8550
TX	Dallas, Rem Air Comps.	214-234-1069
VA	Richmond, L & D Inc.	804-359-0125
WA	Redmond, William J. Purdy Co.	206-882-3144

Local Distributors

AZ	Tempe, Lynntronics	602-433-0288
AR	Hot Springs, Automation Supp. Inc.	501-767-5444
CA	Anaheim, Carefree Unltd.	714-630-3433
CA	Palo Alto, The Power Source, Inc.	415-856-0700
CO	Denver, J & B Sls.	303-698-2211
FL	Duneoin, Battery Powered Lighting & Sys.	813-734-9498
GA	Austell, DC Power Prods.	404-948-2593
GA	Smyrna, Mark C. Pope Assocs.	404-435-2471
IL	Arlington Hgts., Lodan Elctrns.	312-398-5311
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Shreveport, Indl. Elctrn. Supp. Inc.	318-222-9459
MD	Baltimore, Professional Elctrns.	301-661-2126
MA	Sharon, Adcour	617-784-8123
MN	Minneapolis, Ohlin Sls. Co.	612-929-6924
NE	Lincoln, Spectronics Corp.	402-467-3651
NH	Nashua, Sentinel Battery	603-882-9022
NJ	E. Brunswick, Brothers Elctrns.	201-238-2200
NY	Amityville, Battery Power of L.I.	516-691-1993
NY	Brewster, WHI Batteries	914-278-6151
NC	Greensboro, Indl. Elecs.	919-274-3251
OH	Cincinnati, M & B Battery	513-385-5900
OH	Cleveland, Battery Empire	216-266-2244
OH	Columbus, Promark Elctrns., Inc.	614-876-8885
OK	Tulsa, Altair Co.	918-252-5781
OK	Tulsa, Radio Inc.	918-587-9123
PA	Bensalem, Scotts Emergency Lighting	215-639-1777
SC	Greenville, EMSCO	803-233-4121
TN	Goodlettsville, Waller Sls.	614-859-0039
TX	Stafford, Southwest Elctrns.	713-240-4000
VA	Portsmouth, Indl. Parts Corp.	804-393-4033
WA	Tacoma, C & G Elctrns.	206-272-3181
Can	Winnipeg, Manitoba, Westrock Battery Supp. Ltd.	204-786-6034

EAGLE-PICHER INDS., INC., Elctrns. Div., Box 47, Joplin, MO 64801, Tel: 417-623-8000, TWX: 910-774-4508; Empl.: 700

EAGLE SIGNAL CONTROLS, A Wickes Mfg. Co., Box 16100, Austin, TX 78761, Tel: 512-837-8300; Empl.: 600

EALING ELECTRO-OPTICS, New Englander Industrial Park, Holliston, MA 01746, Tel: 617-429-8370, 1-800-343-4912, TELEX: 240041, FAX: 617-875-5616; *Sls. Mgr.:* James F. Babb

E & L INSTRUMENTS, Interplex Electronics, Inc., 70 Fulton Terrace, New Haven, CT 06512, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Dan Marley

Local Sales Offices & Reps

AZ	Phoenix, S.W. Education Sys.	602-992-2838
CA	San Pedro, Kenex Educational Prods.	213-831-8431
CO	Denver, Bill Newman & Co.	303-425-9503
CT	Woodbridge, Electronic Mktg. Co.	203-397-1461
FL	Winter Pk., D. C. Jaeger Co.	305-645-1500
GA	Calhoun, Learning Labs, Inc.	404-629-4624
IL	Downers Grove, Aidex Corp.	312-963-4270
IA	Hiawatha, Gib Klein Co.	319-393-4048
MN	Afton, L.A.B. Corp.	612-436-1169
MS	Jackson, Sivad, Inc.	601-355-3110
MO	Columbia, Advanced Education Sys.	314-449-5200
NJ	Kenilworth, Shortess-Rawson & Assocs.	201-276-2525
OH	Dayton, Rixan Assocs.	513-222-0011
TN	Santa Fe, Technical Lab. Assocs.	615-682-2509
TX	Houston, Tech. Lab. Sys., Inc.	713-465-9793
UT	Salt Lake City, Tech. Training Sys.	801-943-6699
VA	Berryville, Diversified Educational Sys.	703-955-2782
WA	Seattle, Interactive Training, Inc.	206-251-0886
Can	Georgetown, Ont., Merlan Sci., Ltd. E.	416-877-0171

EAO SWITCH CORP., 198 Pepe's Farm Rd., P.O. Box 552 MO, Milford, CT 06460, Tel: 203-877-4577, TELEX: 96-4347, FAX: 203-877-3694; FSC No.: 61706; Empl.: 19; *Sls. Mgr.:* George T. Bracci ..... **B•1697**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg. Co. of AZ	602-949-9333
CA	Los Gatos, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Pasadena, Luscombe Engrg. Co. of L.A.	213-684-2000
CA	San Diego, Luscombe Engrg. Co. of S.D.	619-549-9699
CO	Longmont, Luscombe Engrg. Co. of CO	303-772-3342
CT	Farmington, Ray Perron & Co., Inc.	203-673-4825
FL	Tampa, Florida Comp. sls.	813-960-7044
GA	Norcross, Mtn. Electro Mktg.	404-448-5594
IL	Arlington Hgts., Brainard-Wilson Mktg., Inc.	312-437-2700
IN	Ft. Wayne, M/S Sls. & Assocs.	219-436-3023
IN	Greenwood, M/S Sls. & Assocs.	317-881-0110
IA	Cedar Rapids, Delltron Co., Inc.	319-362-2526
MD	Columbia, Delta III Assocs., Inc.	301-730-4700
MA	Needham, Ray Perron & Co., Inc.	800-225-4280, 617-449-6162
MI	Plymouth, Jay Mktg. Assocs., Inc.	313-459-1200
MN	Golden Valley, Highland Elctrn. Sls.	612-546-2123
MO	Florissant, Delltron Co., Inc.	314-839-0033
MO	Gladstone, Delltron Co., Inc.	816-436-6445
NH	Merrimack, Ray Perron & Co., Inc.	603-424-4423
NJ	Englewood, Sprung/Nussbaum	201-569-5666
NY	Rochester, Apex Assocs., Inc.	716-254-6050
NC	Raleigh, C-Tech Sls., Inc.	919-847-0202
OR	Lake Oswego, Luscombe Engrg. Northwest	503-636-6664
PA	Horsham, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, R. W. Kneip	412-823-0169
TX	Dallas, Glidden Electro Equip. Co	214-341-0610
TX	Houston, Glidden Electro Equip. Co.	713-681-1415
UT	Salt Lake City, Luscombe Engrg. Co.	801-532-4118

WA Bellevue, Luscombe Engrg. N.W. 206-223-1541
WI Mequon, Badgerep 414-241-9200

Local Distributors

AZ Phoenix, Minarik Elec. 602-233-3000
AZ Tempe, Harper SID 602-967-1464
CA Compton, Harper SID 213-979-5090
CA Gardena, California Switch & Sig. 213-770-2330
CA Hawthorne, Electrosonic Comps. 213-970-0997
CA Los Angeles, Minarik Elec. Co. 213-624-3161
CA San Diego, Harper SID 619-578-2500
CA San Diego, Minarik Elec. Co. 619-560-6632
CA San Jose, Dansco Comp. Sls., Inc. 408-292-9740
CA Santa Clara, Bell Elctrl. Supp. 408-727-0575
CA Santa Clara, Minarik Elec. Co. 408-727-0575
CA Santa Minica, Master Distrs. 213-452-1229
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Minarik Elec. Co. 303-329-3525
CT Wallingford, Sager Elec. Supp. co. 203-265-4600
CT Waterbury, Century Elec. Supp. 203-755-0405
FL Lakeland, Wes-Garde/Switch Controls, Inc. 813-644-7564
FL Oviedo, Dixie Sls. 305-365-5211
IL Crystal Lake, Sub-Sem, Inc. 312-782-3954
IL Elk Grove, Martec Assoc. 312-956-8090
IL Rosemont, Advent Elctrns., Inc. 312-297-6200
IL Schaumburg, Minarik Elec. Co. 312-885-9337
IN Indianapolis, Mar Elctrns. 317-633-6699
IN Indianapolis, R.M. Indiana 317-291-7110
IA Cedar Rapids, Advent Elctrns., Inc. 319-363-0221
KS Wichita, Radio, Inc. 316-264-2798
KY Louisville, Peerless Elctrns. 502-637-7674
LA Baton Rouge, Menard Elctrns. 504-355-0323
ME W. Buxton, Nelson & Wright 207-929-8238
MD Gaithersburg, Axis Elctrns. 301-840-9640, 800-492-3190
MD Jessup, Treeko Sls. 301-792-0112
MA Canton, Impact Sls. Co. 617-821-1500
MA Hingham, Sager Elec. Supp. Co. 617-749-6700
MA N. Billerica, Minarik Elec. Co. 617-663-0740
MI Grand Rapids, R. M. Elctrns. Co. 616-531-9300
MI St. Claire Shores, SPEMCO Switches 313-771-2700
MN Minneapolis, Electronic Ctr., Inc. 612-371-5200
MO St. Louis, Beckwith, Inc. 314-343-6463
NH Salem, Sager Elec. Supp. Co. 603-898-1348
NJ Cranford, Garden State Indl. Elctrns., Inc. 201-272-6400
NJ Oakland, Relay Specialties 201-337-1000
NY Bohemia, Key Comps., Inc. 516-567-7500
NY Buffalo, Summit Distrs., Inc. 716-887-2800
NY New York, Martin-Audio/Video 212-541-5900
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns., Inc. 716-334-8110
NY Victor, ADD/Modutex 716-924-4400
NY Woodside, Switches Unlimited 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195
NC Winston-Salem, Kirkman Elctrns., Inc. 919-722-9131,800-334-8688
OH Columbus, Electronics Mktg. Corp. 614-299-4161
OH Highland Hgts., Electronics Mktg. Corp. 216-442-3441
OK Tulsa, Radio, Inc. 919-587-9123
OR Portland, Minarik Elc. Co. 503-253-3402
PA Harrisburg, Ad-Tech Elctrns. 717-939-8337
PA McKean, Advacom 814-476-7774
PA Norristown, Kimberly-James Co. 215-666-7286
PA Pittsburgh, Grant Indl. Controls, Inc. ... 412-787-9770
PA Wayne, Peak Elctrns. Corp. 215-293-9000
SC Columbia, Dixie Elctrns. 803-779-5332
TX Garland, Indl. Equip. Co. of Dallas 214-271-5494
TX Irving, Harper SID 214-621-0500
TX Irving, Minarik Elec. Co. 214-929-4111
TX San Antonio, Minarik Elec. Co. 512-822-7097
WA Seattle, Platt Elec. 206-624-4083
WI Milwaukee, Marsh Elctrns. Corp. 414-475-6000

E-A-R DIV., Cabot Corp., 7911 Zionsville Rd., Indianapolis, IN 46268, Tel: 317-872-1111, TWX: 810-341-3412; *Sls. Mgr.:* Lawrence K. Landers

EASCO/K D TOOLS, See Hunter Tools, Easco/K D Tools

EASTERN AIR DEVICES, INC., 1 Progress Dr., Dover, NH 03820, Tel: 603-742-3330, TWX: 510-297-4454, FAX: 603-742-9080; Empl.: 175 ..... **B•1202**

Local Sales Offices & Reps

CA San Jose, Motion Sys. 408-246-0641
CA Tustin, Schoenbachler-Dobson Co. 714-544-1888
CO Boulder, R. G. Entprs. 303-447-9211
FL Orlando, Perrott Assoc. 305-275-1132
IL Arlington Hgts., CMA 312-577-7924
MA Marlborough, Gerald Rosen Co. 617-481-9277
MN St. Paul, REPCO 612-488-0201
NJ Ridgefield, Rical Assocs. 201-945-5250
NY Rochester, Elcom Sls. 716-385-1400
NY Syracuse, ELCOM Sls. 315-685-8245
NC Charlotte, Jake Rudisill Assocs. 704-377-6901
OH Cincinnati, KCH Co. 513-931-1686
PA Paoli, ETC Sales 215-296-3527
TX Austin, Oeler & Menelaides Inc. 512-453-0275
TX Richardson, D.J. Sls. 214-783-8876
WA Seattle, Eltech 206-767-4330

Local Distributors

NY Plainview, Controls Sls. Inc. 516-756-5652
NC Charlotte, Joyce Sls. Co. 704-377-6901
PA Pittsburgh, EXONIC Sys. 412-784-8400

EASTERN ELECTRONICS MFG. CORP., National Patent Dev. Corp., 180 Roberts St., East Hartford, CT 06108, Tel: 203-528-9821; FSC No.: 203-289-7639; Empl.: 200; *Sls. Mgr.:* Wayne M. Baker

EASTERN MARKING MACHINES, 422 S Franklin St., Hempstead, NY 11550, Tel: 516-483-7070, TELEX: 968095; Empl.: 8; *Sls. Mgr.:* George Rosales; *Dist. Mgr.:* L. Sherman

EASTERN MICROWAVE, 40 Ray Ave., Burlington, MA 01803, Tel: 617-273-4700; FSC No.: 30616; Empl.: 45; *Sls. Mgr.:* S. C. Lowe

EASY HEAT WIREKRAFT, See Electrical Systems, Div. of Bristol Corp.

EATON CORP., Aerospace Controls/Systems Div., 2074 Whitfield Ave., East, Sarasota, FL 33578, Tel: 813-758-7726

EATON CORP., AIL, Commack Rd., Deer Park, NY 11729, Tel: 516-595-3094, TWX: 510-227-6073; FSC No.: 00752; Empl.: 5000; *Sls. Mgr.:* H. N. Kreisberg

EATON CORP, Durant Products, 901 S. 12th St., Watertown, WI 53094, Tel: 414-261-4070, TWX: 910-260-3713; Empl.: 400; *Sls. Mgr.:* H. L. Sisson; *Dist. Mgr.:* Dennis G. Walz

EATON CORP., Electronic Instrument Div., 5340 Alla Rd., Los Angeles, CA 90066, Tel: 213-822-3061, TWX: 910-343-6969; Empl.: 250; *Sls. Mgr.:* Jeff Shahan, VP Sls.

EATON CORPORATION, Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-730-6410, TWX: 910-339-9556; FSC No.: 27338; Empl.: 495; *Sls. Mgr.:* Anton Schaffer

Local Sales Offices & Reps

AZ Tempe, Sierra Tech. Grp. 602-894-2335
CA Irvine, EBA Microwave 714-240-8181
CA Morgan Hill, Loroco Sls. 408-779-5117
FL Winter Pk., Microwave Mktg. 305-678-2141
IL Northfield, Feller Assocs. 312-446-8065
IA Cedar Rapids, S & O Sls. 319-363-7323
MD Silver Springs, Youth Assocs. 301-598-5740
MA Wakefield, Spectrum Mktg. 617-246-4740

EATON CORP., Microwave Products Division, 785 Palomar Ave., Sunnyvale, CA 94086, Tel: 408-773-3700, TWX: 910-339-9395; FSC No.: 27338; Empl.: 495; *Sls. Mgr.:* J. R. Campbell

EATON CORP./MSC PRODUCTS, 1640 Monrovia Avenue, Costa Mesa, CA 92627, Tel: 714-642-2427, TELEX: 67-8433; FSC No.: 96182; Empl.: 500ô; *Sls. Mgr.:* J. R. McDonough

EATON CORP., Printer Prods Oper., Technical Research Park, Riverton, WY 82501, Tel: 307-856-4821, TWX: 910-949-4864, FAX: 307-856-0412; Empl.: 185; *Sls. Mgr.:* Rich Phillips; *Dist. Mgr.:* Rich Phillips

EATON (LORLIN) CORP., See Lorlin, Div. of Axiam, Inc.

EATON CORP./CUTLER-HAMMER PRODS, Aerospace & Commercial Controls Div., 4201 N. 27th St., Milwaukee, WI 53216, Tel: 414-449-7487, TELEX: 26-716; FSC No.: 81640; *Sls. Mgr.:* J. R. McDonough

EBERHARD MFG. CO., DIV., Eastern Co., 21944 Drake Rd., Strongsville, OH 44136, Tel: 216-238-9720, TELEX: 98-5301, FAX: 216-572-2732; FSC No.: 19220; *Sls. Mgr.:* Edward Hongosh

ebm

FAX: 203-674-8536

EBM INDS., INC., 525 New Britain Ave., Unionville, CT 06085, Tel: 203-674-1515, TWX: 710-423-8723; FSC No.: 62292; *Sls. Mgr.:* Robert Sobolewski ..... **C•1642, 1655-1659**

Local Sales Offices & Reps

AL Huntsville, Raycom 205-859-2017
AZ Scottsdale, Harris And Croy 602-951-9121
AZ Tucson, Harris and Croy 602-888-0642
CA Los Angeles, Wiley Co. 213-666-1611
CA San Diego, Wiley Co. 619-453-9018
CA Santa Clara, Ross Mktg. Assocs. 408-988-8111
CO Littleton, Simpson Assocs. 303-794-8381
FL Altamonte Springs, Raycom, Inc. 305-682-0032
FL Davie, Raycom, Inc. 305-475-3022
FL Melbourne, Raycom, Inc. 305-259-7988
FL Orlando, Raycom, Inc. 305-859-5504
FL Wellborn, Raycom, Inc. 904-963-5023
GA Marietta, Raycom 404-952-6061
IL Glendale Hgts., Beta Technig. Sls. 312-790-9886
IA Des Moines, Houk & Assocs., Inc. 515-276-6741
KS Overland Park, Web Elctrns. 913-381-7986
MA Millis, Selmark Assocs. 617-376-2914
MI Warren, Burcaw Co. 313-573-4605
MI Wyoming, Burcaw 800-572-1610
MN St. Paul, Arkco Sls. 612-777-7454
MO Florissant, Web Elctrns. 314-921-5720
NH Hopkinton, Selmark Assocs. 603-746-3299
NJ Marlton, b.g.r. Assocs. 609-983-1020
NY Buffalo, NRM Mktg. Grp. 716-634-4300
NY Franklin Sq., Cooper-Simon & Co., Inc. 516-489-0404
NY Skaneateles, NRM Mktg. Grp. 315-685-8991
NC Raleigh, Raycom 919-847-8276
OH Maple Hgts., Versatron 216-581-0090
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Hillsboro, Temco Northwest 503-649-8375
PA Harrison City, NRM Mktg. Grp. 412-327-0858
TX Austin, Bonser-Philhower Sls. 512-346-9186
TX Houston, Bonser-Philhower Sls. 713-782-4144
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Midvale, Simpson Assocs. 801-566-3691
WA Kirkland, Temco Northwest 206-821-5434
WA Maple Falls, Temco Northwest 206-599-2750
WA Spokane, Temco Northwest 509-534-8635
WI Milwaukee, Beta Technolg. Sls., Inc. ... 414-543-6609
PR Bayamon, Selmark 809-797-9176

Local Distributors

AL Huntsville, Powell Elec. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Supply Team Intl. 602-968-1192
AZ Tucson, Southwest Sls. 602-628-1613
CA Anaheim, Deco Elec. 714-630-8252
CA Costa Mesa, Powell 714-754-1717
CA Fullerton, Pyramid/Fullerton 714-773-0781
CA Hollywood, Yale Elctrns. 818-465-3186
CA Irvine, Integrated Elctrns. 714-837-9960
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Pyramid 619-271-5404
CA San Jose, Integrated 408-435-1000
CA San Jose, Powell Elec. 408-943-9020
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Power Supply Comps. 408-737-1333
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Indl. Elctrns. 303-694-9444
CT Danbury, Pilgrim Elctrns. 203-792-7274
CT E. Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elec. 203-265-3134
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Ft. Lauderdale, Powell Elec. 305-979-5000
FL Ft. Lauderdale, Reptron 305-735-1112
FL Tampa, Reptron 813-855-4656
GA Atlanta, ACK Radio Supp. 404-351-6340
GA Fayetteville, Frankland 404-461-4026
GA Norcross, Reptron 404-446-1300
IL Hoffman Estates, I.E.C. Intercomp 312-843-2040
IL Rosemont, Advent Elctrns. 312-297-6200
IL Schaumburg, Reptron/Illinois 312-882-1700
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
MD Baltimore, Resco/Baltimore 301-529-0500
MD Beltsville, Resco/D.C. 301-937-9100
MD Columbia, Powell 301-621-8080
MA Canton, Impact Sls. Co. 617-821-1500
MA Middleboro, Glynn Elctrns. 617-947-4262
MA Needham, Cronin 617-449-5000
MA Westborough, Powell 617-366-6100
MA Wilmington, Heilind Elctrns. 617-657-4870
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, Reptron 313-525-2700
MN Minneapolis, Control Des. Supp. 612-721-1628
MN Minneapolis, Reptron 612-938-0000
NV Carson City, Integrated Elctrns. 702-883-9399
NH Manchester, Cronin 603-624-0105
NH Manchester, Glynn Elctrns. 603-622-8131
NH Nashua, Brevan Elctrns. 603-889-7230

NJ	Englewood, Powell Elec.	201-894-0800
NJ	W. Berlin, General Comps.	609-768-6767
NY	Farmingdale, Addem Sls.	516-752-9303
NY	Hauppauge, Broadline Elec. Distr.	516-231-4100
NY	Hicksville, Janesway Elctrns.	516-935-1827
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Mt. Vernon, Janesway Elctrns.	914-699-6710
NY	Rochester, Simcona	716-328-3230
NC	Cary, Powell Elec.	919-467-1212
NC	Raleigh, Century	919-782-2116
OH	Akron, Akron Elctrns.	216-762-8818
OH	Twinsburg, Advacom	216-425-8477
OH	Worthington, Reptron Ohio	614-436-6675
OR	Beaverton, Integrated Elctrns.	503-641-1690
PA	Export, Advacom	412-733-5400
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom/Erie	814-476-7774
PA	Norristown, Century Elctrn. Comp. Co.	215-631-5400
PA	Philadelphia, Powell	215-365-1900
TN	Hixson, Techni-Tronics	615-842-0514
TX	Dallas, Omni Pro Elctrns.	214-233-9368
TX	Irving, Powell Elctrns.	214-550-0547
TX	Richardson, Janesway Elctrns.	214-437-5125
UT	N. Salt Lake, Integrated Elctrns.	801-298-1868
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
WA	Bellevue, Integrated Elctrns./Jaco	206-455-2727
WA	Kent, Pyramid Elctrns.	206-872-5800
WI	Mequon, Taylor Elec. Co.	414-241-4321
WI	New Berlin, Control Design Supp.	414-784-1015
WY	Mequon, Lakeview Elctrns.	414-377-8250

EBY COMPANY, Pullman Co., 2751 Southampton Rd., Philadelphia, PA 19154, Tel: 215-969-4200, TWX: 710-670-0452; FSC No.: 72825; Empl.: 92

ECG, 14123 21st Ave. N., Plymouth, MN 55441, Tel: 612-554-0720

ECO INSTRS. DIV., Sea Data Corp., 1 Bridge St., Newton, MA 02158, Tel: 617-964-8360, TELEX: 951107; Empl.: 40; *Sls. Mgr.:* Jill Shipman

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Local Sales Offices & Reps

AL	Huntsville, EMA	205-830-4030
CA	Laguna Hills, WESTEC	714-770-6229
CA	Mtn. View, Kim Buurma	415-494-8343
CO	Littleton, Electronic Comp. Sys.	303-797-0894
FL	Orlando, Honeyco, Inc.	305-299-1000
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Westwood, Apex Assocs.	617-326-5042
NJ	Teaneck, Noreast Tech. Sls.	201-833-2044
OR	Grants Pass, ECS Inc.	503-476-8871
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Dallas, Advance Tech. Sls.	214-340-1300
WA	Bellevue, Comtec	206-453-1188
Can	Stittsville, Ont., Production Case Co.	613-836-2248

Ectron CORPORATION

FAX: 619-278-0372

ECTRON CORP., 8159 Engineer Rd., San Diego, CA 92111, Tel: 619-278-0600, TWX: 910-335-1259; FSC No.: 24856; Empl.: 50; *Sls. Mgr.:* W. W. Hanford ..... **D•1010**

Local Sales Offices & Reps

AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Canoga Pk., FLW Inc.	818-719-0037,
CA	Costa Mesa, FLW Inc.	714-751-7512
CA	Hayward, FLW Inc.	415-786-9070
CO	Denver, Aztec Entprs.	303-779-5285
FL	Melbourne, Saber Assocs.	305-724-0920
GA	Norcross, Saber Assoc. Inc.	800-327-0853
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
KS	Lenexa, Ramsey Assocs.	913-541-1007
LA	Baton Rouge, Sesco	504-928-4951
MD	Laurel, Elctrn. Mktg. Assoc.	301-792-9300
MA	Needham, Addelco Corp.	617-444-4754
MI	Troy, Satullo Assocs.	313-585-4811,
MN	Minneapolis, Sector Eng. Sls. Inc.	612-593-1809
MO	Maryland Hgts., Ramsey Assocs.	314-878-5042
NM	Albuquerque, Westfhal & Assocs.	505-881-0995,
NY	East Syracuse, Ossmann Instrs.	315-437-7052
NY	Plainview, Eastern-Metro Assoc.	516-931-1414
NY	Rochester, Ossmann Instrs.	716-359-1200,
NC	Clayton, Saber Assocs.	800-327-0853
OH	Cleveland, Instrmn. Sys.	216-845-8800
OH	Dayton, Instrmn. Sys.	513-294-2838
OK	Tulsa, Sesco	918-622-3868
PA	Pittsburgh, Instrmn. Sys.	412-823-7005
PA	Plymouth Meeting, Elctrn. Mktg. Assoc.	215-828-7400
SC	Columbia, Saber Assoc. Inc.	800-327-0853
TX	Dallas, Sesco	214-231-9364
TX	Houston, Sesco	713-999-3510
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Seattle, Datacom Assoc. Inc.	206-285-2525
WI	Milwaukee, Sector Eng. Sls. Inc.	414-352-8280

EDAC INC., 20 Railside Rd., Toronto, ON, Canada M3A 1A4, Tel: 416-445-2292, TWX: 610-492-1398, FAX: 416-445-4394; FSC No.: 31781; Empl.: 120; *Sls. Mgr.:* Alan Little; *Dist. Mgr.:* Alan Little

EDA INSTRUMENTS, INC., 4 Thorncliffe Park Dr., Toronto, ON, Canada M4H1H1, Tel: 416-425-7800, TELEX: 06 23222 FEDA TOR, FAX: 416-425-8135; Empl.: 70; *Sls. Mgr.:* Scott Hepburn

EDCLIFF DIV., Systron Donner, 1711 So. Mountain Ave., Monrovia, CA 91016, Tel: 818-358-4571, TWX: 910-585-3248, FAX: 818-359-5719; FSC No.: 00153; Empl.: 110; *Sls. Mgr.:* Cosmo L. Avellis

EDL, INC., 385 Oser Ave., Hauppauge, NY 11788, Tel: 516-435-2808, 1-800-DIAL EDL; Empl.: 50; *Sls. Mgr.:* Ann Marie Capuanno

EDMAN CORP., Subsidiary of Rospatch, 7500 Main St., P.O. Box 750, Fishers, NY 14453-0750, Tel: 716-924-4000, TWX: 510-254-2896; Empl.: 170; *Sls. Mgr.:* Howard Potter

EDO CORP./ELINCO DIV., See Electrical Indicator Co., Inc.

EDO WESTERN CORP., EDO Corp., 2645 South 300 W., Salt Lake City, UT 84115, Tel: 801-486-7481/3846, TELEX: 388-315; Empl.: 360; *Sls. Mgr.:* Ken Etulain

EDSYN, INC., 15958 Arminta Ave., Van Nuys, CA 91406, Tel: 818-989-2324, 213-873-5115, TELEX: 65-1469; *Sls. Mgr.:* Wayne Murry

EDWARDS CO., Signaling Prods. Div., P.O. Box 1188, Farmington, CT 06034, Tel: 203-678-0410; Empl.: 1000; *Sls. Mgr.:* Al Canevari; *Dist. Mgr.:* Al Canevari

EECO INCORPORATED, 1601 E. Chestnut Ave., P.O. Box 659, Santa Ana, CA 92702-0659, Tel: 714-835-6000, TELEX: 67-8420, TWX: 910-595-1550; Empl.: 850; *Sls. Mgr.:* Greg Littler; *Dist. Mgr.:* Dick Fried ..... **B•1698-1700, 1815**

Local Sales Offices & Reps

CA	Santa Ana, Jones & McGeoy Sls., Inc.	714-547-6466
AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Scottsdale, S.W. Sls.	602-391-3180
CA	Los Altos, Recht Assocs.	415-964-6321
CA	San Diego, Harvey King Inc.	619-587-9300
CO	Denver, Delltron Co.	303-373-0300
CT	S. Windsor, Northeast Reps., Inc.	203-644-3728
FL	Altamonte Springs, Carter Assocs.	305-260-5566
FL	Pompano Beach, Carter Assocs.	305-942-4428
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elk Grove Village, TriStar Grp., Inc.	312-593-0200
IN	Fort Wayne, M/S Sls. & Assoc.	219-436-3023
IN	Indianapolis, M/S Sls. & Assocs.	317-257-8915
IA	Cedar Rapids, Palatine Engr. & Sls., Inc.	319-365-8071
KS	Blue Springs, Palatine Engr. & Sls., Inc.	816-229-4007
KS	Wichita/W. Kansas, Palatine Engrg.	316-262-1020
MD	Laurel, EMA, Inc.	301-953-7800
MA	Hingham, Northeast Reps., Inc.	617-749-8700
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MI	Wyoming, Lowell-Wendt Mktg. Co.	606-531-4499
MN	Minneapolis, R.K. Sls. Assocs., Inc.	612-571-1001
MO	Hazelwood, Palatine Engr. & Sls., Inc.	314-839-0800
NH	Milford, Northeast Reps., Inc.	603-673-1406
NJ	Englewood, Tecnimat	201-569-4200
NY	Clarence Ctr., Tech-Mark, Inc.	716-741-9138
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Cary, Montgomery Mktg.	919-467-6319
NC	Raleigh, Montgomery Mktg.	919-851-0010
OH	Aurora, Engrg. Mktg. Assocs.	216-562-6104
OH	Centerville, Engrg. & Mktg. Assocs.	513-433-2800
OK	Tulsa, West Assocs.	918-665-3465
OR	Beaverton, Blair Hirsh Co.	503-641-1875
PA	Huntingdon Valley, Omega Elctrn. Sls.	215-947-4135
TX	Austin, West Assocs.	512-339-6886
TX	El Paso, S.W. Sls.	915-594-8259
TX	Houston, West Assocs.	713-777-4108
TX	Richardson, West Assocs.	214-680-2800
WA	Lynnwood, Blair Hirsh Co.	206-774-8151
WI	Brookfield, TriStar Grp., Inc.	414-782-2670
Can	Montreal, EECO Incorporated	514-286-7105
Can	Napean, Ont., Renmark Elctrns. Ltd.	613-727-0320
Can	Richmond Hill, Ont., Renmark Elctrns. Ltd.	416-881-8844

Local Distributors

CA	Santa Monica, Master Distrs.	213-452-1336
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
AZ	Phoenix, Marshall Inds.	602-496-0290
AZ	Tempe, Harper SID	602-967-1464
CA	Canoga Park, Hall-Mark Elctrns.	818-716-7300
CA	Chatsworth, Marshall Inds.	818-407-0101
CA	Compton, Harper SID	213-979-5090
CA	El Monte, Marshall Inds.	818-459-5500
CA	Irvine, Marshall Inds.	714-859-5050
CA	Milpitas, Marshall Inds.	408-943-4600
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	San Diego, Hall-Mark Elctrns.	619-268-1201
CA	San Diego, Harper SID	619-578-2500
CA	San Diego, Marshall Inds.	619-578-9600
CA	San Jose, Hall-Mark Elctrns.	408-946-0900
CA	Santa Clara, Master Dists.	408-496-6151
CA	Santa Fe Springs, MICRONET Computer Sys.	213-921-0068
CA	Sunnyvale, Harper SID	408-747-0333
CA	Sunnyvale, Marshall Inds.	408-943-4600
CA	Sunnyvale, Time Electronics	408-734-9888
CA	Torrance, Hall-Mark Elctrns.	213-217-8400
CA	Tustin, Hall-Mark Elctrns.	714-669-4700
CO	Englewood, Hall-Mark Elctrns.	303-790-1662
CO	Thornton, Marshall Inds.	303-451-8444
CT	Wallingford, Hall-Mark Elctrns.	203-269-0100
CT	Wallingford, Marshall Inds.	203-265-3822
CT	Wallingford, Sager Electrical Supply Co.	203-265-4600
FL	Clearwater, Hall-Mark Elctrns.	813-576-8691
FL	Orlando, Hall-Mark Elctrns.	305-855-4020

FL Orlando, Marshall Inds. 305-841-1878
FL Pompano Beach, Hall-Mark Elctrns. ... 305-971-9280
GA Norcross, Hall-Mark Elctrns. 404-447-8000
GA Norcross, Marshall Inds. 404-923-5750
IL Schaumburg, Marshall Inds. 312-490-0155
IL Wood Dale, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Hall-Mark Elctrns. 317-872-8875
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
IN Indianapolis, Marshall Inds. 317-297-0483
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
KS Lenexa, Marshall Inds. 913-492-3121
MD Baltimore, Hall-Mark Elctrns. 301-988-9800
MD Gaithersburg, Marshall Inds. 301-840-9450
MA Billerica, Hall-Mark Elctrns. 617-667-0902
MA Hingham, Sager Elctrn. Supp. Co. 617-749-6700
MA Wilmington, Marshall Inds. 617-658-0810
MI Livonia, LWC Distrs. 313-464-7700
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Plymouth, Marshall Inds. 612-559-2211
MO Earth City, Hall-Mark Elctrn. 314-291-5350
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NJ Fairfield, Hall-Mark Elctrns. 201-575-4415
NJ Fairfield, Marshall Inds. 201-882-0320
NJ Mt. Laurel, Marshall Inds. (Philadelphia Div.) 215-627-1920
NM Albuquerque, International Elctrns. 505-345-8127
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Marshall Inds. 516-273-2424
NY Johnson City, Marshall Inds. 716-798-1611
NY Lynbrook, L.I., Peerless Radio Corp. ... 516-593-2121
NY Rochester, Marshall Inds. 716-235-7620
NY Ronkonkoma, Hall-Mark Elctrns. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
NC Raleigh, Marshall Inds. 919-878-9882
OH Dayton, Marshall Ind. 513-236-8088
OH Solon, Hall-Mark Elctrns. 216-349-4632
OH Solon, Marshall Inds. 214-248-1788
OH Worthington, Hall-Mark Elctrns. 614-888-3313
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Marshall Inds. 503-644-5050
PA Mt. Laurel, Marshall Inds. 215-627-1920
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Austin, Marshall Inds. 512-837-1991
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark Elctrns. 214-341-1147
TX El Paso, International Elctrns. 915-598-3406
TX Harper SID, Harper Sls. 214-621-0500
TX Houston, Hall-Mark Elctrns. 713-781-6100
TX Houston, Marshall Inds. 713-895-9200
UT Salt Lake City, Marshall Inds. 801-485-1551
UT West Valley, Hall-Mark Elctrns. 801-972-1008
VT West Valley, Hall-Mark Elctrns. 801-972-1008
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Marshall Inds. 206-747-9100
WA Spokane, Almac Elctrns. 509-924-9500
WI New Berlin, Hall-Mark Elctrns. 414-797-7844
WI Waukesha, Marshall Inds. 414-797-8400
Can Burnaby, BC, RAE Indl. Elec. Ltd. 604-291-8866
Can Calgary, Alb., Cardinal Ind. Elec. Ltd. .. 403-259-6817
Can Calgary, Alta., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Cardinal Ind. Elec. Ltd. 403-483-6266
Can Edmonton, Alta., Future Elctrns. 403-438-2858
Can Guelph, Ont., EMJ Data Sys. Ltd. 416-454-2940, 519-837-2444
Can Montreal, Que., EMJ Data Sys. Ltd. 514-849-4171
Can Nepean, Ont., Carsten Elctrns., Ltd. 613-726-9250
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Scarborough, Ont., Carsten Elctrns., Ltd. 416-751-5002
Can St. Laurent, Que., Carsten Elctrns., Ltd. 514-334-8321
Can Vancouver, BC, EMJ Data Sys. Ltd. 604-732-7268
Can Vancouver, BC, Future Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Future Elctrns. 204-339-0554

EEMCO DIV., Datron Systems Inc., 4585 Electronics Pl, Los Angeles, CA 90039, Tel: 818-247-7060, TWX: 910-497-2269; FSC No.: 72121; Empl.: 300; *Sls. Mgr.:* Russell Johnson

EEV INC., 4 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-6050, TELEX: 6818096, FAX: 914-682-8922; Empl.: 42; *Sls. Mgr.:* Tom Soldano

EFECTOR, INC., 805 Spring Dale Dr., Exton, PA 19341, Tel: 215-524-2000, 800-441-8246, TELEX: 84-6437, FAX: 215-524-2010; Empl.: 35; *Sls. Mgr.:* J. Kelly

EFI CORPORATION, 350 West 2700 South, Salt Lake City, UT 84115, Tel: 801-486-5871, 800-221-1174, FAX: 801-466-8311; Empl.: 60; *Sls. Mgr.:* George O. Stewart

EG&G, INC., Electro-Optics Div., 35 Congress St, Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Electronics Components Div., 35 Congress St, Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* J. Murachver

EG&G, INC., Photon Devices, 35 Congress St, Salem, MA 01970, Tel: 617-745-3200, TELEX: 681-7405 EGSA; FSC No.: 25506; Empl.: 500; *Sls. Mgr.:* James Melnyk

EG & G ALMOND INSTRUMENTS, 1330 E. Cypress St, Covina, CA 91724, Tel: 818-967-9521, TWX: 910-584-1320, FAX: 818-967-3151; Empl.: 380; *Sls. Mgr.:* Dave Adams ..... **D•1708-1709**

Local Sales Offices & Reps
FL Orlando, Truex Assocs. 305-859-2160
NY Yonkers, Sonkin Assocs. 914-968-8282

EG & G BIRTCHER, EG & G, Inc., 4505 N. Arden Dr./P. O. Box 5268, El Monte, CA 91734-1268, Tel: 818-442-2572, TELEX: 247345 EGGUR, FAX: 818-442-8127; FSC No.: 18915; *Sls. Mgr.:* H. Robert Sproul; *Dist. Mgr.:* H. Robert Sproul ..... **C•1028-1029**

Local Sales Offices & Reps
AL Huntsville, Remco 205-533-3763
AZ Phoenix, Mercury Engrg. Sls. 602-244-0123
CA Brea, Masco 714-529-0866
CA San Diego, Masco 619-234-6905
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CO Broomfield, Connors Co. 303-466-9628
FL Clearwater, HHP, Assocs. 813-797-4447
FL Maitland, HHP, Assocs., Inc. 305-831-2474
FL Pompano Beach, HHP Assocs., Inc. 305-971-5750
GA Atlanta, Remco 404-447-6937
IL Rollings Meadows, Heartland Technlg. Mktg., Inc. 312-577-9222
KS Shawnee Mission, M-S-B Assocs., Inc. 913-262-5500
MD Ellicott City, Eastern Tech. Corp. 301-461-7720
MA Burlington, Conti-Younger Assocs., Inc. 617-273-1582
MI Spring Lake, Jim Finnegan & Co. 616-846-4980
MN Minneapolis, Hei-Lite Sls., Inc. 612-861-6051
NJ Haddonfield, Tritek Sls., Inc. 609-429-1551
NY Great Neck, Coakley, Boyd A Bett/Tylinsky 516-466-9070
NY Syracuse, IA Hotze Assocs. 315-479-6641
NC Raleigh, Remco 919-787-2112
OH Cleveland, Jim Finnegan & Co. 216-238-5905
OH Dayton, Jim Finnegan & Co. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Doylestown, Monteiro Assocs., Inc. 215-345-5855
PA Pittsburgh, Jim Finneagan & Co. 412-823-5400
TX Dallas, El-Com Mktg., Inc. 214-241-2166
TX Houston, El-Com Mktg. 713-350-8064
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Milwaukee, Heartland Technlg. Mktg., Inc. 414-931-0606
Can Markham, Ont., P. J. Heenan, Ltd. 416-474-0111

Local Distributors
CA Fullerton, Pyramid Elctrns. 714-773-0781
CA Manhattan Beach, Prime Electro Prods. 213-379-1724
CA Santa Ana, El-Com, Inc. 213-404-2961
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CO Aurora, Jet Elctrns. Supp. Co., Inc. 303-364-5487
CT S. Windsor, Car-Lac Elctrns. 203-282-0631
MA Milford, Car-Lac Elctrns. 617-478-7797
MA Winchester, Rush Inds., Inc. 617-729-5800
MN Minneapolis, Stark Elctrns., Inc. 612-332-1325
NH Hudson, C & H Elctrns., Inc. 603-882-1133
NY Bohemia, Car Lac Inds. Sls., Inc. 516-567-4200
NY Buffalo, Summit Distrs. 716-884-3450
NY Rochester, Summit Distrs. 716-334-8110
OH Englewood, Argent Inds. 513-836-8633
OR Beaverton, Murphy Elctrns. 503-642-2001
TX Ft. Worth, Industrial Elctrns. 817-731-7321
WA Kent, Pyramid Elctrns. 206-872-5800
WA Redmond, Murphy Elctrns. 206-881-1234
Can Mississauga, Ont., Rush Elctrns. 416-677-7280

EG&G GAMMA SCIENTIFIC, Div. of EG&G Inc., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 697938, FAX: 619-576-9286; Empl.: 75; *Sls. Mgr.:* Robert Ruff

EG&G GEOMETRICS, Div. of EG&G Inc., 395 Java Dr., Sunnyvale, CA 94089, Tel: 408-734-4616, TELEX: 357435; FSC No.: 34314; *Dist. Mgr.:* Doug Crice

EG & G JUDSON, 21 Commerce Dr., Montgomeryville, PA 18936, Tel: 215-368-6900, TELEX: 846120, ESYLNK: 62820476, FAX: 215-362-6107; Empl.: 65

EG&G RETICON, Div. of EG&G, 345 Potrero Ave., Sunnyvale, CA 94086-4197, Tel: 408-738-4266, TWX: 910-339-9343; *Sls. Mgr.:* John Skurla

EG & G ROTRON, Commercial Div., Saugerties, NY 12477, Tel: 914-246-3615, TELEX: 551496; *Sls. Mgr.:* Michael Keating; *Dist. Mgr.:* Ralph Stevens

EG & G ROTRON, Custom Div., Hasbrouck La., Woodstock, NY 12498, Tel: 914-679-5201, FAX: 914-679-7080; FSC No.: 82877; *Sls. Mgr.:* Mike Lyon; *Dist. Mgr.:* Mary Fellows

EG&G ROTRON, Industrial Division, Saugerties, NY 12477, Tel: 914-246-3401, TELEX: 551496; FSC No.: 551496; *Sls. Mgr.:* Jay Jarboe; *Dist. Mgr.:* Jay Jarboe

Local Sales Offices & Reps
CA Huntington Bch., GL Sls. 714-841-1898
PA West Chester, James Gasho Assocs. 215-399-1665

EG & G TORQUE SYSTEMS, 36 Arlington St, Watertown, MA 02172, Tel: 617-924-6000, TELEX: 95-1736; Empl.: 200; *Sls. Mgr.:* W. F. O'Leary; *Dist. Mgr.:* H. D. Waddell

EG & G VACTEC, 10900 Page Blvd., St. Louis, MO 63132, Tel: 314-423-4900, TWX: 910-764-0811, FAX: 314-423-3956; Empl.: 250; *Sls. Mgr.:* D. Hartley; *Dist. Mgr.:* D. Hartley ..... **B•1271**

Local Sales Offices & Reps
AZ Scottsdale, Interstate Mktg. 602-244-9050
CA Encino, King-Way Assocs. 818-788-4124
CA Redwood City, Ault Assocs. 415-367-1710
CO Buena Vista, C-Tech 303-395-2025
FL Orlando, EAB Assocs. 305-898-7444
IL Highland Park, T. B. Hunter Assocs. ... 312-433-7000
IN Fort Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. 317-841-0010
MD Laurel, R. W. Mitscher Co. 301-498-6090
MA Norwood, MacInnis Co. 617-762-8090
MI Southfield, O.E.M. Technical Sls. 313-444-1680
MN Eden Prairie, Rockmore Sls. 612-941-1390
MO St. Louis, Acorn Elctrns. 314-644-2510
NJ Marlton, B.G.R. Assocs. 609-428-2440
NY Pittsford, C. W. Beach Co. 716-586-3200
NY Syracuse, C. W. Beach Co. 315-446-9587
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. 216-473-5050
OH Dayton, Scott Elctrns. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
TX Dallas, S. W. Mktg. Assocs. 214-341-8631
VA Shipman, R. W. Mitscher Co. 804-263-5154

Local Distributors
CA Encino, King Way West 818-788-4124
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Santa Clara, Allied Elctrns. 408-727-1690
FL Orlando, Nico 305-898-7444
IL Chicago, Newark Elctrns. 312-638-4411
IL Elgin, Allied Elctrns. 312-697-8200
MO St. Louis, Olive Indl. Elec. 314-426-4500
OH Dayton, Televox, Inc. 513-294-4499
TX Fort Worth, Allied Elctrns. 817-336-5401

EG & G WAKEFIELD ENGINEERING, 60 Audubon Rd, Wakefield, MA 01880, Tel: 617-245-5900, FAX: 617-246-0874; Empl.: 250; *Sls. Mgr.:* Frank Casdia; *Dist. Mgr.:* Carl Swanson ..... **C•1660**

Local Sales Offices & Reps
AL Huntsville, Over & Over, Inc. 205-837-7105
CA Los Altos, Recht Assocs. 415-964-6321
CA San Diego, Mesa Elctrns. 619-278-8021
CO Denver, Delltron Co. 303-373-0300
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over, Inc. 404-449-6205
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IA Cedar Rapids, C. H. Horn Assocs. 319-393-8703
MD Timonium, Bresson Assocs. 215-664-6460
MI Livonia, Luebbe Sls. 313-477-3131
MN Mendota Heights, G-II Sls. 612-454-3086
MO St. Louis, John Macke Co. 314-432-2830
NY Commack, ERA, Inc. 516-543-0510
NY E. Rochester, Tri Tech Elctrns. 716-385-6500
NY Fayetteville, Tri Tech Elctrns. 315-446-2881
NC Charlotte, Over & Over, Inc. 704-542-9111
OH Cincinnati, Luebbe Sls. Co. 513-530-0600
OH Cleveland, Luebbe Sls. Co. 215-333-0425
OR Lake Oswego, RTS Inc. 503-244-4123
PA Narbeth, Bresson Assocs. 215-664-6460
TX Austin, Milco Mktg. 512-453-3023
TX Richardson, Milco Mktg. 214-783-2716
TX Stafford, Milco Mktg. 713-723-5003
UT Sandy, Delltron Co. 801-942-4678
VA Forrest, Bresson, Assocs. 215-664-6460
WA Vashon, RTS Inc. 206-285-1363
WI Brookfield, Sumer, Inc. 414-784-6641

Local Distributors
AL Birmingham, Newark 205-942-4044
AZ Phoenix, Wyle 602-249-2232

AZ	Tempe, Bell	602-966-7800
AZ	Tempe, Newark	602-968-7441
CA	Buena Pk., Cypress	213-521-5230
CA	El Segundo, Wyle	213-322-8100
CA	Foster City, Newark	415-572-8300
CA	Fountain Valley, Comp. Center	714-979-0433
CA	Garden Grove, Bell	714-220-0681
CA	Gardena, Bell	213-515-1800
CA	Inglewood, Newark	213-678-0441
CA	Irvine, Wyle	714-863-9953
CA	Rancho Cordova, Wyle	916-638-5282
CA	Roseville, Bell	916-969-3100
CA	San Diego, Bell	619-268-1277
CA	San Diego, Cypress	619-292-5611
CA	San Diego, Newark	619-481-1251
CA	San Diego, Wyle	619-565-9171
CA	Santa Ana, Elcom	213-404-2961
CA	Santa Ana, Wyle	408-727-2500
CA	Santa Clara, Comps. Ctr.	408-988-3751
CA	Santa Clara, Cypress	408-435-8400
CA	Sunnyside, Bell	408-734-8570
CA	Thousand Oaks, Bell	805-499-6821
CO	Denver, Newark	303-757-3351
CO	Thornton, Wyle	303-457-9953
CO	Wheat Ridge, Bell	303-424-1985
CO	Wheat Ridge, Cypress	303-431-2622
CT	Bloomfield, Newark	203-243-1731
CT	S. Windsor, Carlac	203-282-0631
CT	Wallingford, Midan	203-265-2077
FL	Casselberry, AFCOM	305-767-6565
FL	Ft. Lauderdale, Newark	305-587-2372
FL	Graham/Largo, Bell	813-541-4434
FL	Lake Mary, Elctrn. Fasteners	305-321-4000
FL	Miami, Elctrn. Equip.	305-871-3500
FL	Orlando, Newark	305-896-8350
GA	Atlanta, Newark	404-448-1300
GA	Norcross, Bell	404-662-0923
GA	Norcross, Specialty	404-458-6341
IL	Chicago, Bell	312-640-1910
IL	Chicago, Newark	312-784-5100
IL	Elk Grove Vl, GBL Elec.	312-593-3220
IN	Carmel, Altex	317-848-1323
IN	Ft. Wayne, Bell	219-423-3422
IN	Indianapolis, Bell	317-634-8202
IN	Indianapolis, Newark	317-298-7070
IN	Lafayette, Bell	317-423-5564
IA	Cedar Rapids, Bell	319-395-0730
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
IA	Cedar Rapids, Newark	319-362-1171
KS	Lenexa, Newark	913-492-6000
KS	Wichita, RSC	316-267-5213
KY	Louisville, Newark	502-423-0280
KY	Metarie, Newark	504-888-5174
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MD	Beltsville, Newark	301-937-5085
MD	Columbia, G.R.S.	301-995-6744
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Canton, Impact Sls.	617-821-1500
MA	Milford, CAR-LAC	617-478-7797
MA	Norwood, Emtel Elctrns.	617-769-9500
MA	Winchester, Rush Inds.	617-729-5800
MA	Woburn, JACO	617-933-7760
MA	Woburn, Newark	617-935-8350
MI	Ann Arbor, Bell	313-971-9093
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Grand Rapids, Newark	616-241-6681
MI	Livonia, RS Elec.	313-525-1155
MN	Minneapolis, Newark	612-331-6350
MN	St. Paul, Gophers	612-483-3322
MO	Hazelwood, Newark	314-731-1204
MO	St. Louis, Newark	314-298-2505
NE	Omaha, Newark	402-392-1221
NJ	Camden, G.R.S.	609-964-8560
NJ	Clifton, Engrd. Assemblies	201-340-0600
NJ	E. Hanover, Delburn	201-884-0800
NJ	Kenilworth, Newark	201-272-8410
NJ	Penshauken, Newark	609-663-9490
NJ	Springfield, Route Elec.	201-379-7710
NM	Albuquerque, Bell	505-292-2700
NY	Bohemia, Car-Lac	516-567-4200
NY	Buffalo, Genesee Radio	716-873-9661
NY	Buffalo, Summit	716-884-3450
NY	Commack, CAR-LAC	516-282-0631
NY	Farmingdale, Semispecialists	516-293-2710
NY	Hauppauge, JACO	516-273-5500
NY	Henrietta, CAM/RPC	716-334-5600
NY	Rochester, Newark	716-473-6600
NY	Rochester, Summit	716-334-8110
NY	Suffern, Nobel Elec.	914-357-4500
NY	Valley Stream, Newark	516-887-2100
NC	Greensboro, Newark	919-292-7240
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Winston-Salem, Kirkman Elec.	919-722-9131
OH	Cincinnati, Bell	513-772-1661
OH	Cincinnati, Hughes Peters	513-351-2000
OH	Cleveland, CAM/Ohio	216-461-4700
OH	Cleveland, Darrah	216-631-0912
OH	Columbia, Newark	614-451-0002
OH	Columbus, Bell	614-895-1590
OH	Columbus, Hughes Peters	614-294-5351
OH	Dayton, Bell	513-434-8231
OH	Dayton, Stotts Friedman	513-298-5555
OH	Warren, REM Elec.	216-373-1300
OK	Oklahoma City, Newark	405-495-5000
OK	Tulsa, Altair	918-252-5781
OK	Tulsa, Radio Inc.	918-587-9123
OR	Beaverton, Comp. Resources	503-641-8488
OR	Hillsboro, Wyle	503-640-6000
OR	Lake Oswego, Bell	503-241-4115
OR	Portland, Newark	503-620-1614
OR	Wilsonville, Shelley-Ragon	503-682-2929
PA	Allentown, Newark	215-434-7171
PA	Montgomeryville, Pyttronic	215-643-2850
PA	Pittsburgh, CAM-RPC	412-782-3770
PA	Pittsburgh, Newark	412-787-7740
PA	Reading, Barbey	215-376-7451
RI	Knoxville, Newark	615-588-6493
RI	Warwick, Newark	401-738-4010
TN	Nashville, Bell	615-367-4400
TX	Austin, Wyle	512-834-9957
TX	Dallas, Cypress	214-869-1435
TX	Dallas, Newark	214-494-5911
TX	Houston, Altair	713-462-3029
TX	Houston, Newark	713-782-4800
TX	Houston, Wyle	713-879-9953
TX	McKinney, Prime	214-542-7915
TX	Richardson, Altair	214-231-5166
TX	Richardson, JACO	214-235-9575
TX	Richardson, Wyle	214-235-9953
TX	Stafford, Harrison Equip.	713-879-2660
TX	Sugarland, Quality Comps.	713-491-2255
UT	Salt Lake City, Bell	801-972-6969
UT	Salt Lake City, Newark	801-484-8611
UT	Salt Lake City, Wyle	801-974-9953
VA	Arlington, Newark	703-522-0880
VA	Charlottesville, Virginia Elec.	804-296-4184
WA	Bellevue, Bell	206-747-1515
WA	Bellevue, Newark	206-641-9800
WA	Bellevue, Wyle	206-453-8300
WA	Redmond, Shelley-Ragon	206-241-1980
WI	Milwaukee, Indl. Elec.	414-276-1212
WI	Milwaukee, Newark	414-463-1100
WI	Ocomonowoc, GW Elec.	414-567-9445
WI	Waukesha, Bell	414-547-8879

EGIS CORPORATION, P. O. Box 751, Barrington, IL 60011-0751, Tel: 312-639-4448, TELEX: 650-336-1335 IMD, FAX: 312-639-8710; Empl.: 14; *Sls. Mgr.:* Tim Neale; *Dist. Mgr.:* Glenn P. Antonic

EH ELECTRONICS, INC., See Wavetek San Diego, Inc., Tel. 619-279-2200

EH ELECTRONICS, INC., Sub. EH Intl., Inc., 48507 Milmont Drive, Fremont, CA 94538, Tel: 415-651-2340, TWX: 910-366-7258; FSC No.: 13488; Empl.: 67; *Sls. Mgr.:* Donald F. Smith

EHRHORN TECHNOLOGICAL OPERS., INC., P.O. Box 888, Canon City, CO 81212, Tel: 303-275-1613; Empl.: 70; *Sls. Mgr.:* Mark Forbes

FAX: 401-738-7154

EICHHOFF ELECTRONICS, 205 Hallene Rd., Warwick, RI 02886, Tel: 401-738-1440; Empl.: 280; *Sls. Mgr.:* Gernot O. Gust, VP, Sls. & Mktg.; *Dist. Mgr.:* Glenn Johannsen ..... **A•1648-1651; B•1412-1413**

Local Sales Offices & Reps

CA	Redwood City, James S. Heaton Co., Inc.	415-367-9000
CA	Simi Valley, Tri-Electro Sls., Inc.	805-527-3317
CO	Denver, Quorum 3	303-696-8480
CT	Simsbury, Electrotechnika, Inc.	203-658-6762
FL	Tampa, Std. Mktg. Inc.	813-933-5833
FL	W. Melbourne, Dale Moats	305-725-7073
IL	Franklin Pk., Stetco, Inc.	312-671-4208
MA	Chelmsford, Encotronics, Inc.	617-256-4207
MI	Livonia, Wenner & Assocs.	313-591-7955
MN	Minneapolis, Electro-Serv Co.	612-338-3475
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Rochester, Lupton Assocs.	716-381-4800
NC	Charlotte, W. L. Moorhead & Co.	704-366-2791
OH	Mansfield, R. J. Goosman & Assocs.	419-756-5746
OR	Portland, Michael Carroll	503-629-9871
PA	Birchrunville, Jadelectronics Assocs.	215-296-3800
TN	Chattanooga, Stetco, Inc.	615-899-6831
TX	Dallas, Comp. Technlg.	214-783-8831
UT	Salt Lake City, Quorum 3	801-943-9227
WA	Seattle, W3C Technlg. Grp., Inc.	206-285-0210
Can	Oakville, Ont., Haltronics Ltd.	416-844-2121

EIKONIX, Electronic Pre-Press Systems, Inc., 15 Wiggins Avenue, Bedford, MA 01730, Tel: 617-276-7161, TELEX: Vern Heinz; Empl.: 175; *Sls. Mgr.:* Vern Heinz

EI MICROCIRCUITS, INC., 1650 Madison Ave., Mankato, MN 56001, Tel: 507-345-5786; Empl.: 25; *Sls. Mgr.:* Perry Eimers

EI NORTH AMERICA, 435 E. 79th St., New York, NY 10021, Tel: 212-517-5622, TELEX: 803347 'EINA'

EIP MICROWAVE, INC., 2731 North First St., San Jose, CA 95134, Tel: 408-433-5900, TWX: 910-338-0155, FAX: 408-434-0258; FSC No.: 34257; Empl.: 200; *Sls. Mgr.:* Bob Loft

EITEL MFG., 33208 Paseo Cerveza, Ste. G, San Juan Capistrano, CA 92675, Tel: 714-240-3933; Empl.: 6; *Sls. Mgr.:* H. Mengel

ELANTEC, INC., 1996 Tarob Ct., Milpitas, CA 95035, Tel: 408-945-1323, 800-821-7429, TWX: 910-997-0649; FSC No.: 64762; Empl.: 90; *Sls. Mgr.:* Ralph Granchelli

ELASTIC STOP NUT DIV., Harvard Inds. Inc., 3200 Country Club Rd., Pocahontas, AR 72455, Tel: 501-892-5201; Empl.: 175; *Sls. Mgr.:* R. Durette; *Dist. Mgr.:* G. Bennett

ELASTOMERIC TECHNOLOGIES INC., (FORMERLY PCK ELASTOMERICS), See PCK Elastomerics

ELCO, KTRONICS, 1333 Lawrence Expwy., Suite 145, Santa Clara, CA 95051, Tel: 408-241-3024, FAX: 408-241-6546

ELCO CORP., Electronic Connector Div., Huntingdon Ind'l. Park, Huntingdon, PA 16652, Tel: 814-643-0700, TWX: 510-691-3117; Empl.: 500; *Sls. Mgr.:* W. J. Graef; *Dist. Mgr.:* W. G. Solomon

ELCOM INDUSTRIES, INC., 10268 Bach Blvd., St. Louis, MO 63132, Tel: 314-429-3100, TELEX: 1561229 ELCOM UT; Empl.: 20; *Sls. Mgr.:* Thomas C. Noel

ELCOM SYSTEMS, INC., 932 Clint Moore Rd., Boca Raton, FL 33487, Tel: 305-994-1774; FSC No.: 32424; Empl.: 8; *Sls. Mgr.:* D. Pollachek ..... **A•1768**

Local Sales Offices & Reps

EXP	MA, Mattapoisett, Clark Export-Import Co.	617-758-6448

ELCON PRODUCTS INTERNATIONAL COMPANY, 42700 Lawrence Place, Fremont, CA 94538, Tel: 415-490-4200, FAX: 415-490-3740; FSC No.: 85901; Empl.: 33; *Sls. Mgr.:* Shirlee Gendreau (inside Sls. Mgr.)

Local Sales Offices & Reps

CA	La Miranda, Isys West	714-738-1582
CA	San Jose, Isys, Inc.	408-259-0800
CT	Danbury, Hathaway Elctrns.	203-790-6993
GA	Norcross, S.E. Power Comps.	404-448-2458
KS	Kansas City, Bonner & Assocs.	816-756-0082
MA	Lexington, Hathaway Elctrns.	617-861-7010
MN	Minneapolis, Boerger & Assocs.	612-560-3435
MO	Kansas City, Bonner & Assocs.	816-756-0082
NJ	Basking Ridge, Churchill Assocs.	201-204-0744
NY	Larchmont, Hingston Walsh Assocs.	914-834-5781
NC	Greensboro, S.E. Power Comps.	919-275-4711
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Lake Oswego, RTS, Inc.	503-635-4927
PA	Trevose, P.S.A.	215-245-0513
TX	Dallas, Dynamark Tech. Sls.	214-437-3333
WA	Vashon, RTS, Inc.	206-285-1363
Can	Mississauga, Ont., Patlon Aircraft & Inds.	416-624-5572

ELDEC CORP., Monitor & Control Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, TELEX: 32-8959, TWX: 910-449-2855; Empl.: 1321

ELDEC CORP., Power Conversion Div., 16700 13th Ave. W., P.O. Box 100, Lynnwood, WA 98046-0100, Tel: 206-743-1313, TELEX: 497-0640, TWX: 910-449-2855; Empl.: 1400

ELDEC CORPORATION, Sensing Systems Div., 22000 Bothell Way-S.E., Bothell, WA 98041-3002, Tel: 206-487-4000, TELEX: 910-449-0873

ELDRE CORPORATION, 1500 Jefferson Rd., Rochester, NY 14623, Tel: 716-427-7280, TWX: 510-253-4347, FAX: 716-272-0018; FSC No.: 19648; Empl.: 220; *Sls. Mgr.:* James N. Fitzpatrick

ELEC-TEK, INC., 10280 Alliance Rd., Cincinnati, OH 45242, Tel: 513-793-7937; FSC No.: 5U373; Empl.: 10; *Sls. Mgr.:* Rick Groth

ELECTRAC, INC., 1614 Orangethrope Way, Anaheim, CA 92801, Tel: 714-879-6021, TELEX: 692433; FSC No.: 016154; Empl.: 35; *Sls. Mgr.:* Roland H. Wills

ELECTRICAL INDUSTRIES, North American Philips Corp., 691 Central Ave., Murray Hill, NJ 07974, Tel: 201-464-3200, TWX: 710-984-7979; FSC No.: 20093; Empl.: 300; *Sls. Mgr.:* D.V. Wilson

ELECTRICAL INSTRUMENT SERVICE, 25 Dock St., Mt. Vernon, NY 10550, Tel: 914-699-9717; FSC No.: 32590;16034A; Empl.: 35 ..... **D•1320-1321**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
KS	Shawnee Mission, Comtel - Midwest	913-268-0762
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MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Comtel - Midwest	314-991-5363
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Williams-Assocs.	801-532-7701
WI	Lake Mills, Saffro & Assocs.	414-648-2605
Can	Beaconsfield, Que., Mesurina Ltee/Ltd.	514-697-6581

ELECTRICAL STANDARDS DIV., E.S.R.S., Inc., 7337 Greenbush, N. Hollywood, CA 91605, Tel: 818-765-4224; Empl.: 6

ELECTRICAL WINDINGS, INC., 2015 N. Kolmar Ave., Chicago, IL 60639, Tel: 312-235-3360; FSC No.: 72128; Empl.: 160; *Sls. Mgr.:* Donal R. Murphy

ELECTRIC DEVICE, PO Box 337, Canfield, OH 44406, Tel: 216-533-1111, FAX: 216-533-2639

ELECTRIC INDICATOR COMPANY INC., 272 Main Ave., Norwalk, CT 06851, Tel: 203-847-5861; FSC No.: 73693; Empl.: 60

ELECTRIC MOTOR ENGINEERING, 1847 Victory Blvd., Glendale, CA 91201, Tel: 818-502-1866, TELEX: 4973366 EME INC LSA, FAX: 818-502-1780; Empl.: 5; *Sls. Mgr.:* Jerry Kibler; *Dist. Mgr.:* Jerry Kibler

Distributor

ELECTRIC SWITCHES, INC., 2478 Fletcher Dr., Los Angeles, CA 90039, Tel: 213-660-1310, TWX: 910-321-2971; Empl.: 42; *Sls. Mgr.:* Louis Lim ..... **B•1708-1709**
617, 619, 621, 624, 638, 641, 643, 644, 657, 663, 695, 706, 714, 716, 721, 727, 734, 740, 747, 755, 772, 789, 794

ELECTRIC TACHOMETER, 68th & Upland Sts., Philadelphia, PA 19142, Tel: 215-SA6-7723, TELEX: 83-1475, FAX: 215-724-3682; FSC No.: 20049; Empl.: 50; *Sls. Mgr.:* F. M. Porter

ELECTRIC TIME COMPANY, INC., P.O. Box 466, Medfield, MA 02052, Tel: 617-359-4396, FAX: 617-359-4482; FSC No.: 6645; Empl.: 10

ELECTRO ASSEMBLIES CORP., 425 Huehl Rd., Bldg. 17, Northbrook, IL 60062, Tel: 312-498-6520; FSC No.: 09250; Empl.: 60; *Sls. Mgr.:* Greg Andrews

ELECTROCHEM INDUSTRIES

FAX: 716-759-7390

ELECTROCHEM INDUSTRIES, Wilson Greatbatch Ltd., 10000 Wehrle, Clarence, NY 14031, Tel: 716-759-7320, TELEX: 137-084; FSC No.: 6U589; Empl.: 300; *Dist. Mgr.:* R. Altieri ..... **D•1453**

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AZ	Scottsdale, S.M.S. Assocs.	602-998-0831
AR	Little Rock, Erickson Sls., Inc.	501-455-0618
CA	Garden Grove, Elsco Elctrns., Inc.	714-891-4621
CA	San Diego, Elsco Elctrns., Inc.	619-292-1771
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Englewood, Omega Ltd.	303-762-1921
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
FL	Sanford, R. W. Mitscher Co.	305-322-7141
IL	Park Ridge, Metcom Assocs. Corp.	312-696-1490
IN	Indianapolis, STB & Assocs., Inc.	317-844-9227
LA	Chalmette, Erickson Sls., Inc.	504-271-1976
MA	Waltham, Del Tech Sls.	617-894-4550
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Medford, Champion Elctrn. Sls., Inc.	609-983-0932
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NC	Pineville, JWL Assocs., Inc.	704-541-5750
OH	Beachwood, Electronic Salesmasters	216-831-8647
TX	Dallas, Erickson Sls., Inc.	214-739-5833
TX	Houston, Erickson Sls., Inc.	713-953-9513
TX	Round Rock, Erickson Sls., Inc.	512-244-3068
UT	Salt Lake City, Omega Ltd.	801-277-8061
WA	Bellevue, Nova-Tronix, Inc.	206-634-7355
Can	Downsview, Designtronics	416-747-1171
Can	Vancouver, Blakewood Elctrns.	604-261-8099

Local Distributors

CA	Long bch., Battery Specialties	213-437-1809
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	San Jose, Rose Elctrns.	408-263-2934
CO	Englewood, Colorado IEI, Inc.	303-694-9444
MA	Sharon, Adcour, Inc.	617-784-8123
MI	Ann Arbor, Wedemeyer Elctrns. Supp. Co.	313-665-8611
NJ	Clifton, Engrd. Assemblies Corp.	201-340-0600
TX	Houston, Kent Elctrns.	713-978-5890
WA	Redmond, Priebe Elctrns.	206-881-2363
Can	Calgary, Alberta, Saynor Varah Inc.	403-255-9550
Can	Don Mills, Ont., Saynor Varah Inc.	416-445-2340
Can	Edmonton, Alberta, Saynor Varah Inc.	403-461-2222
Can	Vancouver, BC, Saynor Varah Inc.	604-873-3211
Can	Victoria, BC, Pacific Coast Elctrns. Ltd.	604-385-5111
Can	Winnipeg, Manitoba, Saynor Varah Inc.	204-633-6190

ELECTROCOM INDUSTRIES, 1105 N. Ironwood Dr., S. Bend, IN 46615, Tel: 219-232-2743; FSC No.: 27114; *Sls. Mgr.:* B. Jaffe

ELECTRO COMP., INC., 2415 Main St., Stratford, CT 06497, Tel: 203-375-5811

ELECTRO CORPORATION, Sub. of Fasco Industries Inc., 1845 57th Street, P.O. Box 3049, Sarasota, FL 33578, Tel: 813-355-8411, TELEX: 52683, FAX: 813-355-3120; FSC No.: 81692; Empl.: 200; *Sls. Mgr.:* John MacKay; *Dist. Mgr.:* Ron Essig

ELECTRO-CRAFT, 1600 2nd St. S., Hopkins, MN 55343, Tel: 612-931-2700

ELECTROCUBE, 1710 So. Del Mar Ave., San Gabriel, CA 91776, Tel: 818-573-3300, FAX: 818-280-9259; FSC No.: 14752; Empl.: 175; *Sls. Mgr.:* Gene Williams; *Dist. Mgr.:* Gene Williams

Local Sales Offices & Reps

AZ	Scottsdale, EDP & Assocs.	602-991-6119
AR	Doby Assocs.	601-981-1138
CA	Newport Bch., Forbes Pacific	714-722-6174
CA	Palo Alto, Horne Electro Sls.	415-494-6777
CA	San Diego, Forbes Pacific	714-722-6179
CO	Englewood, Megatronix	303-799-3700
FL	Tarpon Springs, LP Sls.	813-934-4749
GA	Atlanta, JWL Assocs.	404-320-7643
ID	Boise, Ray Over Sls.	206-695-6179
IL	Downers Grove, Richmar Elctrn. Sls.	312-968-0118
IN	Indianapolis, Richmar Elctrn. Sls.	317-846-6383
MD	Chevy Chase, T. Griffin Co.	301-951-0112
MA	Reading, C. Godfrey Co.	617-944-2230
MN	Minneapolis, Electro-Serv Co.	612-338-3475
MS	Jackson, Doby Assocs.	601-981-1138
MO	Raytown, Centech Sls.	816-358-8100
MO	St. Louis, Centech Sls.	314-291-4230
NM	Albuquerque, EDP & Assocs.	602-991-6119
NY	Great Neck, MOS Assocs.	516-487-3966
NY	Rochester, Gislason Sls.	716-454-4741
NC	Raleigh, JWL Assocs.	919-781-7566
OH	Cleveland, K.W. Elctrn. Sls.	216-491-9177
OH	Dayton, K.W. Elctrn. Sls.	513-890-2150
OR	Portland, Ray Over Sls., Inc.	206-695-6179
PA	Allison Park, K.W. Elctrn. Sls.	412-487-4300
PA	Paoli, T. Griffin Co.	215-647-1550
TX	Austin, Richmar Elctrn. Sls.	515-251-7582
TX	Plano, Richmar Elctrns. Corp.	214-424-8388
WA	Kirkland, J. Findley Co.	206-822-7510
WA	Seattle, Ray Over Sls.	206-695-6179
WI	Butler, Richmar Elctrn. Sls.	414-781-1730

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AZ	Tempe, Acacia Sls. Inc.	602-894-2874
CA	Chatsworth, Mil-Comm Distrs.	213-998-3111
CA	Irvine, Acacia Sls. Inc.	714-660-0834
CA	San Diego, Acacia Sls. Inc.	619-565-4365
CA	San Diego, Mock III Sls.	619-560-0515
CA	Sunnyvale, Acacia Sls.	408-745-7200
CO	Lakewood, Acacia Sls.	303-232-2882
FL	N. Clearwater, Elctrn. Precepts	813-530-9781
FL	Pompano Bch., Elcon	305-781-8600
IL	Elk Grove Village, Nu-Way Elctrns.	312-437-7120
IL	Morton Grove, Nedco Elctrns.	312-966-6000
NJ	Newark, Meltronics	201-242-1686
NY	Ronkonkoma, Prime Comps.	516-737-1730
OH	Englewood, Argent Inds.	513-836-8633
OH	Solon, Repco, Inc.	216-248-8900
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls. Inc.	503-646-3377
PA	McKean, Advacom	814-476-7774
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
WA	Sumner, Acacia Sls., Inc.	206-862-6931
Can	Concord, Ont., Astec Comps.	416-668-4022

ELECTRODATA, INC., 23020 Miles Rd., Bedford Heights, OH 44128, Tel: 216-663-3333, TWX: 810-427-2280; FSC No.: 34-1173465; Empl.: 15; *Sls. Mgr.:* Philip Ardire; *Dist. Mgr.:* Philip Ardire

ELECTRODYNAMICS

FAX: 312-255-3827

ELECTRODYNAMICS, INC., A Talley Inds. Co., 1200 Hicks Rd., Rolling Meadows, IL 60008, Tel: 312-259-0740, TELEX: 28-1070; FSC No.: 10236; Empl.: 250; *Sls. Mgr.:* Frank Rafferty ..... **D•1129**

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Hayward, Liaison, Inc.	415-783-1131
CO	Denver, West High-Tech, JV	303-477-8180
CT	Old Saybrook, FJS Assocs.	203-388-5374
IA	Cedar Rapids, J.R. Sales Engrg.	319-393-2232
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NY Pittsford, Noeth Honsinger Assocs. ... 716-586-9002
OR Tigard, ElTech, Inc. 503-684-3458
PA Norristown, Rivco January Inc. 215-631-1414
TX Roanoke, CMR 817-379-6540
WA Bellevue, ElTech, Inc. 206-643-4330

ELECTRO DYNAMICS, Sub. of SFE Technologies, 9075 Cody, Overland Park, KS 66214 Elec. Dyna., Tel: 913-888-1750, TELEX: 42254

ELECTRO-DYNAMICS DEV. CO., 475 Mt. Hood Dr. S.W., Issaquah, WA 98027-4038, Tel: 206-392-2493; FSC No.: 9J838; *Sls. Mgr.:* W. A. Pommer

ELECTRO-DYN CORPORATION, 90 Sparta Ave., Sparta, NJ 07871, Tel: 201-729-9350, FAX: 201-729-8412; Empl.: 40; *Sls. Mgr.:* Alex Jordan ..... **D•1711**

Local Sales Offices & Reps
CA Mtn. View, Poltronics 415-960-3020
FL Pompano Bch., Bolton Assocs. 305-975-7245
IL Wheeling, Ed Joyner & Co. 312-520-1200
MD Annapolis, Parogem 301-269-1898
MA Needham Hgts., Todino Engrg. Sls. ... 617-444-7925
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
OH Solon, Five-Star Elctrns. 216-349-1611
PA Dresher, CMS Mktg. 215-885-4424
TX Irving, Space Elctrns. 214-251-3636

ELECTROFILM, 27727 Avenue Scott, P.O. Box 55669, Valencia, CA 91355, Tel: 805-257-2240, TELEX: 65-1438; FSC No.: 85932; Empl.: 75; *Sls. Mgr.:* Richard W. Pearson

ELECTRO-FILMS

FAX: 401-738-4389

ELECTRO-FILMS, INC., 111 Gilbane St., Warwick Central Indl. Pk., Warwick, RI 02886, Tel: 401-738-9150, TWX: 710-382-0405; FSC No.: 57252; Empl.: 240; *Sls. Mgr.:* Frank Urrico, Dir., Mktg. Sls. ..... **A•1932-1933**

Local Sales Offices & Reps
CA Santa Ana, Weatherman Assocs. 714-544-1304
CA Sunnyvale, NES Assocs. 408-738-3259
CO Ft. Collins, Rep Sls. 303-226-1504
FL St. Petersburg, QXI 813-894-4556
GA Chamblee, BCI, Inc. 404-455-0405
IL Palatine, M & S Sls. 312-934-1200
IN Ft. Wayne, Corrao Marsh 219-482-2725
MA Bedford, Vector Assocs. 617-271-0000
MI Livonia, Electro Sls. Assocs. 313-421-7500
MN Minneapolis, PSA 612-835-5281
NM Albuquerque, Western High Tech. Mktg. 505-884-2256
NY Plainview, Robert Smith Assocs. 516-681-3155
NY Syracuse, Labtronics 315-455-7314
NJ Whippany, Robert Smith Assocs. 201-340-0204
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MD Ellicott City, Saltech 301-461-7350,
MA Reading, Geder Assocs. 617-944-3105
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EXP NJ, Oradell, Sylvan Ginsbury Ltd. 201-261-3200

ELECTRO INDUSTRIES, Div. E.I. Elctrns., Inc., 1800 Shames Drive, Westbury, NY 11590, Tel: 516-334-0870, TELEX: 4948652 ELECTRO, FAX: 516-338-4741; Empl.: 20; *Sls. Mgr.:* S. Kagan ..... **D•1368**

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AR Little Rock, Beacon Elctrn. Assocs. 501-224-5449
CA Garden Grove, Elsco 714-891-4621
CA San Jose, Vernexx 408-972-9072
CO Denver, Elcom 303-337-2300
FL Boca Raton, Beacon Elctrn. Assocs. .. 305-392-3500
FL Clearwater, Beacon Elctrn. Assocs. ... 813-796-2378
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FL Melbourne, Beacon Elctrn. Assocs. ... 305-724-8010
GA Atlanta, Beacon Elctrn. Assocs. 404-256-9640
IL Des Plaines, Lincoln, Hodges & Assocs. 312-297-3810
MA Framingham, Stone Comps. 617-875-3266
MI Ypsilanti, TechRep 616-642-6594
MN Minneapolis, R. K. Sls. Assocs. 612-571-1001
NY Clark Mills, KLM-Garner Co. 315-853-6126
NY North Syracuse, KLM-Garner Co. 315-458-6214
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NY Yonkers, Sonkin Assocs. 914-968-8282
NC Greensboro, Beacon Elctrn. Assocs. .. 919-275-9997
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OR Portland, Earl & Brown Co. 503-245-2283
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CA Sunnyvale, Sierra West 408-747-1188
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CO Denver, Arrow Elctrns. 303-758-2100
CO Englewood, Indl. Elctrns., Inc. 303-694-9444
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IL Itasca, Voyager Elctrns. 312-773-4900
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NY Rochester, Arrow Elctrns. 716-275-0300
NY Rochester, Simcona Elctrns. Corp. 716-328-3230
NY Yonkers, Kin-Tronics 914-968-7736
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NC Raleigh, Comp. Distrs. 919-834-9465
NC Winston Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Dayton, Bell Inds. 513-434-8231
OH Solon, Arrow Elctrns. 216-248-3990
OH Solon, Repco 216-248-8900
OR Beaverton, Acacia Sls. 503-646-3377
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Philadelphia, Shap Elctrns. 215-969-3300
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TX Dallas, Arrow Elctrns. 214-386-7500
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ELECTROLOGIC, INC., 1359 28th St., Signal Hill, CA 90806, Tel: 213-595-0551, FAX: 213-595-0554; Empl.: 10; *Sls. Mgr.:* Tony Hudson

ELECTRO-MAGENTIC PROCESSES, INC., Subsidiary of ISC Group, Inc., 9616 Owensmouth Ave., Chatsworth, CA 91311-4858, Tel: 818-882-6333, TELEX: 499 2240 EMP UI; FSC No.: 51290; Empl.: 100; *Sls. Mgr.:* Kenneth A. Hacker

ELECTROMATIC CONTROLS CORP., 2495 Pembroke Road, Hoffman Estates, IL 60195-2010, Tel: 312-882-5757, TWX: 910-222-3452; FSC No.: 75203; Empl.: 400; *Sls. Mgr.:* Mike Meurer; *Dist. Mgr.:* Lawrence Tolvaysh

ELECTROMECH, INC., 528 Elm Street, Kearny, NJ 07032, Tel: 201-997-0950; Empl.: 40; *Sls. Mgr.:* Solomon Ezra ..... **A•2214**

Local Sales Offices & Reps
NJ Kearny, Electromech, Inc. 201-997-0950

ELECTRO MECHANICAL SYSTEMS, INC., 801 W. Bradley Ave., Champaign, IL 61820, Tel: 217-359-7125, FAX: 217-359-2075; Empl.: 20; *Sls. Mgr.:* Julie L. Redman

ELECTRO-MECHANICS CO., Box 1546, Austin, TX 78767, Tel: 512-835-4684, TELEX: 767178

FAX: 818-303-2189

ELECTRO-MECHANISMS, INC., 2745 E. Huntington Dr., Duarte, CA 91010, Tel: 818-359-2535; FSC No.: 52592; Empl.: 27 ..... **B•1622-1623**

Local Sales Offices & Reps

CA San Carlos, Hickey Indl. Sls. 415-594-9978
CO Lakewood, Cristee-Meade Co. 303-232-0287
IL Addison, Vikeland Sls.-Chicago 312-832-8425
MN St. Paul, Vikeland Sls., Inc. 612-645-4647
NJ Piscataway, R. P. Luce 201-752-8750
NY Buffalo, Good Comps. 716-634-4400
NY New Hyde Park, R. P. Luce 516-437-4550
OH Dayton, Harvey Teplitz 513-898-5282
PA Philadelphia, R. P. Luce & Co. 215-233-0999
TX Dallas, Marcom 214-351-4532
TX Houston, Marcom 713-271-5635

ELECTRO-MECH COMPONENTS, INC., 1826 N. Floradale Ave., South El Monte, CA 91733-3689, Tel: 818-442-7180, TWX: 510-601-8764, FAX: 818-350-8070; FSC No.: 07150; Empl.: 25; *Sls. Mgr.:* T. Trumbull; *Dist. Mgr.:* Terry Trumbull ..... **B•1702-1703**

Local Sales Offices & Reps

CA Los Angeles, Universal Comps. Co. ... 213-641-4255
CA San Diego, Qualtronics 619-695-0118
CA Santa Clara, Engrg. Assocs. 408-988-5001
CO Englewood, Franklin Sls. 303-789-2526
CT Milford, Todino Engrg. 203-874-6643
FL Orlando, Publicover 305-898-9361
IL Chicago, IRI 312-967-8430
MA Needham Hgts., Todino Engrg. 617-444-7925
MI Plymouth, Leading Edge Sls. 313-420-3344
MN Minneapolis, D. A. Case Assocs. 612-869-3700
NJ Medford, Comp. Consits. 609-654-5300
NY Mamaroneck, Bassin Tech. 914-698-9332
NY Orchard Pk., SHR 716-662-0555
OH Cincinnati, KCH Co. 513-931-1686
OR Forest Grove, Doran Sls. 503-357-3333
SC Greenville, Eltron Sls. 803-234-6931
TX Leander, McCoy Assocs. 512-259-1109
TX Richardson, McCoy Assocs. 214-238-1017
VA Front Royal, Eltron Sls. 703-635-7201
WA Redmond, Doran Sls. 206-885-1885
WI Milwaukee, IRI 414-259-0965

Local Distributors

AZ Phoenix, Parts Elctrn. 602-258-6476
CA Los Angeles, Elec. Switches 213-660-1310
CA Los Angeles, Master Distrs. 213-452-1229
CA Redwood City, SLD, Inc. 415-364-9881
NY Buffalo, Industrial Elctrns. 716-873-9661
NY Mamaroneck, Logicomp Elctrns. 800-431-2625

ELECTRO-METRICS, Penril Corp., 100 Church St, Amsterdam, NY 12010, Tel: 518-843-2600, TWX: 710-446-4798, FAX: 518-843-2812; FSC No.: 18581; Empl.: 105; *Sls. Mgr.:* James Havlicek

ELECTRO NATIONAL, Matthews Ave., Canton, MS 39046, Tel: 601-859-5511, TWX: 810-990-0938, FAX: 601-859-5518; FSC No.: M-54208; Empl.: 40; *Sls. Mgr.:* Patsy Hicks

ELECTRONETICS, INC., Paine Field Bldg 335, Everett, WA 98204, Tel: 206-355-1855; Empl.: 10

ELECTRONIC COIL CORP., Farmington Industrial Park, Farmington, CT 06032, Tel: 203-677-6731, FAX: 203-677-1902; Empl.: 127; *Sls. Mgr.:* Raymond Gorski, Jr.

ELECTRONIC COMPONENT ASSEMBLY, INC., 7181-Construction Ct., San Diego, CA 92121, Tel: 619-549-0808; Empl.: 180; *Sls. Mgr.:* Denise N. Winter

ELECTRONIC COMPONENTS GROUPE

FAX: 612-375-1905

ELECTRONIC COMPONENTS GROUPE, Stein Industries, Inc., 26 North 5th Street, Minneapolis, MN 55403, Tel: 612-375-9639, 800-826-8719, TELEX: 62985650, TWX: 910-240-7878 (for Overseas); *Sls. Mgr.:* Rick Hampton; *Dist. Mgr.:* Rick Hampton ..... **B•1704**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean 205-830-1540
CA Cupertino, F & F Assocs. 408-446-2349
CA Irvine, Groh Assocs. 714-837-9871
CA San Diego, Groh Assocs. 619-453-7572
CO Littleton, Electronic Comp. Sls. 303-797-0894/2772
CT Cheshire, A & M Elctrns., Inc. 203-271-3065
CT Cheshire, MacInnis Co. 203-272-3797
FL Margate, EPM Corp. 305-977-0331
FL Orlando, EPM Corp. 305-977-0331
GA Atlanta, Cartwright & Bean, Inc.;GA Div. 404-368-0160
GA Norcross, Cartwright & Bean, Inc./GA Div. 404-368-0160
IL Downers Grove, Richmar Elec. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-577-9950
KS Overland Pk., Electri-Rep 913-649-2168
LA Covington, Cartwright & Bean, Inc. 504-892-1780
MA Norwood, MacInnis Co. 617-762-8090
MI St. Joseph, OBE, Inc. 616-429-7788
MI W. Bloomfield, OBE, Inc. 313-332-4900
MN New Brighton, Complete Sls. 612-731-2923
MN Oakdale, Complete Sls. 612-731-2923
MS Jackson, Cartwright & Bean, Inc. 601-981-1170
MO St. Louis, Electri-Rep 314-993-4421
NJ Mtn. Lakes, Comps. Technlg. 201-334-2921
NM Albequerque, Syntech 505-266-7951
NY Islip, ABS Technlgs. 516-277-7101
NY Rochester, Tech. Comp. Sls. 716-342-2406
NC Charlotte, Cartwright & Bean, Inc. 704-536-0303
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Centerville, Components Inc. 513-436-0255
OH Cleveland, Components, Inc. 216-243-9200
OR Portland, Elctrn. Engrg. Sls. 503-639-3978
PA West Chester, TCA Assocs., Inc. 215-692-6853
TN Knoxville, Cartwright & Bean 605-693-7450
TN Memphis, Cartwright & Bean, Inc. 901-362-8345
TX Dallas, Rem Air Comps. Corp. 214-234-1069
TX Houston, Dunkel Assocs. 713-729-1670
VA Randallstown, Beacon North, Inc. 703-478-2480
VA Sterling, Beacon North, Inc. 703-478-2480
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors

AL Huntsville, C.D.I. 205-883-7501
AR Little Rock, C.D.I. 501-227-6278
CA Chatsworth, Poco Sls. 818-700-8727
CA Hollywood, Yale Elec. 213-465-3186
CA Manhattan Beach, Prime Electro 213-379-3642
CA San Carlos, Logan Elec. 415-594-0700
CA Santa Ana, El-Com, Inc. 714-432-6630
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Target Elctrns. 408-734-5611
CA Van Nuys, Wes-Garde Comps. 213-873-4802
CO Englewood, Industrial Elctrns. 303-694-9444
CT Hartford, Wes-Garde Comps. 203-527-7705
CT Waterbury, Century Elec. Supp. 203-755-0405
FL Ft. Lauderdale, C.D.I. (Acct. Only) 305-973-6650
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900
FL Lakeland, Wes-Garde Comps. 813-644-7564
FL Melbourne, C.D.I. 305-724-9910
GA Atlanta, KSM Elctrns. 404-458-2013
GA Norcross, C.D.I. 404-441-3320
IL Carol Stream, Wes-Garde 312-653-1460
KS Wichita, Radio Inc. 316-264-2798
MD Beltsville, PSI 301-937-4960
MD Columbia, D. K. Elctrns. 301-995-1950
MA Holliston, Add Elctrns. .. 800-541-7400,800-343-4933
MA Newton, Greene-Shaw Co. 617-969-8900
MN New Brighton, Chris Elctrns. 612-631-2647
MO Florrissant, Delltron Co., Inc. 314-839-0033
MO St. Louis, Wes-Garde Elctrns. 314-567-7776
NH Nashua, Wes-Garde Elctrns. 603-880-1971
NJ Mt. Laurel, Wes-Garde Elctrns. 609-778-8190
NJ W. Berlin, G.C.I. 609-768-6767
NY E. Syracuse, Add Elctrns. 315-437-0300
NY Victor, Add Elctrns. Corp. 716-924-4400
NC Raleigh, C.D.I. 919-834-9465
OH Westerville, Wes-Garde Elctrns. 614-885-0319
OH Youngston, Add Elctrns. 216-792-6900
OK Oklahoma City, Radio Inc. 405-789-0741
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Portland, Radar Elec. 503-232-3404
TX Dallas, C.D.I. 214-644-0373
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Wes-Garde Elctrns. 214-357-1768
TX Richardson, Off-the-Shelf Comps. 214-238-0808
WA Kent, Comp. Resources 206-454-8666
WA Redmond, Shelly Ragon 206-883-2220
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WA Seattle, Shelly (Zepher) Ragon 206-241-1980
WA Spokane, Radar Elec. 509-747-3053

FAX: 201-542-0524

ELECTRONIC CONCEPTS, INC., Box 1278, Eatontown, NJ 07724, Tel: 201-542-7880, TELEX: 7107226661; FSC No.: 50558; Empl.: 240; *Sls. Mgr.:* Philip N. Lepore ..... **A•1076-1081**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. Co. 602-949-0048
CA La Mirada, Select Elctrns. 714-739-8891
IL Wheaton, Elctrn. Concepts, Inc. 312-668-8747
MN Minneapolis, Components Grp. 612-374-1250
MO Grandview, Harris-Hanson Co. 816-763-6200
NJ Eatontown, Elctrn. Concepts, Inc. 201-542-7880
NM Albuquerque, Piper Sls. Co. 505-883-9090
MO St. Louis, Harris-Hanson Co. 314-432-3611
OR Tigard, Comps. West, Inc. 503-684-1671
TX Richardson, Milred Assocs., Inc. 214-644-6731
WA Redmond, Components West 206-885-5880
WA Spokane, Components West 509-922-2412

Local Distributors

NJ Clifton, Elcon Sls. 201-546-5022

ELECTRONIC CONNECTOR DIV., Midland-Ross Corp., One Alewife Pl, Cambridge, MA 02140, Tel: 617-491-5400, TELEX: 6817363; *Sls. Mgr.:* Bill Hickey; *Dist. Mgr.:* Karen McMillan

ELECTRONIC CONTROLS, INC., 431 Park Industrial Dr., La Habra, CA 90631, Tel: 213-697-4189; Empl.: 9

ELECTRONIC CONTROLS DESIGN, 13626 S. Freeman Rd., Mulino, OR 97042, Tel: 503-829-9108, TELEX: 703874 ECDINC UD, FAX: 503-829-4113; Empl.: 120; *Sls. Mgr.:* Steven Glass

ELECTRONIC DEVELOPMENT ASSOCIATES, INC., 1 Westcliff Drive, Dix Hills, New York 11746, Tel: 516-673-3881; FSC No.: 9V841

ELECTRONIC DEVELOPMENT CORP., EDC, 11 Hamlin St., Boston, MA 02127-4198, Tel: 617-268-9696, TELEX: 951596, FAX: 617-268-6754; FSC No.: 12619; *Sls. Mgr.:* R. B. Ross ..... **D•1243**

Local Sales Offices & Reps

AL Huntsville, MOCO 205-881-5968
AK Anchorage, Topp Engrg. 907-243-4131
AZ Tempe, Mesa Technlg. 602-279-5243
CA Carlsbad, F.L.W. Inc. 619-434-5251
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Hayward, FLW, Inc. 415-786-9070
CA Van Nuys, FLW, Inc. 213-989-5238
CO Englewood, R. A. Mayes Co. 303-761-9447
FL Orlando, Gentry Assocs. 305-859-7450
IL Hoffman Estates, Carvel Engrg. 312-885-8800
IN Carmel, Berndt Assocs. 317-844-0114
KS Lenexa, Ramsey Assts. 913-541-1007
MA Reading, Scheinfein Assocs. 617-944-2304
MI Hazel Park, Tiby Co. 313-547-3550
MN Edina, Carvel Engrg. & Sls. 612-835-7929
MO St. Louis, Ramsey Assocs. 314-878-5042
NJ Neptune, C.P.N. Assts. 201-774-5244
NM Albuquerque, Mesa Technlg. 505-292-2330
NY E. Syracuse, Ossmann Instrs. 315-437-7052
NY Henrietta, Ossmann Instrs. 716-359-3801
NJ Spring Lake, C.P.N. Assocs. 201-774-5244
NC Raleigh, Lee Assocs. 919-848-8818
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822
OR Portland, Topp Engrg. Sls. 503-244-7265
PA Willow Grove, Rhodes Technlg. 215-657-0330
TX El Paso, R. A. Mayes Co. ..... Enterprise 750
TX Farmers Branch, Tech Rep Mktg. 214-241-2434
TX Kemah, Hi Tech Sys. 713-783-3856
UT West Jordan, R. A. Mayes Co. 801-292-6781
VT Burlington, Scheinfein Assocs. 802-864-0933
WA Bellevue, Topp Engrg. Sls. 206-747-5400
WI Sheboygan, Carvel Engrg. 414-457-8800
PR Santurce, Sisco 809-726-7635

ELECTRONIC DEVELOPMENT LABS., See EDL Inc.

ELECTRONIC DEVICES, INC., 21 Gray Oaks Ave., Yonkers, NY 10710, Tel: 914-965-4400, TELEX: 681-8047; Empl.: 200; *Sls. Mgr.:* Paul Dengler; *Dist. Mgr.:* Paul Dengler ..... **A•2131**

Local Sales Offices & Reps

AZ Tempe, Cantec Sls. 602-345-1276
CA San Jose, Nelson Elctrn. Sls., Inc. 408-293-2600
CO Golden, Dossett Elctrn. Mktg. Inc. 303-278-4620
FL Melbourne, Kennedy Assocs. 305-676-6875
IN Carmel, Berndt Assocs. 317-844-0114
MA Sharon, Cummings Assocs. 617-784-5600
MI Grand Blanc, Inter-Comm, inc. 313-695-0665
MN Brooklyn Ctr., P Lydon 612-535-6526
MO St. Louis, Rep-tronics Inc. 314-576-9816
NY Mastic, Optimum Sls. Co. 516-589-4664
NY Morrisville, Promark Elctrns. 315-662-3310
NC Raleigh, B. T. Funderburk Inc. 919-782-3493
OR Portland, IVC Inds. Vehicle Corp. 503-297-3364
PA Newtown, Yax Assocs. 215-860-2540
PA Waterford, Bacon Elec. Sls. 814-796-2381

TX Ft. Worth, El-tec Sls. 817-643-4812
WI Mequon, Stumm Sls. 414-241-8414
Can Montreal, Que., Elcom GMB Inc. 514-643-4812

Local Distributors

AL Huntsville, Comp. Dists. 205-883-7501
AR Little Rock, Comp. Dists. 501-227-6278
CA Anaheim, A-Z Elctrns. 714-632-1620
CO Denver, Regon Elctrn. Parts 303-744-1992
CO Englewood, Indl. Elctrns. 303-694-9444
CT Greenwich, Wise Comps. 203-531-4880
FL Melbourne, Comp. Dists. 305-724-9910
GA Atlanta, Specialty Dist. 404-873-2521
GA Norcross, Comp. Dists. 404-441-3320
IL Chicago, E M D 312-577-0067
IN Indianapolis, Gateway Megatech 317-577-0067
KY Louisville, Peerless Elctrn. Equip. 502-637-7674
MA Billerica, Mayer Elctrns. Inc. 617-667-6900
MI Livonia, Reptron Inc. 313-525-2700
MI Wyoming, Gateway Megatech 616-538-7925
MN Minneapolis, Bergquist Co. 612-835-2322
MO St. Louis, Ric-Tronics 314-576-9816
NJ Fairfield, Verdura Sls. Co. 201-785-1242
NJ Nutley, Eacon Elctrns. 201-667-5117
NY Albany, E. E. Taylor Co. 518-438-7811
NY Buffalo, Summit Dists. 716-887-2820
NY Mt. Vernon, QAR Elec. Sls. 914-699-2224
NY Rochester, Summit Dists. 716-334-8110
NC Raleigh, Century Elec. Comps. 919-872-2203
NC Raleigh, Comp. Dists. 919-834-9465
OH Wickliffe, Gateway Megatech 216-944-5801
OH Worthington, Reptron/Ohio 614-436-6675
OK Oklahoma City, Trice Whlsl. Elec. 405-528-2632
OK Tulsa, Quality Comps. 918-664-8812
OR Portland, Radar Elec. Co. 503-232-3404
TX Addison, Quality Comps. 214-733-4300
TX Austin, Quality Comps. 512-835-0220
TX Sugarland, Quality Comps. 713-491-2255
VA Roanoke, Peoples Elctrns. 703-342-8933
WA Seattle, Radar Elec. 206-282-2511
WI Racine, Badger Elctrns. 414-637-1256
PR Rio Piedras, Klamco Elctrns. 809-752-6169
Can Downsview, Ont., Westburne 416-635-2980
Can Montreal, Que., Elctrn. Whlslrs. 514-769-8851
Can Ottawa, Ont., Elctrn. Whlslrs. 613-746-4413

ELECTRONIC ENCLOSURES, Div. Wyle Labs, 225 South Aviation Blvd., El Segundo, CA 90245, Tel: 213-643-8181, FAX: 213-643-8565; FSC No.: 09097; Empl.: 230; *Sls. Mgr.:* Hillard W. Sorey ..... **C•1030**

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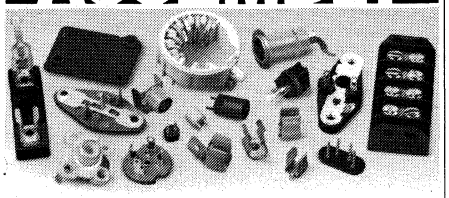

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Local Sales Offices & Reps

AL Huntsville, Shivers Instrs. 205-881-7617
CA Campbell, Carlson & Assocs. 408-370-1284
CA El Segundo, Wyle Labs.;Elctrn. Encl. .. 213-643-8181
CA San Diego, Wyle Labs.;Elctrn. Encl. ... 619-489-2957
CO Wheat Ridge, Waugaman & Assocs., Inc. 303-423-1020
FL Casselberry, T-Squared Mktg. 305-699-9992
IL Elmhurst, Scott Assocs. 312-279-5681
KS Olathe, C-Tron Inc. 913-829-0073
MD Upperco, Imigtron Sls. Co. 301-374-5600
MA Lexington, Zieco Inc. 617-861-8300
MI Jackson, Norwood Scroggs Co. 517-750-1170
NE C-Tron Inc. 314-928-8078
NJ Pennsauken, Wyle Labs.;Elctrn. Encl. 609-665-6810
NJ Teaneck, Noreast Tech. Sls., Inc. 201-833-2044
NM Albuquerque, Brytec Sls. Inc. 505-884-1123
OH Galion, J. R. Bright Agy. 419-468-3787
OR Eugene, H. Hogstrom & Assocs. 503-689-1076
TX Ft. Worth, Zonk Engrg. Co. 817-429-9551
TX Houston, Zonk Engrg. Co. 713-895-9131
TX Richardson, Zonk Engrg. Co. 214-238-7651

ELECTRONIC ENGRG. CO. OF CAL., See EECO

ELECTRONIC ESSENTIALS, 60-20 34th Avenue, Woodside, NY 11377, Tel: 718-898-8300, TELEX: 384-873, ESYLNK: 6275-6172, FAX: 718-899-7995; Empl.: 49

ELECTRONIC FILM CAPACITORS, INC., Reidville Industrial Pk., 41 Interstate Ln., Waterbury, CT 06705, Tel: 203-755-5629, FAX: 203-755-0659; Empl.: 65; *Sls. Mgr.:* Robert Fountain Sr.

ELECTRONIC HARDWARE, 320 Broad Hollow Rd., Farmingdale, NY 11735, Tel: 516-752-1950, FAX: 516-752-1971; Empl.: 100; *Sls. Mgr.:* V. DiSalvo

ELECTRONIC INSTRUMENTS & SPECIALTY CORP., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-5300, TELEX: 948-025; FSC No.: 14908; Empl.: 100

ELCTRN. INSTR. & SPEC. CORP., MC DIV., See Millen Comps.

ELECTRONIC MEASUREMENTS, 405 Essex Rd., Neptune, NJ 07753, Tel: 201-922-9300, TELEX: 132-424; Empl.: 250; *Sls. Mgr.:* Charles Lehmann ..... **D•1712-1715**

Local Sales Offices & Reps

AL Huntsville, Sci. Devices 205-536-1969
AZ Phoenix, Sci. Devices 602-957-0401
CA Huntington Beach, Sci. Devices 714-840-3501
CA San Diego, Sci. Devices 619-573-0157
CA San Jose, Sci. Devices 408-554-0455
CO Broomfield, Sci. Devices 303-469-5145
FL Orlando, Sci. Devices 305-841-8180
GA Marietta, Sci. Devices 404-427-8660
IL Chicago, Comtel 312-539-4838
IN Indianapolis, Comtel 317-253-1681
IA Cedar Rapids, Comtel 319-377-9434
MA Winchester, FJS Assoc. 617-729-3135
MI Southfield, Comtel 313-358-2510
MN Wayzata, Comtel 612-476-1551
NM Albuquerque, Sci. Devices 505-883-3668
NY East Syracuse, Ossmann Insts. 315-437-7052
NC Winston-Salem, Sci. Devices 919-765-5776
OH Dayton, WKM Assoc. 513-434-7500
PA Pittsburgh, WKM Assoc. 412-892-2953
PA Plymouth Meeting, Electronic Mktg. Assocs. 215-828-7400
TX Austin, Alphatech 512-458-9179
WA Redmond, Sci. Dvcs. 206-885-0004
WI New Berlin, Comtel 414-544-6042

ELECTRONIC MODULAR SYSTEMS, INC., Pasadena Technology Corp., 1325 Capital Pkway, No. 109, Carrollton, TX 75006, Tel: 214-446-2900, TELEX: 791688, FAX: 214-245-1559; Empl.: 45; *Sls. Mgr.:* Dale R. Sparrow

ELECTRONIC NAVIGATION INDUSTRIES, See ENI, Inc.

ELECTRONIC PACKAGING TECHNOLOGY, INC., 132 Gloster Road, Lawrenceville, GA 30245, Tel: 404-925-8149; Empl.: 5; *Sls. Mgr.:* Al Lipphardt

ELECTRONIC PRECISION COMPONENTS CORPORATION, 11 W. Sandford Blvd., Mt. Vernon, NY 10550, Tel: 914-664-2333; FSC No.: 75898; Empl.: 8; *Sls. Mgr.:* Don Edwards ..... **A•1652**

Local Sales Offices & Reps

CA Granada Hills, W. H. Inds., Inc. 213-363-3910
CO Denver, Midwest Meridian Corp. 303-341-7550
IL Elk Grove Village, Midwest Meridian Corp. 312-640-9540
IA Cedar Rapids, Midwest Meridian Corp. 319-365-6561
MA Andover, William Crawford Assocs. ... 617-470-2122
MN Prior Lake, Midwest Meridian Corp. ... 612-447-8222
MO Marylan Heights, Midwest Meridian Corp. 314-878-4441
OH Fairborn, Midwest Meridian Corp. 513-879-7100
TX Fort Worth, Midwest Meridian Corp. ... 817-654-2132
WA Kirkland, W.H. Industries 206-827-1024

ELECTRONIC RESEARCH ASSOCIATES, INC., See ERA/Refac, ERA Transpac

ELECTRONIC RESEARCH CO., 7618 Wedd St., Overland Park, KS 66204, Tel: 913-631-6700, TWX: 910-749-6477; FSC No.: 13571; Empl.: 60; *Sls. Mgr.:* Charles Ditzler ..... **A•1392**

Local Sales Offices & Reps

NJ Riverdale, Comp-Tech Sls. 201-935-5454
NJ Union, Comp-Tech Sls. 201-687-2484
NY New Hyde Pk., Comp-Tech Sls. 516-593-2628

ELECTRONIC RESOURCES INC., 568 Weddell Dr., No. 8, Sunnyvale, CA 94089, Tel: 408-745-1420, TWX: 510-600-7616, FAX: 408-745-0533; Empl.: 6; *Dist. Mgr.:* Cari Ikya

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ELECTRONIC SOLUTIONS, A Unit of Zero Corp., 6790 Flanders Dr., San Diego, CA 92121, Tel: 619-452-9333, TELEX: 910-335-1169; Empl.: 100 ..... **C•1032-1034**

Local Sales Offices & Reps

AZ Phoenix, Holder Hauer 602-242-4025
CA Concord, Qualtech Assoc. North 415-680-1800
CA Orange, Qualtech South 714-639-9820
CA San Diego, Mesa Engrg. 619-278-8021
CA Sunnyvale, Qualtech North 408-732-4800
CA Thousand Oaks, Qualtech South 805-495-7100
CO Denver, Holder Hauer 303-427-3443
CT Stamford, Tech. Applications Assocs. 203-327-2934
FL Casselberry, Dyne-A-Mark 305-629-5557
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Norcross, Mtn. Electro Prods. 404-448-5594
IL Elk Grove VL, Control Sls. 312-595-2110
KS Lenexa, Midtec 913-541-0505
MD Rockville, Spectro 301-294-9770
MA Framingham, TA Squared 617-875-3586
MA Westborough, Tech. Applications Assocs. 617-366-9781
MI Grosse Pointe Pk., Greiner Assocs. ... 313-499-0188
MN Edina, Micro Res. 612-830-1454
MO St. Louis, Midtec 314-275-8666
NM Albuquerque, S & S Technlgs. 505-255-5599
NY New York, Gebhardt Mktg. 201-376-4415
NJ Springfield, Gebhardt Mktg. 201-376-4415
NC Wake Forest, Mtn. Electro Prods. 919-556-7103
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OK Stillwater, Acudata, Inc. 405-743-1886
OR Beaverton, Thorson Co., N.W. 503-644-5900
PA Allison Park, Monument Tech. 412-487-1770
PA Jenkintown, Monument Tech. Assocs. 215-884-3737
TX Austin, Acudata 512-478-1018
TX Houston, Acudata 713-580-2451
TX Plano, Acudata 214-424-3567
UT Salt Lake City, Holder Hauer 801-532-2111
WA Bellevue, Thorson Co. N.W. 206-455-9180
WI Thiensville, Control Sys. 414-242-4580

ELECTRONIC SPACE SYSTEMS CORP., Old Powder Mill Rd., Concord, MA 01742, Tel: 617-369-7200, TELEX: 923480 ESSCO WCRD, FAX: 617-369-7641; FSC No.: 15175; Empl.: 100; *Sls. Mgr.:* Susan M. Cuevas

ELECTRONIC SPECIALISTS, 171 South Main St., Natick, MA 01760, Tel: 617-655-1532, 800-225-4876, TELEX: 955-329 ATTN: ESP; Empl.: 42; *Sls. Mgr.:* Dan Gendron

FAX: 206-573-4635

ELECTRONIC SPECIALTY CORP., 14511 N.E. 13th Ave., P.O. Box 3501, Vancouver, WA 98668-3501, Tel: 206-574-5000, TELEX: 152-386, TWX: 910-444-0005; FSC No.: 98927;Multiple; Empl.: 132; *Sls. Mgr.:* L. Fuller ..... **B•1416-1419, 1624-1625**

Local Sales Offices & Reps

CA	Anaheim, Gabriel & Assocs.	714-666-0660
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Denver, Tri Tec Sls.	303-440-7862
CT	Bethel, Livera-Polk Assocs.	203-748-4639
FL	Lighthouse Point, Jack Krutek & Assocs.	305-427-4202
KS	Olathe, SPS Assocs. Ltd.	913-764-4460
MD	Gaithersburg, Eastern Comp.	215-825-8610
MA	Lexington, Hathaway Elec.	617-861-7010
MN	Hopkins, The Kits Co.	612-933-1888
NJ	Madison, Livera-Polk Assocs.	201-377-3239
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
NC	Raleigh, Eastern Comp.	919-787-3416
OH	Cleveland, Components Inc.	216-243-9200
OH	Englewood, Newberry & Assocs.	513-832-2114
PA	West Conshohocken, Eastern Comp.	215-825-8610
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
VA	Annandale, Eastern Comp.	703-354-0723

ELECTRONIC SYS. & PROGRAMMING, See Augat/ES)sP, Inc.

ELECTRONIC TESTING & CONSULTING, 812 Carver St., Mesquite, TX 75149, Tel: 214-288-0331; Empl.: 3

ELECTRONIC TRANSFORMER CORP., P.O. Box 188, Totowa, NJ 07511, Tel: 201-942-2222; FSC No.: 72149; Empl.: 130; *Sls. Mgr.:* Dan Rovine

ELECTRON-MACHINE CORP., Box M, Umatilla, FL 32784, Tel: 904-669-3101, TELEX: 56-4300; Empl.: 55; *Sls. Mgr.:* S. K. Kemp V.P. Mktg

ELECTRON PRODUCTS, 2084 Central Ave., Duarte, CA 91010, Tel: 818-359-8281, TELEX: 910-333-9810; FSC No.: 99515; Empl.: 65; *Sls. Mgr.:* John Williams; *Dist. Mgr.:* Ann Meunier

ELECTRO-NUMERICS, INC., 1811 Reynolds, Irvine, CA 92714, Tel: 714-250-1501, TELEX: 68-5612, FAX: 714-250-0958; FSC No.: 51666; Empl.: 18 ..... **D•1369**

Local Sales Offices & Reps

AL	Huntsville, FLW S.E., Inc.	205-536-6207
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	San Jose, Gamma Saturn	408-248-4143
CO	Boulder, Herb Bass Assocs.	303-530-7509
FL	Orlando, FLW S.E., Inc.	305-894-1100
GA	Atlanta, FLW S.E., Inc.	404-424-1731
IL	Chicago, PVA Corp.	312-655-3355
KS	Topeka, R. E. Pedrotti Co.	913-677-3366
KY	Louisville, Instr. & Tech. Sys., Inc.	502-244-1498
LA	Lafayette, Kemp Engrg. Co., Inc.	318-269-9452
MA	Boston, Di-Ana Sls. Co.	617-363-5420
MI	Detroit, Satullo Assocs., Inc.	313-585-4811
MN	Minneapolis, Kits Co.	612-933-1888
NY	Hewlett, Metropolitan Sls. Co.	516-599-7900
NC	Charlotte, FLW S.E., Inc.	205-536-6207
OH	Cleveland, Meas. Instr. E., Inc.	216-476-0277
OK	Tulsa, Golden Rule Sls. Co.	918-836-7556
OR	Portland, Topp Engrg. Sls. Corp.	503-244-7265
PA	Philadelphia, FLW of PA, Inc.	215-251-9700
PA	Pittsburgh, Meas. Instr. E., Inc.	412-459-8090
TN	Oak Ridge, Instr. & Tech. Sys.	615-483-5715
TX	Houston, E. V. Smith Sls. Co.	713-931-0403
WA	Seattle, Topp Engrg. Sls. Corp.	206-747-5400
WI	Milwaukee, Stapleman Corp.	414-352-5777
Can	Toronto, Smart Control Sys.	416-474-0550

Local Distributors

AL	Huntsville, FLW S.E., Inc.	205-536-6207
CA	Costa Mesa, FLW, Inc.	714-751-7512
FL	Orlando, FLW S.E., Inc.	305-894-1100
GA	Atlanta, FLW S.E., Inc.	404-424-1731
MI	Detroit, RAM Meter, Inc.	313-398-6767
NC	Charlotte, FLW S.E., Inc.	704-391-8812
PA	Philadelphia, FLW of PA, Inc.	215-251-9700

ELECTRO-OPTICAL INDUSTRIES, Box 3770, Santa Barbara, CA 93130, Tel: 805-964-6701 (ext. 280), TELEX: 65-8427 EOIND SNC, FAX: 805-967-8590; Empl.: 130

ELECTRO-PACIFIC, 5770 Thornwood Dr., Goleta, CA 93117, Tel: 805-964-0751; FSC No.: 29853; Empl.: 60; *Sls. Mgr.:* T. Calhoun

ELECTRO PHYSICS CO., INC., 3009 Central Ave., Waukegan, IL 60085, Tel: 312-249-5801; Empl.: 6; *Sls. Mgr.:* Abe Siegelman

ELECTROPHYSICS CORP., 48 Spruce St., Nutley, NJ 07110, Tel: 201-667-2262, TELEX: 642277

ELECTROPREP, INC., Rt 28A, P.O. Box 437, Cataumet, MA 02534, Tel: 617-563-5559; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

ELECTRORACK PRODUCTS CO., 1443 S. Sunkist St., Anaheim, CA 92806, Tel: 714-776-5420; FSC No.: 26073; Empl.: 50; *Sls. Mgr.:* Donn Krauser

Local Sales Offices & Reps

AL	Huntsville, Remco	205-533-3763
AZ	Scottsdale, Western Mktg. Eng.	602-948-1773
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Thornton, E & C Johnson Co.	303-457-2247
IA	Des Moines, Beams Corp.	515-255-1148
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Burlington, Intersell	617-273-3844
OK	Tulsa, Spectra Sls.	918-663-7188
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
WA	Seattle, Horton Assocs.	206-322-1500

ELECTRO RENT CORP., 4209 Van Owen Place, Burbank, CA 91505, Tel: 818-843-1221, TELEX: 314225, TWX: 910-498-2238; Empl.: 400; *Sls. Mgr.:* D. Kebadle

ELECTRO SCIENTIFIC INDS., 13900 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-4141, TELEX: 474-2064; FSC No.: 11837; Empl.: 800; *Sls. Mgr.:* Dick Donaca, Sys./Gay Gasque

FAX: 215-682-2133

ELECTRO SPACE FABRICATORS, 300 W. High St., P.O. BOX 67, Topton, PA 19562-0067, Tel: 215-682-7181; Empl.: 205; *Sls. Mgr.:* T. Roth ..... **C•1035-1038**

Local Sales Offices & Reps

CA	Campbell, Shursales	408-374-5577
CA	Irvine, Vale Assocs.	714-551-4004, 4821
FL	Deerfield Beach, Jack Krutek & Assocs., Inc.	305-427-4202
FL	Melbourne, Winter Assocs.	305-254-6556
GA	Norcross, Hollingsworth & Still	404-447-1700
MD	Upperco, Imagitron Sls. Co.	800-638-3592
MA	Waltham, Betronic Assocs.	617-894-8400
NJ	Boonton, Winter Assocs.	201-334-3434
NY	Morrisville, Promark Elctrns., Inc.	315-662-3310
OH	Galion, James R. Bright	419-468-3787
OR	Beaverton, Electronics Northwest, Inc.	503-629-9241
PA	Huntingdon Valley, OMEGA Elctrn. Sls., Inc.	215-947-4135
PA	McKean, Ecco Electrns. Sls.	814-476-1376
TX	Dallas, Blair Engrg.	214-241-5655
WA	Redmond, Electronics Northwest, Inc.	206-883-1959
WA	Spokane, Electronic Northwest, Inc.	509-924-0450

Local Distributors

CA	Redwood City, HdB Elctrns.	415-368-1388
NJ	Frenchtown, SINTEC	201-996-4093
NY	Baldwin, Accessories for Elctrns.	516-546-1751

ELECTROSPACE SYSTEMS, INC., P. O. Box 831359, Richardson, TX 75083-1359, Tel: 214-470-2106/2107, TWX: 910-867-4768; FSC No.: 33875; Empl.: 2618

Local Sales Offices & Reps

CA	Newbury Pk., Electrospace Sys., Inc.	805-498-9733
FL	Orlando, Electrospace Sys., Inc.	305-273-3310
MA	Acton, Electrospace Sys., Inc.	617-861-6009
NJ	Holmdel, Electrospace Sys., Inc.	201-264-5958
OH	Dayton, Electrospace Sys., Inc.	513-426-3200
VA	Arlington, Electrospace Sys., Inc.	703-979-1220

ELECTRO STANDARDS LAB., INC., P.O. Box 9144, Providence, RI 02940, Tel: 401-943-1164, TELEX: 697-2057 ESLAB, FAX: 401-946-5790; Empl.: 25; *Sls. Mgr.:* R. B. Sepe; *Dist. Mgr.:* R. B. Sepe

ELECTROSTATICS, 7718 Clairemont Mesa Blvd., San Diego, CA 92111, Tel: 619-279-1414; FSC No.: 34538; Empl.: 17

ELECTROSWITCH, Unit of Electro Switch Corp., 180 King Ave., Weymouth, MA 02188, Tel: 617-335-5200, FAX: 617-335-4253; FSC No.: 82121; Empl.: 290; *Sls. Mgr.:* W. M. Mello ..... **B•1705**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Los Angeles, Wiley	213-666-1611
CA	Mtn. View, W. Nott & Co.	415-969-7411
CA	San Diego, Wiley Co.	619-453-9018
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Winter Park, Floritronics	305-886-4818
GA	Atlanta, Holman-Gillespie	404-992-8820
IL	Elk Grove Village, Electroswitch	312-593-2225
IA	Bettendorf, Weisler & Assocs.	319-355-5911
MD	Gaithersburg, Naudain Assocs.-Southern	301-258-5040
MI	Royal Oak, Hilltronics	313-435-0920
MN	St. Paul, Kencotronics	612-645-7717
MO	Ellisville, Weisler & Assocs.	314-394-4543
MO	No. Kansas City, Weisler & Assocs.	816-421-1679
NJ	Fairfield, Electroswitch	201-227-6559
NJ	Marlton, Naudain Assocs.	609-983-5300
NY	Rochester, Sweetco Assocs.	716-225-2383
NY	Utica, Sweetco Assocs.	315-797-6721
NC	Winston-Salem, L.G. White Southern	919-725-3612
OH	Dayton, Rockford Controls	513-898-5452
OH	Medina, Rockford Controls	216-725-3705
PA	Pittsburgh, R. F. Clark	412-242-9500
SC	Greenville, L.G. White Southern	803-271-0630
TX	Dallas, Brice Co.	214-233-9808
TX	Stafford, Brice Co.	713-240-1788
VA	Ruther Glen, L.G. White Southern	804-448-4476
WA	Kent, C.B. Parsons & Co.	206-762-7373
WI	Wauwatosa, Larsen Assocs.	414-258-0529

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Georgia Control Ctr.	404-876-8833
IL	Bridgeview, Midco Comp. Sls.	312-599-7777
MD	Kensington, Marine Air Supp.	301-949-9560
MN	St. Paul, K. D. I.	612-645-7717
NY	Hempstead, Electronic Equip. Co.	516-538-5510
NC	Raleigh, Wholesale Elctrns.	919-878-9400
OH	Medina, Rockford Controls Ohio	216-725-3705
TX	Stafford, Barclay Whls.	713-240-1788
WA	Seattle, C.B. Parsons Co.	206-762-7373

ELECTROSWITCH, SOUTHERN DIV., Electro Switch Corp., 2510 North Blvd., Raleigh, NC 27604, Tel: 919-833-0707, TWX: 910-240-4611, FAX: 919-833-8016; Empl.: 70; *Sls. Mgr.:* Doyle N. Evans; *Dist. Mgr.:* Lisa C. Tillis ..... **B•1706**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co., Inc.	205-882-6050
CA	Campbell, Luscombe Engrg. Co. of S.F.	408-370-2020
CA	Irvine, Vale Elctrns.	714-551-4004
CA	San Diego, Vale Elctrns.	619-693-0113
FL	Clearwater, Electrocraft, Inc.	813-578-2233
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Itasca, Janus, Inc.	312-250-9650
IN	Indianapolis, C.C. Electro Sls.	317-255-1508
KS	Overland Pk., Electri Rep., Inc.	913-649-2168
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Electri Rep., Inc.	314-993-4421
NH	Salem, Sls. Engrg. Co.	603-893-5521
NJ	Englewood, Sprung/Nussbaum, Inc.	201-569-5666
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
NC	Raleigh, R. W. Mitscher Co., Inc.	919-848-0941
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Huntingdon Valley, R. W. Mitscher Co.	215-355-4452
PA	Pittsburgh, Cliff Price	412-831-1588
TN	Johnson City, R. W. Mitscher Co., Inc.	615-929-7258
TX	Austin, Allied Comps., Inc.	512-331-4494
TX	Dallas, Allied Comps., Inc.	214-238-0408
VA	Shipman, R. W. Mitscher Co., Inc.	804-263-5154
Can	Mississauga, Ont., Gidden-Morton Assocs., Inc.	416-671-8111

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
IL	Lisle, Components, Inc.	312-852-7707
MA	Canton, Impact Sls.	617-821-1500

MA Hingham, Sager Elctrns. 617-749-6700
NJ Cranford, Garden State Inds. 201-272-6400
NY Buffalo, Summit Distrs. 716-887-2800
NY Mt. Vernon, QAR Indl. Elctrns. 914-699-2224
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Dixie Elctrns. 704-377-4348
OH Solon, Repco Elctrns., Inc. 216-248-8900
OR Portland, United Radio Supp. 503-233-5341
SC Columbia, Dixie Elctrns. 803-779-5332
WI Waukesha, Bell Inds. 414-547-8879

ELECTRO-TECH SYSTEMS, INC., 115 E. Glenside Ave., Glenside, PA 19038, Tel: 215-887-2196, TELEX: 797137; Empl.: 13; *Sls. Mgr.:* Sharon Sandy; *Dist. Mgr.:* Stanley Weitz

ELECTRO VECTOR, INC., 6555 Covey Rd., Forestville, CA 95436, Tel: 707-887-2292, TWX: 510-746-6024; *Sls. Mgr.:* Wayne Brigden

ELECTROVERT, INC., 466 Main St., New Rochelle, NY 10801, Tel: 914-633-0222

ELECTRO WEAVE, 425 Shrewsbury St., Worcester, MA 01604, Tel: 617-752-8932, FAX: 617-753-2173; FSC No.: 54207; Empl.: 18; *Sls. Mgr.:* Peter Andrews

ELFAB CORPORATION, Augat, Inc., 1097 Yates Street, Lewisville, TX 75067, Tel: 214-221-8776, TWX: 910-860-5460, FAX: 214-221-9667; Empl.: 250; *Dist. Mgr.:* Peter Kiddy

ELFORM, INC., P.O. Box 7362, Reno, NV 89510, Tel: 702-356-1734, TWX: 510-600-5662 ELFORM, FAX: 702-356-1742; *Sls. Mgr.:* Roger R. Reinke

ELGAR

FAX: 619-458-0267

ELGAR CORP., 9250 Brown Deer Rd., San Diego, CA 92121, Tel: 619-450-0085, 800-854-2213, TELEX: 211063 ELSD UR; FSC No.: 25965; Empl.: 275; *Dist. Mgr.:* Doug Caldwell ..... **D•2092-2096**

Local Sales Offices & Reps

AL Huntsville, Beacon 205-881-5031
AZ Tempe, Trembly Assoc. 602-967-2058
CA Costa Mesa, Ward Davis Assocs. 714-556-0955
CA Redondo Beach, Ward/Davis Assocs. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Wallington, Pat Jenks Assocs., Inc. 203-265-9939
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 305-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Heights, Dytec/Central 312-394-3380
IN Indianapolis, Dytec/Central 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
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NY Liverpool, Northern Tech. Sls. 315-451-1091
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
TX Richardson, Testech, Inc. 214-644-5010
OR Lake Oswego, Syntek 503-636-6793
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Kirkland, Syntek 206-488-0394
WI Brookfield, Dytec Central Inc. 414-792-0320
EXP CA, San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

Local Distributors

AZ Tempe, Micro Source 602-968-6062
CA Mtn. View, Costa Dist. 415-968-1200
CA San Jose, Vitek 408-436-8026
CA San Marcos, Vitek 619-744-8305
FL Ft. Lauderdale, Manchester Equip. 305-491-7660
FL Tampa Bay, CPU Corp. 813-886-1711
IL Northbrook, PC Dist. 312-298-1400
MD Hunt Valley, Micro Wholesalers, Inc ... 301-785-6300
MD Laurel, Trimarc Sys. 301-725-7869
MA Milford, Microserv Tech. 617-478-1600
MA Wellesley, Power Sys Distrb 617-235-7884
MO St. Louis, Indl. Battery 314-423-7005
NH Londonderry, Power Sys Distrb 603-434-2841
NJ Carlstadt, Costa Distbg. 201-507-8700
NY Hauppauge, Manchester Equp. Co., I .. 516-434-8700
NY W. Hempstead, TriCom 516-483-9700
OH Toledo, Tel-Matic 419-241-8141
TX Houston, CPU Corp. 713-987-0234
TX Houston, Q.C. Distrb, Inc 713-988-2290
TX Richardson, Computer-Mate 214-669-9370
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VA Roanoke, ComTech 703-981-0326
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Can Mississauga, Ont., Drake 416-629-2606

ELGAR/INTEPRO SYSTEMS, 9250 Brown Deer Road, San Diego, CA 92121, Tel: 619-458-0261, 1-800-854-2213, TELEX: 211063 ELSO UR, FAX: 619-458-0267; Empl.: 250; *Sls. Mgr.:* Sam Lewis ..... **D•2097**

Local Sales Offices & Reps

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AZ Tempe, Trembly Assocs. 602-967-2058
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CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward Davis Assocs. 408-245-3700
CO Wheat Ridge, Trembly Assocs. 303-421-8900
CT Wallington, Pat Jenks Assocs., Inc. 203-265-9939
FL Boca Raton, Beacon 305-997-5740
FL Clearwater, Beacon 813-796-2378
FL Longwood, Beacon 305-332-1940
GA Atlanta, Beacon 404-256-9640
IL Arlington Hgts., Dytec/Central 312-394-3380
IN Indianapolis, Dytec/Central 317-297-5988
KS Lenexa, Dytec/South 913-888-0215
KS Wichita, Dytec/South, Inc. 316-945-7090
MD Laurel, Elctrn. Mktg. Assocs. 301-953-7800
MD Maryland Hgts., Dytec/South 314-739-0665
MA Danvers, P. Jenks Assocs. 617-777-5600
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Minneapolis, Berndt Assocs. 612-546-2021
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, Trembly Assocs. 505-266-8616
NY Great Neck, RTI 516-829-3770
NY Liverpool, Northern Tech. Sls. 315-451-1091
NC Raleigh, Beacon 919-787-0330
OH Dayton, WKM Assocs. 513-434-7500
OH Independence, WKM Assocs. 216-524-5930
OR Lake Oswego, Syntek 503-636-6793
PA Pittsburgh, WKM Assocs. 412-892-2953
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
TX Richardson, Testech, Inc. 214-644-5010
UT Salt Lake City, Trembly Assocs. 801-295-4703
WA Kirkland, Syntek 206-488-0394
WI Brookfield, Dytec Central Inc. 414-792-0320
EXP CA/San Diego, Elgar Intl. Corp. 619-450-0085
PR Santurce, Beacon 809-728-5040

ELGENCO, INC., Box 460, Hurricane, UT 84737, Tel: 801-635-4954; FSC No.: 15455; *Sls. Mgr.:* D. E. Beecher ..... **D•1244-1249**

Local Sales Offices & Reps

CA Mtn. View, N-S Westronics 415-960-1111
CA Sherman Oaks, Windsor Dynamics ... 818-990-4173
CT Meriden, Polytek Assoc. 203-621-4521
MA Waban, Polytek Assoc. 617-881-4741
NJ Marmore, SWR Tech., Inc. 609-390-0094
NM Albuquerque, Technology Mktg. Assoc. 505-345-8921
PA Broomall, SWR Tech., Inc. 215-353-6639

ELGIN ELECTRONICS, Combustion Engineering, 5533 New Perry Hwy., Erie, PA 16509-3570, Tel: 814-864-4921, TWX: 510-699-6870, FAX: 814-864-1260; Empl.: 500; *Sls. Mgr.:* D. Selmon

ELITE ELECTRONICS, INC., 1408 Summit - Suite 65, Plano, TX 75074, Tel: 214-881-0026, 800-553-4376, FAX: 214-424-7299; Empl.: 4

ELITE SOFTWARE DEVELOPMENT, INC., P.O. Drawer 1194, Bryan, TX 77806, Tel: 409-846-2340, TELEX: 910-997-6760; Empl.: 9; *Sls. Mgr.:* Terri J. King

ELLIOTT/JORDAN, A Sub. of Vishay Intertechnology, 63 Lincoln Highway, Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-8944, FAX: 215-296-0657; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•1934-1935**

For sales office, representative, and distributor information, see Vishay Resistive Systems Group.

ELMA

FAX: 415-656-3783

ELMA ELECTRONIC INC., 41440 Christy Street, Fremont, CA 94538, Tel: 415-656-3400 ..... **B•1707; C•1040-1041, 1605; D•1111**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Sls. Inc. 205-533-1735
CA Anaheim, Impact Elctrns., Inc. 714-533-1351
CA Fremont, ELMA Elctrn. Inc. 415-656-3400
CA Santa Ana, Caltronics, Inc. 714-751-9162
GA Norcross, Elctrn. Sls. Inc. 404-448-6554
IL Elmhurst, F.F./Hill Gray Inc. 312-832-4101
IN Indianapolis, John Sukup, Inc. 317-253-5501
MD Lisbon, Samuel K. MacDonald Inc. 301-982-1088
MI Royal Oak, Hilltronics 313-435-0920
NH Nashua, Bell Controls Inc. 603-882-6984
NJ Englewood, Harold Gray Assocs. Inc. 201-894-0894
NY Rochester, Lamb Comps., Inc. 716-323-1250
NC Greensboro, Hile Assocs. Inc. 919-288-1500
MA Beachwood, Land Elctrn. Supp. Co. ... 216-831-9555
PA Philadelphia, Samuel K. MacDonald Inc. 215-545-1205

Local Distributors

CA Canoga Pk., Panel Parts Co. 818-884-8898
CO Lakewood, ACACIA Sls. Inc. 303-232-2882
CT Wallingford, Sager Elctrl. Supp. Co. 203-265-4600
IL Chicago, Federal Screw Prods. Inc. ... 800-225-5377
IL Villa Pk., Melvin Elctrns. 312-279-5010
MA Lynn, Land Elctrn. Cupp. Co. 617-592-2220
MA Waltham, Vantage Elctrns. Corp. 617-894-8690
NJ Cranford, Garden State Indl. Elect. 201-272-6400
NJ Cranford, Garden State Indl., Inc. 201-272-6400
NY Buffalo, Summit Distrs. Inc. 716-884-3450
NC Raleigh, Meter Metrics 804-275-1431
OK Tulsa, Radio, Inc. 918-587-9123
PA Philadelphia, PEI-Genesis 215-568-7400
VA Richmond, Meter Metrics 804-275-1431

ELMA ENGINEERING, 1066 E. Meadow Circle, Palo Alto, CA 94303, Tel: 415-494-7303, TELEX: 345-560; FSC No.: 59810; Empl.: 38; *Sls. Mgr.:* T. A. Beno; *Dist. Mgr.:* T. A. Beno

ELMAG DIVISION, Lindgren RF Enclosures, 54 Clark St., Newark, NJ 07104, Tel: 201-481-1600; FSC No.: 23160; Empl.: 15

ELMEC
DELAY LINE

FAX: 213-265-1908

ELMEC TECHNOLOGY OF AMERICA, 1225 Ridgecrest St., Monterey Pk., CA 91754, Tel: 213-265-1861; *Sls. Mgr.:* Steve Sameshima ..... **A•1552-1557**

ELM SYSTEMS, 1101 Brown St, Wauconda, IL 60084, Tel: 312-526-5003

HAWKER SIDDELEY Elmwood Sensors

FAX: 401-728-5390

ELMWOOD SENSORS, 500 Narragansett Park Drive, Pawtucket, RI 02861, Tel: 401-727-1300, TELEX: 6814066 ELMWOOD; Empl.: 700; *Sls. Mgr.:* Steve Fox ..... **B•1843-1845**

Local Sales Offices & Reps

AL	Decatur, Tenn. Tech. Sls.	205-350-0630
AZ	Phoenix, O'Donnell SW	602-944-9542
AR	Tulsa, Ion Assoc.-Arkla	918-644-0187
CA	San Diego, O'Donnell Assocs.	619-578-1645
CA	San Jose, O'Donnell Assocs.	408-263-6500
CA	Torrance, O'Donnell Assocs.	213-539-9664
CO	Boulder, Front Range Mktg.	303-443-4780
FL	Coral Springs, CBC Electronics	305-755-1111
GA	Marietta, Tenn. Tech. Sls.	404-428-9594
IL	Arlington Heights, Thermek	312-577-6900
IN	Fort Wayne, O. Bromberg	219-456-6010
KY	Louisville, O. Bromberg	502-456-1498
MD	Glen Burnie, Faber-Renoff, Inc.	301-768-4554
MA	Danvers, C. H. Burnham Assoc.	617-774-0111
MI	Brooklyn, Engineered Comps.	517-592-3236
MN	Minneapolis, C. Listug Sls.	612-537-6740
MO	St. Louis, Hill & Co.	314-432-1136
NH	Durham, C. H. Burnham Assoc.	603-868-2282
NJ	Pitman, Colrud Corp.	609-589-5866
NY	Fairport, Bastian Sls.	716-223-0237
NY	Larchmont, G. M. Moch Co.	914-834-3530
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Raleigh, Tenn-Tech	919-266-3610
OH	Cincinnati, O. H. Bromberg	513-771-9333
OH	Cleveland, Allied Entprs.	216-779-0080
OK	Tulsa, Ion Assoc.	918-644-0186
OR	Hillsboro, Temco-Northwest	503-649-8375
PA	Murrysville, Allied Entprs.	412-325-3200
NJ	Pittman, Colrud Corp.	609-589-5866
RI	Johnston, C. H. Burnham Assoc.	401-231-7475
TX	Austin, Ion Assocs.	512-331-7251
TX	Grand Prairie, Ion Assocs.	214-647-8225
TX	Houston, Ion Assocs.	713-537-7717
UT	Salt Lake City, Front Range Mktg.	801-364-6481
VA	Midlothian, Daniel E. Boehling Assocs.	804-794-5879
WA	Bellevue, Lehr Assocs.	206-453-9993
WA	Bothell, Temco Northwest	206-821-5434
WI	Milwaukee, R. Zingler	414-351-5005
Can	Mississauga, Ont., Andy Baumen Assocs.	416-828-2600

ELNA AMERICA, INC., 153 E. Savarona Way, Carson, CA 90746, Tel: 213-327-6090, TELEX: 68-6427, TWX: 910-346-6730; *Sls. Mgr.:* Don L. Bilsing; *Dist. Mgr.:* Isao Kikuchi

ELNETIC ELECTRONICS, INC., P.O. Box 88232, Los Angeles, CA 90009-8232, Tel: 213-515-1546; FSC No.: 98460; Empl.: 25; *Sls. Mgr.:* Ernest H. Carlson, Jr.

ELOGRAPHICS, 105 Randolph Rd., Oak Ridge, TN 37830, Tel: 615-482-4100, TELEX: 350348; *Sls. Mgr.:* R. Highfill

FAX: 714-241-7293

ELPAC COMPONENTS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513; Empl.: 130 ... **A•1082-1083**

Local Sales Offices & Reps

AZ	Phoenix, Eltron	602-266-2164
CA	San Diego, Wes-K Assocs.	619-655-2040
CA	San Jose, Ruppert Sls.	408-998-8717
CA	Van Nuys, Wes-K Assocs.	213-989-3070
CT	Milford, Todino Engr. Sls.	203-874-6643
FL	Orlando, Honeyco Inc.	305-299-1222
IL	Highland Park, Bransky Sls.	312-433-2375
MA	Needham Heights, Todino Engr. Sls.	617-444-7925
MN	Bloomington, Smiley-Scott Assocs.	612-888-5551
NJ	Englewood, Harold Gray Assocs.	201-894-0894
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
WA	Seattle, Harry Levinson Co.	206-382-1300
WI	Cedarburg, Bransky Sls.	414-377-8507

Local Distributors

AZ	Phoenix, T.T.I.	602-861-0222
CA	Chatsworth, Mil-Comm	818-998-3111
CA	Chatsworth, TTI	818-709-8693
CA	Irvine, Kelex	714-863-1230
CA	San Diego, T.T.I.	619-587-4888
CA	San Jose, T.T.I.	408-946-5577
CO	Westminster, T.T.I.	303-429-6806
CT	Stratford, T.T.I.	203-375-1400
FL	Orlando, T.T.I. Florida	305-859-1000
GA	Norcross, T.T.I.	404-662-0911
IL	Northbrook, Classic Components	312-272-9650
IL	Skokie, Kellner Elctrns.	312-677-1120
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MA	Wilmington, Aved Elctrns.	617-657-9310
MA	Woburn, T.T.I., Inc. NE	617-938-8800
MN	Eden Prairie, T.T.I.	612-944-5080
MN	Minneapolis, Northern	612-944-1167
NJ	S. Hackensack, Waltech	201-641-7300
NY	Bohemia, T.T.I.	516-737-2000
NY	Mamaroneck, New Yorker Elec.	914-698-7600
NY	Elmsford, Ancar	914-592-7100
OH	Dayton, Electro Supp.	513-299-5020
OK	Tulsa, Altair Co.	918-252-5781
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair	214-231-5166
VA	Charlotte, Kellner	802-425-3250
WA	Seattle, Kam Elec.	206-382-1300
WI	New Berlin, Classic	414-786-5300
WI	Racine, Badger Elctrns.	414-637-1256, 414-933-6685

ELPAC POWER SYSTEMS, Elpac Electronics, Inc., 3131 S. Standard Ave., Santa Ana, CA 92705, Tel: 714-979-4440, TWX: 910-595-1513, FAX: 714-241-7293; Empl.: 270; *Sls. Mgr.:* H. Myers; *Dist. Mgr.:* H. Myers

ELPAZ INSTRUMENTS, INC., 160 N. Craig St., Pittsburgh, PA 15213, Tel: 412-687-8700, TELEX: 382960; Empl.: 15; *Sls. Mgr.:* Stephen Phelps; *Dist. Mgr.:* Stephen Phelps

ELPOWER CORPORATION, 2117 S. Anne St., Santa Ana, CA 92704, Tel: 714-540-6155, TELEX: 678354 ELPOWER SNA; Empl.: 200; *Sls. Mgr.:* R. Calvert; *Dist. Mgr.:* Ronnie LeFevre

E-L PRODUCTS CORP., Sub.of Astronics Co., 77 Olean Rd., E. Aurora, NY 14052, Tel: 716-655-0800, FAX: 716-655-0309; Empl.: 100; *Sls. Mgr.:* Patrick McCann

EL-RAD MFG., 2800 W. Cullom Ave., Chicago, IL 60618, Tel: 312-478-7300, TWX: 910-221-0104; FSC No.: 11253; Empl.: 225; *Sls. Mgr.:* Marvin S. Christ

ELTEC INSTRUMENTS INC., P.O. Box 9610, Daytona Bch., FL 32020, Tel: 904-253-5328, TWX: 810-832-6294, FAX: 904-258-3791; Empl.: 120; *Sls. Mgr.:* Douglas S. Armstrong

ELTROL CORPORATION, 20942 Osborne Street, Bldg. I, Canoga Park, CA 91304, Tel: 818-709-0131, FAX: 818-709-0132; FSC No.: IER54; Empl.: 6; *Sls. Mgr.:* Terry E. Donovan ..... **B•1203**

Local Sales Offices & Reps

CA	Glendale, Halbar Assocs.	818-246-8263
OH	Broadview Hgts., Controlled Prods.	216-838-5700

ELVO ELECTRONICS CORPORATION, 140 Kisco Avenue, Mt. Kisco, NY 10549, Tel: 914-241-1008, TWX: 910-250-5181, FAX: 914-241-7096; *Sls. Mgr.:* Thomas H. Stein

EMCA, Sub. Rohm and Haas Advanced Matls. Co., 605 Center Ave., Mamaroneck, NY 10543, Tel: 914-698-8434, TWX: 710-566-1128; Empl.: 70; *Sls. Mgr.:* Dennis Hanley

EMCO ELECTRONICS, 104 S. Central Ave., Valley Stream, NY 11580, Tel: 516-825-3330, TELEX: 276590; Empl.: 9; *Sls. Mgr.:* K. Berkowitz; *Dist. Mgr.:* Jay Robinson

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GA	Roswell, Henry W. Phillips Co.	404-992-3070,
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CT	Hartford, John Colavecchio	203-522-0596,
FL	Venice, JGG Sls.	813-497-0177
HI	Honolulu, Lee Gaber	808-536-2457
IA	W. Des Moines, Nevco Inc.	515-225-9866,
MD	Baltimore, David S. Linz	301-435-0012
MO	No. Kansas City, Nevco Inc.	816-421-1751,
NY	Bellmore, Mike Sussman	516-221-7867,
OH	Akron, Buckeye Mktg.	216-836-7875
OH	Jamestown, Buckeye Mktg.	513-675-2059
PA	Philadelphia, David S. Linz Co.	215-379-0734
NC	Statesville, Henry W. Phillips	803-244-6254
TX	Garland, Nesbitt Co.	214-270-9867
EXP	Valley Stream, NY, Bysk Elctrns.	516-825-7302
Can	Vancouver, H. W. Cowan Ltd.	604-576-8236,

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FAX: 209-223-2779

EMCO HIGH VOLTAGE CO., 11126 Ridge Road, Sutter Creek, CA 95685, Tel: 209-223-3626, TELEX: 5101008006; FSC No.: 3T243; Empl.: 38; *Sls. Mgr.:* Roxanne McCoy ..... **D•1717**

E/M CORPORATION, 2801 Kent Avenue, P.O. Box 2400, W. Lafayette, IN 47906, Tel: 317-497-6100, FAX: 317-497-6348; FSC No.: 11770

Emcor Products

FAX: 507-287-3405

EMCOR PRODUCTS, Crenlo, Inc., 1600 Fourth Ave. NW, Rochester, MN 55901, Tel: 507-289-3371; *Sls. Mgr.:* John Horton ..... **C•1039**

EMC TECHNOLOGY INC, 1971 Old Cuthbert Rd., Cherry Hill, NJ 08034, Tel: 609-429-7800, TWX: 710 896 0193, FAX: 609-429-6814; FSC No.: 24602; Empl.: 75; *Sls. Mgr.:* Peter Semitschew

EMDS, INC., 16618 Oakmont Ave., Gaithersburg, MD 20877, Tel: 301-840-5710, FAX: 301-840-8589; *Sls. Mgr.:* Patrick E. Roney ..... **D•1250**

EMERSON, INDL. CONTROLS DIV., 3300 Standard St., Santa Ana, CA 92702, Tel: 714-545-5581, TELEX: 67-8460, FAX: 714-540-6718; Empl.: 800; *Sls. Mgr.:* W. Sgro; *Dist. Mgr.:* S. Leschin

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CA	La Canada, Brooks-Moore & Assocs.	818-790-8358
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CA	Santa Ana, Brooks-Moore & Assocs.	714-544-8900
GA	Atlanta, Brownell Electro Inc.	404-762-5181
IL	Chicago, Best Rep Co.	312-992-1055

MA Burlington, E.I.L. Instr. 617-272-9450
NJ Belleville, D. F. Tobias & Co. 201-751-8680
OH Cleveland, Weschler Elec. Corp. 216-238-2550
PA Philadelphia, Sunshine Sci. Instr. Inc. .. 215-673-5600
TX Arlington, Ev Smith Sls. 817-572-2911
TX Houston, Ev Smith Sls. 713-931-0403

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CA Dublin, Std. Meter Lab 415-828-4837
CA Glendale, Instr. Meter Specialties 818-243-0416
CA S. Pasadena, Dae Instr. & Svc., Inc. 213-258-0578
LA Harahan, Indl. Instrs. Works 504-733-8355
MD Sparks, E.I.L. Instrs. 301-771-4800
NJ Belleville, Miscorp 201-751-1190
PA Norristown, Kimberly-James 215-666-7186
TX Beaumont, Straughn Elctrns. 409-838-4563
TX Houston, American Analog 713-941-7265
TX Houston, Meters & Instrs. 713-644-1631
WI Milwaukee, E-M Instrs. 414-272-7799

EMR DATA SYSTEMS, DIV. SANGAMO- WESTON, Box 3041, Sarasota, FL 33578, Tel: 813-371-0811, TELEX: 052-890, TWX: 810-864-0406; Empl.: 1100; *Sls. Mgr.:* F. V. Hinkel

EMS

FAX: 714-838-2967

E.M.S., Div. of Sandberg Industries, 2922 Dow Street, Tustin, CA 92680, Tel: 714-669-9473, TWX: 910-595-2767; Empl.: 125; *Sls. Mgr.:* Duane Halverson, Opers. Mgr.; *Dist. Mgr.:* Noel Kennedy ..... **C•1726**

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TX Austin, Allied Comps., Inc. 512-258-7558
TX Dallas, Allied Comps., Inc. 214-238-0408
VA Reston, Tytronics Tech. Sls. 703-620-4600

E M S DEVELOPMENT CORP., 100 Sea La., Farmingdale, NY 11735, Tel: 516-293-7900, TWX: 510-224-6480; FSC No.: 51435; Empl.: 125; *Sls. Mgr.:* Ed Simkovich

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IL Schaumburg, PosiTech Sls. 312-980-9407
IN Carmel, STB & Assocs. 317-844-9227
WI Colgate, Rep I & Assocs., Inc. 414-628-4016

EMULATION TECHNOLOGY, INC., 2368B Walsh Ave, Bldg. D, Santa Clara, CA 95051, Tel: 408-982-0660, TELEX: 981866, FAX: 408-982-0664; Empl.: 7; *Sls. Mgr.:* Joseph J. Bagliere, Jr. ..... **C•1326**

Local Distributors
CA Monterey, Adams/MacDonald Entrps. 408-373-3607
TX Allen, Prime Distributing Co. 214-231-0170

ENCLOSURE CORP., 2900 Wharton Rd., Bristol, PA 19007, Tel: 215-785-2900, FAX: 215-785-2960; FSC No.: 32360; Empl.: 120; *Sls. Mgr.:* Gene Goldner

ENCODER DIV., LITTON SYSTEMS, INC., See Litton Encoder Div.

ENCODER PRODUCTS, 1601B Dover Rd., Sandpoint, ID 83864, Tel: 208-263-8541, TWX: 510-776-1595; Empl.: 70; *Sls. Mgr.:* Vance Conner

ENDEVCO, 30700 Rancho Viejo Rd., San Juan Capistrano, CA 92675, Tel: 714-493-8181, TELEX: 68-5608, TWX: 910-596-1415; FSC No.: 95411; Empl.: 400; *Sls. Mgr.:* D. McMahon

ENDICOTT COIL, 24 Charlotte St., Binghamton, NY 13905, Tel: 607-797-1263, TELEX: 932411; Empl.: 110; *Sls. Mgr.:* Thomas E. Frank

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ENDICOTT RESEARCH GROUP, 2601 Wayne St., P.O. Box 269, Endicott, NY 13760, Tel: 607-754-9187, TWX: 510-252-0155; FSC No.: 63312; Empl.: 150 ..... **B•1063-1065; D•1718-1719**

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AZ Phoenix, Finn-Pat Co., Inc. 602-954-0301
CA Irvine, Component Mktg. Assocs. 714-951-5950
CA Saratoga, Testco 408-253-1900
CA Solana Bch., Component Mktg. Assoc. 619-268-4612
CO Littleton, MRC 303-794-4684
CT Bloomfield, Sands Co./Sir Assocs. 203-243-9343
FL Maitland, EIR, Inc. 305-660-9600
GA Atlanta, Wallace Electronics 800-334-3518
IL Elk Grove Village, Carlson Elctrn. Sls. 312-956-8240
IN Indianapolis, Precision Elctrn. Comps. 317-842-3740
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
KS Wichita, Palatine 319-365-8071
MA Westford, SIR Assocs. 617-692-2500
MI West Bloomfield, Granneman & Mize 317-849-2000
MN Minneapolis, OEM Prods. 612-541-0236
MO Hazelwood, Palatine 314-839-0800
NJ Livingston, Eagle Sls. Co. 201-992-2030
NY Jericho, Metro-Tech 516-935-3330
NY Rochester, H. C. Johnson Agencies ... 716-586-0777
NC Kernersville, Wallace Electronics 919-996-2742
OH Worthington, Elctrn. Sls. & Technlg. ... 614-438-2622
PA Glenshaw, H. C. Johnson Agencies ... 412-487-1246
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Austin, Component Technlg. 512-250-2450
TX Dallas, Component Technlg. 214-783-8831
TX Houston, Component Technlg. 713-961-1262
UT Salt Lake City, MRC 303-794-4684
WA Bellevue, Testco 206-454-7422
WI Milwaukee, Carlson Elctrn. Sls. 414-476-2790
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663

ENERCO, INC., 9615 W. Marginal Way S., Seattle, WA 98108, Tel: 206-762-1422; Empl.: 5; *Sls. Mgr.:* Lee Rabie

ENERGETEC SYSTEMS, INC., 130 E. St. Charles Rd., Carol Stream, IL 60188, Tel: 312-653-1920, TELEX: 910-380-8574; Empl.: 40

ENERGY CONCEPTS INC., 5205D Avenida Encinas, Carlsbad, CA 92008, Tel: 619-438-2202, TELEX: 01830, FAX: 619-438-0694; FSC No.: 01830; Empl.: 16; *Sls. Mgr.:* Tim O'Connell

Local Sales Offices & Reps
CA Carlsbad, Energy Concepts 619-438-2202
IL Wilmette, Energy Concepts Cen. 312-256-6197
Can Bramalea, Ont., EC Battery Canada Corp. 416-458-4572
Can Mississauga, Ont., EC Battery Canada Corp. 416-624-6626

ENERGY ELECTRONIC SYSTEMS, INC, 9486 Deereco Rd., Timonium, MD 21093, Tel: 301-252-2240, 800-233-4544, FAX: 301-561-5412; Empl.: 35; *Sls. Mgr.:* Mike Lynch

ENERGY ENGINEERING, Rt. 4, Box 330, Fayetteville, AR 72701, Tel: 501-521-4707; Empl.: 3; *Sls. Mgr.:* David F. Scott; *Dist. Mgr.:* David F. Scott

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Local Distributors
MD Bladensburg, Energy, Ltd. 301-699-1144

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OH Cincinnati, Makin Assocs. 513-871-2424
OR Beaverton, Ravencraft 503-646-9261
TX Plano, Zeus Engrg. 214-423-2027
VA Reston, Tytronics Tech. Sls. 703-620-4600
WI Milwaukee, Carlson Elctrn. Sls. Co. 414-476-2790
EXP NJ, Palisades Pk., ESC Elctrns. Corp. 201-947-0400
Can Toronto, Ont., CEA Assocs. 416-231-9717

ESE, 142 Sierra St., El Segundo, CA 90245, Tel: 213-322-2136; FSC No.: 58525; Empl.: 25; *Sls. Mgr.:* R. Mayers; *Dist. Mgr.:* R. Mayers

ESICO/TRITON, Triton Industries Inc., Box 247, Deep River, CT 06417, Tel: 203-526-5361, TELEX: 955439, FAX: 203-526-9524; FSC No.: 54195; *Sls. Mgr.:* Robert W. Mead

E-SQUARED TECHNOLOGY CORP., 4475 Dupont Ct 09, Ventura, CA 93003, Tel: 805-644-9544, TELEX: 887971 E Sq. Tech. UD; Empl.: 19; *Sls. Mgr.:* Larry D. Emery

ESSCO INDS., P.O. Box 515, Sierra Madre, CA 91024-0515, Tel: 818-355-8315; Empl.: 33

ESSEX GROUP, 9933 13th St., Ft. Wayne, IN. 46809, Tel: 219-478-1521; Empl.: 300-500; *Sls. Mgr.:* J. Scott

ESSEX GRP., Power Conductor Div., 2601 S. Adams, Marion, IN 46953, Tel: 317-664-6211, TWX: 317-667-6972; Empl.: 700; *Sls. Mgr.:* J. Burdick

ESTERLINE ANGUS INSTRUMENT CORP., Box 24000, Indianapolis, IN 46224, Tel: 317-244-7611, TELEX: 027-419, ESYLNK: 317-247-4749; FSC No.: 72264; Empl.: 2000; *Sls. Mgr.:* Donald E. Allen, Pres. & Sls. Mgr.

E-SYSTEMS, Greenville Div., P.O. Box 1056, Greenville, TX 75401, Tel: 214-457-4694, TELEX: 73-2392; *Sls. Mgr.:* C. L. Byrom

E-SYSTEMS, Melpar Div., 7700 Arlington Blvd., Falls Church, VA 22046, Tel: 703-560-5000, TELEX: 89-9494, TWX: 710-831-9802, FAX: 703-280-4627; Empl.: 2400; *Sls. Mgr.:* Richard F. Kolasheski

E-SYSTEMS, See Memcor-Truohm, Inc.

E-T-A®

FAX: 312-647-7494

E-T-A CIRCUIT BREAKERS, 7400 N. Croname Rd., Chicago, IL 60648, Tel: 312-647-8303, TELEX: 253780; Empl.: 20; *Sls. Mgr.:* John J. Palsir
..... **B•1311-1313, 1890; D•1364**

Local Sales Offices & Reps

CA	Los Angeles, Sierra-Pacific Eng.	714-731-3411
CA	San Francisco, Moulthrop Sls.	415-463-0450
CO	Denver, Candal, Inc.	303-233-0155
CT	East Haven, Eagle Assocs.	203-467-6542
FL	Orlando, EAB Inc.	305-898-7444
IN	Ft. Wayne, Needler Sls. Co.	219-447-2123
IN	Indianapolis, Needler Sls. Co.	317-255-8056
IA	Bettendorf, Weisler & Assocs.	319-344-0566
MA	Boston, Eagle Assocs.	617-444-3446
MI	Detroit, Hilltronics	313-398-5556
MN	Minneapolis, Chris & Assocs.	612-861-1634
MO	N. Kansas City, Weisler & Assocs.	816-421-1679
MO	St. Louis, Weisler & Assocs.	314-394-4543
NY	New York, Schmitt Indl. Mktg. Corp.	516-486-3510
NY	Rochester, Lamb Comps.	716-323-1250
NY	Syracuse, Lamb Comps.	315-455-6286
OH	Cincinnati, J. O. Olsen Co.	513-922-8885
OH	Cleveland, J. O. Olsen Co.	216-662-3454
OR	Portland, Doran Sls.	503-357-3333
PA	Philadelphia, Jacobsen Assocs.	215-674-2937
TN	Hendersonville, Stark & Assoc.	615-822-1667
TX	Austin, Delta Comps.	512-458-4288
TX	Dallas, Delta Comps.	214-287-6333
UT	Salt Lake City, Frank Merchant	801-277-3775
VA	Forest, Beacon North	804-239-8486
VA	Sterling, Beacon North	703-478-2480
WA	Seattle, Doran Sls. Assocs.	206-885-1885
WI	Milwaukee, Star Engineering	414-645-3680

ETA POWER, See JETA Power Systems

ETD TECHNOLOGY, INC., 605 West County Road E, Shoreview, MN 55126, Tel: 612-482-7760; Empl.: 35; *Sls. Mgr.:* John Parsons

ETI SYSTEMS

FAX: 619-757-2305

ETI SYSTEMS, Polaris Indl. Entprs., 215 Via Del Norte, Oceanside, CA 92054, Tel: 619-757-7770, TWX: 910-322-1396; FSC No.: 952 762672; Empl.: 25; *Sls. Mgr.:* Bill Tice; *Dist. Mgr.:* Bill Tice ... **A•2070-2074; B•1205**

Local Sales Offices & Reps

MD	Baltimore, Eltron Sls.	707-635-1933
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NJ	Haddon Hgts., Eltron Sls.	609-428-3311
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Cortland, Net Sls.	607-756-6592
NY	DeRuyter, Net Sls.	315-662-7996
NY	Fairport, Net Sls.	716-223-1030
OH	Beachwood, Electronic	216-831-9555
PA	Westchester, Eltron Sls.	215-793-1468
SC	Greenville, Eltron Sls.	803-234-6931
VA	Front Royale, Eltron Sls.	703-635-7201
VA	Midlothian, Eltron Sls.	804-744-1337
Can	Downsview, Ont., Electrodesign, Ltd.	416-665-4405
Can	Lachine, Ont., Electrodesign, Ltd.	613-727-5220
Can	Que., Electrodesign, Ltd.	514-636-4838

Local Distributors

AZ	Tempe, Anjon Enterprises	602-894-1332
CA	Anaheim, A To Z Elctrns.	714-632-1620
CA	Garden Grove, Allied Elctrns.	714-544-0731
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Los Angeles, Allied Elctrns.	213-725-7111
CA	San Jose, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Hamden, Allied Elctrns.	203-248-8900
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Lisle, Components, Inc.	312-852-7707
MD	Marlow Heights, Allied Elctrns.	301-423-0161
MA	Holliston, Mac Bearing Co.	617-429-7945
MA	Wilmington, Allied Elctrns.	617-942-0150
MA	Woburn, Mac Bearing Co.	617-933-2110
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Mineola, Allied Elctrns.	516-248-2360
NY	Victor, Add Elctrns.	716-924-4760
NC	Raleigh, Allied Elctrns.	919-467-0720
OH	Cleveland, Specialized Comp. Sls.	216-464-0405
OK	Oklahoma City, Trice Wholesales Elec.	405-524-4411
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Lenert Co.	713-225-1465
TX	Humble, Allied Elctrns.	713-852-3730
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-235-4233
WI	Oshkosh, Electronic Inds.	414-235-4233

ETM ELECTROMATIC INC, 35451 Dumbarton Ct., Newark, CA 94560, Tel: 415-797-1100, FAX: 415-797-4358; Empl.: 85; *Sls. Mgr.:* Kenneth F. Lillis

ETRI, INC., 608 Broome St., Monroe, NC 28110, Tel: 704-289-5423, FAX: 704-283-7170; *Sls. Mgr.:* G. Wolf
..... **C•1664-1668**

Local Sales Offices & Reps

CA	Los Gatos, Norwest Elctrns.	408-395-1190
CA	San Diego, Bestronics	619-693-1111
CA	Westminster, West Elctrn. Sls.	714-898-0120
CO	Boulder, Comp. Prods. Sls.	303-530-2800
FL	Ft. Lauderdale, QXI, Inc.	305-978-0120
FL	Orlando, QXI, Inc.	305-423-3682
FL	St. Petersburg, QXI, Inc.	813-894-4556
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
KS	Overland Pk., Spectrum Sls.	913-648-6811
MI	Farmington Hills, Tritech Sls., Inc.	313-553-3370
MI	Kalamazoo, Tritech Sls., Inc.	616-382-5570
MN	Minneapolis, Milt Westlund Assocs.	612-866-5002
MO	Hazelwood, Spectrum Sls.	314-731-5151
NH	Salem, Sls. Engrg. Co.	603-893-5521
NY	Marcellus, Noeth-Honsinger	315-673-1052
NY	Pittsford, Noeth-Honsinger	716-586-9002
NY	Port Washington, Ashtec, Inc.	516-767-0336
NC	Raleigh, Tingen Tech. Sls., Inc.	919-878-4440
OH	Cincinnati, Makin & Assocs., Inc.	513-871-2424
OH	Colombus, Makin & Assocs., Inc.	614-848-5454
OH	Solon, Makin & Assocs., Inc.	216-248-7370
OK	Tulsa, Nova Mktg.	918-660-5105
OR	Lake Oswego, RTS, Inc.	503-244-4123
TX	Austin, Nova Mktg.	512-343-2321
TX	Dallas, Nova Mktg.	214-750-6082
TX	Houston, Nova Mktg.	713-988-6082
WA	Seattle, RTS, Inc.	206-527-7945
WA	Vashon, RTS, Inc.	206-285-1363
WI	Janesville, Antek/Lincoln Hodges & Assocs.	608-754-4214
Can	Mississauga, Ont., R-Theta	416-890-0221

Local Distributors

AZ	Tempe, Acacia Sls., Inc.	602-894-2874
AZ	Tempe, Harper, S.I.D.	602-967-1464
CA	Alhambra, Harper, S.I.D.	213-979-5090
CA	Fountain Valley, Components Ctr.	714-979-0433
CA	Irvine, Acacia Sls., Inc.	714-660-0834
CA	San Diego, Acacia Sls., Inc.	619-565-4365
CA	San Diego, Harper, S.I.D.	619-578-2500
CA	San Jose, Dansco	408-292-9740
CA	Santa Clara, Comp. Ctr., Inc.	408-988-3751
CA	Sunnyvale, Acacia Sls., Inc.	408-745-7200
CA	Sunnyvale, Harper, S.I.D.	408-747-0333
CO	Lakewood, Acacia Sls., Inc.	303-232-2882
CT	Milford, Jaco Elctrns., Inc.	203-874-0006
CT	Orange, Milgray Elctrns.	203-795-0711
FL	Altamonte Springs, Pioneer Elctrns.	305-834-9090
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Winter Park, Milgray Elctrns.	305-647-5747
GA	Atlanta, Milgray Elctrns.	404-393-9666
IL	Bensenville, Milgray Elctrns.	312-350-0490
IL	Bensenville, Voyager Elctrns.	312-860-1300
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Indianapolis, Advent Elctrns.	317-872-4910
KS	Overland Park, Milgray Elctrns.	913-236-8800
KS	Wichita, L-Comp	316-265-5100
MD	Columbia, Milgray Elctrns.	301-621-6169
MD	Gaithersburg, MS Elctrns.	301-921-0200
MA	Wilmington, Jaco Elctrns., Inc.	617-273-1860
MA	Wilmington, Milgray Elctrns.	617-657-5900
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Minneapolis, Stark Elctrns.	612-332-1325
NH	Hudson, Bell Inds.	603-882-1133
NJ	Marlton, Milgray Elctrns.	609-983-5010
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Farmingdale, Milgray Elctrns.	516-420-9800
NY	Rochester, Milgray Elctrns.	716-235-0830
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Charlotte, Electronic Mktg. Corp.	704-394-6195
OH	Cleveland, Milgray Elctrns.	216-447-1520
OH	Columbus, Electronic Mktg. Corp.	614-299-4161
OH	Dayton, Electronic Mktg. Corp.	513-439-4711
OH	Highland Heights, Electronic Mktg. Corp.	216-442-3441
OK	Tulsa, Norvell Elctrns.	918-254-8606
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
PA	Allentown, P.A. Peters	215-434-5237
PA	Montgomeryville, Pyttronics Inds.	215-643-2850
TX	Austin, Norvell Elctrns.	512-837-5555
TX	Dallas, Milgray Elctrns.	214-248-1603
TX	Dallas, Norvell Elctrns.	214-233-0020
TX	Houston, Norvell Elctrns.	713-777-1666
TX	Irving, Harper, S.I.D.	214-621-0500
UT	Salt Lake City, Bell Indus.	801-972-6969
VA	Charlottesville, Virginia Elctrn. Comps.	804-296-4184
WI	Milwaukee, Indl. Elctrns.	414-276-1212
Can	Mississauga, Ont., R-Theta	416-890-0221
Can	Vancouver B.C., Intek Elctrns.	604-324-6831

E-TRON CORPORATION, 30 Ethel Rd., Edison, NJ 08817, Tel: 201-287-9039; FSC No.: 06007; Empl.: 65; *Sls. Mgr.:* Ray Lanihan

E-TRONICS, 16774 Schoenborn, Sepulveda, CA 91343, Tel: 818-892-7279; FSC No.: 29077; Empl.: 28

E.T. TECH INC., Empire Telecommunications, 15 S. Van Brunt St., Englewood, NJ 07631, Tel: 201-569-3339, FAX: 201-569-5838; Empl.: 12; *Sls. Mgr.:* Burton Green
..... **D•1723**

EUBANKS ENGINEERING, 1307 So. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-7011, TELEX: 675403; Empl.: 90; *Sls. Mgr.:* Alex Vallin

EVANS & SUTHERLAND COMPUTER CORP., P.O. Box 8700, 580 Arapeen Dr., Salt Lake City, UT 84108, Tel: 801-582-5847, TELEX: 389492, TWX: 910-925-5818; Empl.: 850; *Sls. Mgr.:* David Luther

EVANS ELECTRONICS, Box 5055, Berkeley, CA 94705, Tel: 415-653-3083

EVAPORATED COATINGS, INC., 2365 Maryland Rd., Willow Grove, PA 19090, Tel: 215-659-3080; Empl.: 24; *Sls. Mgr.:* Stephen L. Schaffer

EVENTIDE, INC., One Alsan Way, Little Ferry, NJ 07643, Tel: 201-641-1200, 800-446-7878, TWX: 710-991-8715; Empl.: 48; *Sls. Mgr.:* Gil Griffith; *Dist. Mgr.:* Gil Griffith

EVEREADY. ENERGIZER®

EVEREADY BATTERY COMPANY, INC.

FAX: 314-982-4078

EVEREADY BATTERY CO. INC., Checkerboard Square, St. Louis, MO 63164, Tel: 314-982-2000
..... **D•1456-1457**

Local Sales Offices & Reps

CA	Fountain Valley	714-964-9203
GA	Norcross	404-446-2400
IL	Itasca	312-773-3444
MO	St. Louis	314-982-1990
NJ	Saddle Brook	201-845-5400
OH	Middleburg Hgts.	216-826-4444
TX	Dallas	214-241-9100

EVEREST ELECTRONIC EQUIPMENT, 1800-G MacLeod Dr., Lawrenceville, GA 30243, Tel: 404-995-8688, FAX: 404-995-9371; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

Local Sales Offices & Reps

AZ	Phoenix, Holder Hauer, Inc.	602-242-4025
CA	Anaheim, Everest Elctrn. Equip., Inc.	714-634-2200
CO	Broomfield, B-5, Inc.	303-466-1761
CO	Denver, Holder Hauer, Inc.	303-427-3443
CT	Tariffville, OEM Mktg. & Sls	203-241-1612
FL	Orlando, Honeyco, Inc.	305-299-1222
GA	Lawrenceville, Everest Elctrn. Equip., Inc.	404-995-8688
GA	Lawrenceville, Tek-Rep Mktg.	404-963-1600
GA	Marietta, Southern Equip. Add-On, Inc.	404-953-3970
MD	Linthicum, KD Assocs.	301-859-5151
MA	Dedham, Pall Assocs.	617-461-0402
MA	Franklin, OEM Mktg. & Sls.	617-528-4983
MN	Eden Prairie, Choice-Tech, Inc.	612-941-5099
MN	Golden Valley, Tech Resources, Inc.	612-546-6099
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NM	Albuquerque, Holder Hauer, Inc.	505-888-9614
NY	Liverpool, Syronics, Inc.	315-451-0968
NC	Winston-Salem, Southern Equip. Add-On, Inc.	919-724-1187
OH	Akron, Augnat Assocs.	216-273-1211
PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
PA	W. Conshohocken, Hopkins Assocs.	215-828-7191
TX	Dallas, SCI Sls., Inc.	214-931-1487
UT	Salt Lake City, Holder Hauer, Inc.	801-532-2111

EVEREST ELECTRONIC EQUIPMENT, INC., 2100 E. Orangewood Avenue, Anaheim, CA 92806, Tel: 714-634-2200, TWX: 910-591-2303, FAX: 714-634-1369; Empl.: 200; *Sls. Mgr.:* Barry Holman; *Dist. Mgr.:* Mike Bullock ..... **C•1053**

EVEREST INTERSCIENCE, INC., P. O. Box 3640, Fullerton, CA 92634-3640, Tel: 714-992-4461, TELEX: 295368 EVER UR, FAX: 714-556-8325; Empl.: 20; *Sls. Mgr.:* Steve A. Giffin

Local Sales Offices & Reps

CA	Camarillo, Delta Thermographics	805-388-2010
CO	Littleton, Radco Tech. Sls.	303-794-4279
IL	La Grange, Karon Co.	312-354-4833
ME	Sudbury, Poulin Assocs., Inc.	617-443-7333
NJ	Milltown, New Process Dev.	201-390-8893
NY	Rochester, TechNY	716-288-0921
NC	Fayetteville, Zim-Tek Sls. Co.	919-488-4101
OH	Cincinnati, Pro-Con Analytical	513-272-3300
PA	Upper Darby, Shelby Jones Co.	215-446-6600
TX	Coppell, Microlec, Inc.	214-987-1827
VA	Richmond, Jadex Corp.	804-232-1959
Can	Scarborough, Ont., Brosz & Assocs.	416-299-4224

EVERETT/CHARLES CONTACT PRODUCTS, 700 E. Harrison Ave., Pomona, CA 91767, Tel: 714-625-5551, TELEX: 67-55-78, TWX: 910-581-1210; Empl.: 75; *Sls. Mgr.:* Bud Fabian

EVERETT/CHARLES TEST EQUIPMENT, INC., 2887 N. Towne Ave., Pomona, CA 91767, Tel: 714-621-9511, TWX: 910-581-3838; Empl.: 110; *Sls. Mgr.:* James Hall

EVERSHED & VIGNOLES, LTD., Meggitt Holdings P. L. C., Acton Lane, Chiswick, London, England W4 5HJ, Tel: 01-994-3670, TELEX: 22583, FAX: 01-994-5246; Empl.: 300; *Sls. Mgr.:* J. Gilpin

EVI, INC., 8300 Guilford Rd., Ste. A, Columbia, MD 21046, Tel: 301-290-9550; Empl.: 20

EVOX, INC., 100 Tri State International, Lincolnshire, IL 60015, Tel: 312-948-9511, TELEX: 206997, FAX: 312-948-9320; FSC No.: 7422160666; Empl.: 300; *Sls. Mgr.:* Dale Price; *Dist. Mgr.:* Dale Price ..... **A•1084**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, ISDS	602-971-6250
CA	Burbank, DeAngelo, Rothman & Co.	818-504-2425
CA	Santa Clara, Caltron Comps. Corp.	408-980-0181
CO	Wallingford, Apex Assocs.	203-269-8401
FL	Deerfield Bch., Sls. Engrg. Concepts	305-426-4601
GA	Alphretta, FBO Sls.	404-475-3421
ID	Boise, Cascade Comps.	208-343-9826
IL	Chicago, Marvin Gottlieb Assocs.	312-775-1151
IN	Kokomo, Marvin Gottlieb Assocs.	317-455-0444
MA	Westwood, Apex Assocs.	617-326-5042
MI	Livonia, Aetech Reps.	313-474-8300
MN	Bloomington, Murnco	612-854-4161
NJ	Ft. Lee, Caravan Sls. Corp.	201-944-9476
NJ	Kenilworth, Ventronics	201-272-9262
NY	Melville, Comtronic Assocs.	516-249-0505
NC	Greensboro, Caravan Sls. Corp.	919-294-1500
OH	Cincinnati, G & H Sls.	513-272-0580
OH	Lakewood, G & H Sls.	216-226-6800
OR	Portland, Westmark	503-641-0760
TN	Nashville, Hughes Assocs.	615-753-2719
TX	Dallas, Tesco, Inc.	214-553-1200
VA	Portsmith, FBO Sls.	804-488-6145
WA	Seattle, Westmark	206-281-4025
Can	Markham, Ont., SP Intl.	416-475-5305

Local Distributors

CA	Burbank, TAW	818-846-3911
CA	Garden Grove, Natl. Capacitor	714-892-7749
CA	Industry, Ital Elctrn. Sls.	818-968-8515
CA	Milpitas, California Capacitors	408-262-6000
CA	Santa Ana, Projections Unltd.	714-261-2323
CT	Norwalk, Delta Elctrns.	203-847-7285
FL	Ft. Lauderdale, NRC	305-772-4500
IL	Addison, Belford Elctrns.	312-691-1100
IL	Chicago, Bell Inds.	312-982-9210
MD	Bletsville, Resco/Washington	301-937-9100
MA	Burlington, TLC	617-273-0140
MA	Wilmington, JV Elctrns.	617-657-6523
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	New Brighton, Chris Elctrns.	612-631-2647
NJ	E. Brunswick, Varitech	516-593-9300
NJ	Kenilworth, Ventronics/Mutronics	201-272-9262
NY	Farmingdale, SAI	516-293-2710
NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Ronkonkoma, Prime	516-737-1730
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, JAN Indl.	215-922-1321
TX	Ft. Worth, C & W Supp.	817-831-0395

EWALD INSTRUMENTS CORP., Rte. 7R, Kent, CT 06757, Tel: 203-927-3278

EWC® INC.

FAX: 201-245-8430

EWC, INC., 725 Federal Ave., Kenilworth, NJ 07033, Tel: 201-245-3200, 800-526-4048, TWX: 710-996-5993; FSC No.: 15387;MIL-T-27D; Empl.: 230; *Sls. Mgr.:* P. D. MacMillan; *Dist. Mgr.:* P. D. MacMillan ..... **A•1244, 2216-2228**

Local Sales Offices & Reps

CA	Canoga Park, Cummings & Assocs.	818-340-6035
CA	Los Gatos, Featherstone Sls.	408-356-3243
CO	Denver, AKI Entprs.	303-388-4488
FL	Clearwater, Tech-Rep Assocs.	813-576-9900
IL	Schaumburg, Delta Tech. Sls. Corp.	312-310-0280
IA	Cedar Rapids, Pattison Sls.	319-395-9866
MD	Hagerstown, Stinson Assocs.	301-790-1193
MA	Chelmsford, Interstate Sls. Assocs.	617-256-2287
MO	St. Louis, Clyde Logsdon & Assocs.	314-849-5125
NJ	E. Brunswick, Winch Assoc.	201-828-4615
NY	Fairport, Net Sls.	716-223-1030
NY	Plainview, Winch Assocs.	516-681-3163
NC	Raleigh, Mead & Assocs. Mktg.	919-782-3094
OH	Dayton, J. C. Hofstetter	513-296-1010
OH	Medina, J. C. Hofstetter	216-241-4880
OR	Portland, SPS Elctrns.	203-243-9343
PA	Bensalem, Cimperman Assocs.	215-638-4850
PA	Greensberg, Pro-Mark	412-832-3800
VA	Cloverdale, Stinson Assocs.	703-992-5459
VA	Reston, Stinson Assoc.	703-620-0088
WI	Mequon, Tumy Assocs.	414-473-6997

Local Distributors

CA	Mountain View, Abacus Elctrns.	415-961-1500

EXACT ELECTRONICS, Div. of Dynatech Nevada Inc., Box 1925, 2000 Arrowhead Dr., Carson City, NV 89701, Tel: 702-883-3400, 800-648-7952, TELEX: 170054; FSC No.: 34511; Empl.: 60; *Sls. Mgr.:* Mike Brisbin

EXAR CORP., 2222 Qume Dr., P.O.Box 49007, San Jose, CA 95161-9007, Tel: 408-732-7970, TWX: 910-339-9233; Empl.: 600; *Dist. Mgr.:* Tom Wargo

EXATRON AUTOMATIC TEST EQUIP., 2842 Aiello Dr., San Jose, CA 95111, Tel: 408-629-7600, 800-EXA-TRON, TELEX: 172-090, FAX: 408-629-2832; Empl.: 17; *Sls. Mgr.:* Kathryn Henderson

EXCEL SPECIALTY CORP., 6335 N. Broadway, Chicago, IL 60660, Tel: 312-262-4781; Empl.: 50

EXCEL TECHNOLOGY INTL. CORP., 4-5 Stryker La., Hillsborough Indl. Pk., Belle Mead, NJ 08502, Tel: 201-874-4747, TWX: 910-333-9588; *Sls. Mgr.:* Michi Chen ..... **B•1068-1069**

Local Sales Offices & Reps

IL	Westchester, W. G. Brouillette & Assocs., Inc.	312-345-6500
MO	Independence, Engrg. Svcs. Co.	816-254-3600
MO	St. Louis, Engrg. Svcs. Co.	314-997-1515
OR	Portland, Frank Jackson, Assoc.	503-292-2638
TX	Dallas, Southwest Elctrn. Inds.	214-690-9881

Local Distributors

CA	Los Angeles	213-824-0988

EXCELTA CORPORATION, 3740 Skypark Dr., Torrance, CA 90505, Tel: 213-772-0751, FAX: 213-378-4923; Empl.: 25; *Sls. Mgr.:* G. Johnson; *Dist. Mgr.:* L. Johnson

EXEL MICROELECTRONICS, INC., Sub. of Exar Corp., 2150 Commerce Dr., San Jose, CA 95131, Tel: 408-432-0500, TELEX: 171339, TWX: 910-338-2116, FAX: 408-434-6444; Empl.: 180; *Sls. Mgr.:* Victor Okumoto

EXFO E.O. ENGINEERING, 352 St.-Sacrement Ave., Quebec City, Quebec, Canada G1N 3Y2, Tel: 418-683-0211, TELEX: 051-3786, FAX: 418-683-2170; Empl.: 15; *Sls. Mgr.:* Germain Lamonde; *Dist. Mgr.:* Ginette Bourgeois

EXIDE CORPORATION, 645 Penn St., Reading, PA 19601, Tel: 215-378-0500, TWX: 510-651-5288, FAX: 215-378-0345; Empl.: 2200

EXIDE ELCTRNS., 3201 Spring Forest Rd., Raleigh, NC 27604, Tel: 919-872-3020, TELEX: 289968; FSC No.: 31795; Empl.: 900; *Sls. Mgr.:* Phil Tompkins

EXPRESS TEST CORP., 1161 D San Antonio Rd., Mountain View, CA 94043, Tel: 415-968-8818, TELEX: 4942091; *Sls. Mgr.:* Frank S. Gavin

EXTECH INSTRUMENTS CORP., 150 Bear Hill Rd., Waltham, MA 02154, Tel: 617-890-7440, TELEX: 940913; *Sls. Mgr.:* Robert M. Shipione

EYRING RESEARCH INST., INC., 1455 W. 820 N., Provo, UT 84601, Tel: 801-375-2434, TELEX: 882000, FAX: 801-374-8339; Empl.: 350

E-Z-HOOK, Div. Tektest Inc., Box 450 - 225 N. Second Ave., Arcadia, CA 91006, Tel: 818-446-6175, TWX: 910-582-1614; FSC No.: 08505; Empl.: 23; *Sls. Mgr.:* C. Haskin; *Dist. Mgr.:* P. Wood

Fabricast, Inc.

FABRICAST, 2517 Seaman Ave., P.O. Box 3176, S. El Monte, CA 91733, Tel: 818-443-3247; FSC No.: 13345; Empl.: 8 ..... **B•1206-1211**

FAB-TEK INC., 68 Morgan Ave., Danbury, CT 06810, Tel: 203-743-3312; Empl.: 5

FACET ENTERPRISES, INC., Elmira, NY 14903, Tel: 607-737-8011, TELEX: 93-2490, TWX: 510-252-1594; Empl.: 400; *Sls. Mgr.:* Gene Ebbrecht

FACET ENTERPRISES, Fluid Technology Group, 2225 E. Randol Mill Rd., Ste. 223, Arlington, TX 76011, Tel: 816-649-5597

FACTRON/SCHLUMBERGER, 299 Old Niskayuna Rd., Latham, NY 12110, Tel: 518-783-3600, TWX: 710-444-4968; Empl.: 126; *Sls. Mgr.:* Marvin Cox

FAGOR ELCTRN. COMPS., INC., CORP. HDQTRS. & SLS. OFF., Fagor Electronica S. Coop., 121 W. 27th St., 4th Fl., New York, NY 10001, Tel: 212-463-7168, 800-283-8383, FAX: 212-463-7199; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg. ..... **A•2132-2133**

FAGOR ELCTRN. COMPS., INC., NATL. MKTG. SLS. OFFS., Fagor Electrotecnica S. Coop., 8419 Canoga Ave., Canoga Pk., CA 91304, Tel: 818-718-2500, 800-624-5367, TWX: 910-494-1948, FAX: 818-341-2860; Empl.: 18,000; *Sls. Mgr.:* Marvin R. Zidel, VP Mktg.; *Dist. Mgr.:* Marvin R. Zidel, VP Mktg. ..... **A•2132-2133**

Local Sales Offices & Reps

CA	Burbank, Darco, Inc.	818-504-2425
CA	San Jose, Silicon Valley Sls.	408-432-1967
CO	Denver, West Inc.	303-477-8180
CT	Madison, Conti-Younger Assocs., Inc.	203-245-1136
FL	Umatilla, Jim Slade Assocs, Ltd.	904-669-4738
GA	Alpharetta, DeWitt Austin Co. Inc.	404-442-1326
GA	Marietta, DeWitt Austin Co., Inc.	404-926-4943
IL	Highland Pk., Bransky Sls. Co.	312-433-2375
IN	Indianapolis, CC Electro Sls., Inc.	317-255-1508
MA	Burlington, Conti-Younger Assocs. Inc.	617-273-1582
MI	Grand Rapids, DEM Elctrn. Sls.	616-364-4024
MI	St. Clair Shores, DEM Elctrn. Sls.	313-777-1750
MN	Minneapolis, Microelctrn. Sls.	612-829-0948
MO	St. Louis, KKB & Co.	314-647-2400
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Willingboro, Austin Assocs.	609-871-9290
NC	Charlotte, DeWitt Austin Co., Inc.	704-334-0174
OR	Beaverton, Olson Tech. Sls. Corp.	206-883-7792
TX	Austin, Vielock Assocs.	512-346-4037
TX	Plano, Vielock Assocs.	214-881-1940
WA	Bellevue, Olson Tech. Sls. Corp.	503-643-9488

Local Distributors

CA	Industry, Ital Sls.	818-968-8515
CA	San Jose, All American	408-287-0190
CA	Torrance, All American	213-320-0240
CA	Westlake VL, Semtex	805-373-6850
CT	Norwalk, Cobra Comps., Inc.	203-272-9650
FL	Ft. Lauderdale, Universal Semiconductor, Inc.	305-972-8111
FL	Miami, All American	305-621-8282
FL	Miami, Intermark Inds., Inc.	305-591-8930
FL	Riviera Bch., Semiconductors, Inc.	305-842-0305
FL	W. Palm Bch., Nurmi Inds.	305-686-8553
IL	Addison, Belford Elctrns., Inc.	312-691-1100
IL	Chicago, Newark Elctrns.	312-784-5100
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
MD	Rockville, All American	301-251-1205
MA	Salem, J & C Elctrns.	617-745-5809
MA	Woburn, Semtex	617-935-2150
MN	Minneapolis, All American	612-884-2220
NY	Freeport, Semtex	516-223-0200
NY	Ronkonkoma, All American	516-981-3935
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Cleveland, CAM/RPC Elctrns.	216-461-4700
OH	Dayton, Semtex	513-435-6600
PA	Pittsburgh, CAM/RPC Elctrns.	412-782-3770
TX	Channelview, Henry Elctrns.	713-452-4451
TX	Richardson, All American	800-541-1435
VA	Roanoke, Southeastern Elctrns.	703-344-6611
WA	Kent, Shannon Indl., Inc.	206-575-8600
WI	Milwaukee, Marsh Elctrns., Inc.	414-475-6000
Can	Montreal, Que., Prelco Elctrns., Ltd.	514-389-8051

FAIRBANKS WEIGHING DIV., Colt Industries, 711 E. St. Johnsbury Rd., St. Johnsbury, VT 05819, Tel: 800-451-4107, 802-748-5111

FAIRCHILD SEMICONDUCTOR CORP., 333 Western Avenue, So. Portland, ME 04106, Tel: 207-775-8700, TELEX: 710-221-1980; *Sls. Mgr.:* Dan Bongatti; *Dist. Mgr.:* Brigid O'Rourke

FAIRCHILD CAMERA & INSTR. CORP., Linear Div., 313 Fairchild Dr., Mountain View, CA 94139, Tel: 415-962-4011, TELEX: MVLD

FAIRCHILD SEMICONDUCTOR, M&HSL, 1111 39th Ave. S.E., Puyallup, WA 98373, Tel: 206-841-6700, TELEX: 206-841-6723; *Sls. Mgr.:* Jim Brye

FAIRCHILD WESTON, DATA RECORDERS, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, TWX: 494-7160; FSC No.: GS-00K-8301-S0078; Empl.: 750; *Sls. Mgr.:* Ron Johnson

FAIRCHILD WESTON SYSTEMS, INC., CCD Imaging Division, 810 W. Maude Ave., Sunnyvale, CA 94086, Tel: 408-720-7600, TWX: 910-373-2110, FAX: 408-720-8438; *Sls. Mgr.:* Jim Johnson; *Dist. Mgr.:* Patricia A. Lippe

FAIRCHILD - WESTON - TELEMETRY, P.O. Box 3041, Sarasota, FL 34230, Tel: 813-371-0811, TELEX: 4947160; FSC No.: 06141; Empl.: 825; *Sls. Mgr.:* F. V. Bud Hinkel

FAIR-RITE PRODS., PO Box J, Wallkill, NY 12589, Tel: 914-895-2055, TWX: 510-249-4819; FSC No.: 34899; Empl.: 2000; *Sls. Mgr.:* B. G. Tolen ..... **C•1750**

Local Sales Offices & Reps

AL	Huntsville, Macro-Mktg. Assocs.	205-883-9630
CA	Anaheim, Micrometals	714-630-7420
CA	Sunnyvale, Schwerin & Merrill Assocs.	408-735-7900
CO	Littleton, TMC	303-773-0643
CT	W. Hartford, R. S. Pettigrew & Assocs.	203-236-5891
FL	New Smyrna Beach, J. Wetzel	904-423-5707
IL	Wheaton, Charles D. Atwater Assocs.	312-653-5701
IN	Indianapolis, Frank J. Campisano Co.	317-253-7651
MI	Southfield, J. L. Montgomery Assocs.	313-358-2616
MN	Bloomington, Holmes & Ladky Assocs. of Minn.	612-884-2125
NY	Hempstead, Kahgan Sls.	516-538-2300
OH	Cincinnati, F. J. Campisano & Assocs.	513-574-7111
PA	Easton, Kendon Co.	215-253-3100
TX	Dallas, S.E.I., Inc.	214-690-9881
VA	Front Royal, Eltron Sls., Ltd.	703-635-7201
VA	Roanoke, A. B. Kreger & Co.	703-989-4738
WA	Bellevue, Quest Mktg., Inc.	206-747-9424
WI	Milwaukee, Frank W. Ladky Assocs.	414-351-2112

FANCORT INDUSTRIES, INC., 31 Fairfield Place, W. Caldwell, NJ 07006, Tel: 201-575-0610, TELEX: 130540, FAX: 201-575-9234; Empl.: 18; *Sls. Mgr.:* Ron Corey; *Dist. Mgr.:* Ron Corey

FAN-S CORP., See Qualtek Electronics Corp.

FARADAY ELECTRONICS, 749 N. Mary Avenue, Sunnyvale, CA 94086, Tel: 408-749-1900, TELEX: 706738, FAX: 408-738-1671; Empl.: 85; *Sls. Mgr.:* Nick Antonopoulos

FARIA, THOMAS G., CORP., P.O. Box 983, Uncasville, CT 06382-0983, Tel: 203-848-9271, TELEX: 4970991 TGF CORP; FSC No.: 09527; Empl.: 250; *Sls. Mgr.:* A. Knupp

FARINON DIV., Harris Corp., 1691 Bayport, San Carlos, CA 94070, Tel: 415-594-3000, TELEX: 34-8491; *Sls. Mgr.:* George Woodruff

FARRAND CONTROLS, Div. of Farrand Industries, Inc., 99 Wall St., Valhalla, NY 10595, Tel: 914-761-2600, TELEX: 646-640, FAX: 914-761-0405; Empl.: 120; *Sls. Mgr.:* George A. Quinn; *Dist. Mgr.:* George A. Quinn

FASCO INDUSTRIES, INC., Div. of Hawker Siddeley Grp. Plc., 601 North Federal Highway, Boca Raton, FL 33432, Tel: 305-368-0600, TELEX: 51-5612; *Sls. Mgr.:* O. J. Binnette; *Dist. Mgr.:* Paul R. Reid

FASTEK TEST SYSTEMS, Div. of International Fastek Corp., 5235-A Avenida Encinas, Carlsbad, CA 92008, Tel: 619-438-7818, TELEX: 188912 ATSD UT, FAX: 619-438-8205

FASTEX, 195 Algonquin Rd., Des Plaines, IL 60016, Tel: 312-299-2222, TWX: 910-233-2786; FSC No.: 02768; *Sls. Mgr.:* Andy Flis; *Dist. Mgr.:* Denis Singery

FAST FEEDBACK TECHNOLOGIES, 1505 Aviation Blvd., Redoudo Beach, CA 90278, Tel: 213-379-6100; Empl.: 4; *Sls. Mgr.:* M. Lacas

FCM PLASTICS, Plastics Technologies Inc., 2555 Oak Industrial Dr. NE, Grand Rapids, MI 49505, Tel: 616-451-4502, TWX: 810-273-6038; *Sls. Mgr.:* Patrick K. Parsons

FDK

FAX: 213-404-2850

FDK AMERICA, INC., Fuji Electromechanical Co., Ltd., 17326 Edwards Rd., Ste. A-130, Cerritos, CA 90701, Tel: 213-404-1770, TELEX: 18-1998; *Sls. Mgr.:* Yasu Yasutani ..... **A•1319, 1654-1655, 1734-1735, 1769; B•1166; D•1458-1459, 1724-1726**

Local Sales Offices & Reps

NJ	Englewood Cliffs, FDK America, Inc.	201-567-1900

F-DYNE ELCTRNS., 449 Howard Ave., Bridgeport, CT 06605, Tel: 203-367-6431, TWX: 710-453-0087; Empl.: 175; *Sls. Mgr.:* Robert Furst

FEDERAL ELECTRONICS, 75 Stamp Farm Rd., Cranston, RI 02921, Tel: 401-944-6200, FAX: 401-946-6280; FSC No.: 69343; Empl.: 140; *Sls. Mgr.:* Timothy Collins

FEEDBACK, 620 Springfield Ave., Berkeley Hghts., NJ 07922, Tel: 201-464-5181; Empl.: 28; *Sls. Mgr.:* John Lawson

FEI MICROWAVE, INC., Frequency Electronics, Inc., 825 Stewart Dr., Sunnyvale, CA 94086, Tel: 408-732-0880, TWX: 910-339-9207; FSC No.: 21847; Empl.: 450; *Sls. Mgr.:* P. Thesing

FEMA ELCTRNS. CORP., 12-6 Edgeboro Rd., E. Brunswick, NJ 08816, Tel: 201-238-1223, TELEX: 299425 FEMA UR, FAX: 201-238-7981; Empl.: 10 to 20; *Sls. Mgr.:* Bob Cheng; *Dist. Mgr.:* E. Wong

FEMCO, INC., P.O. Box 26710 Parkmoor Sta., San Jose, CA 95159, Tel: 408-946-1188, TELEX: 17-1618, TWX: 910-338-2290

FEME ELECTRONICS, INC., 661 W. Germantown Pike, No. 206, Plymouth Meeting, PA 19462, Tel: 215-941-0366, TWX: 910-240-4181, ESYLNK: 62773739, FAX: 215-941-0377

FENWAL, 400 Main St., Ashland, MA 01721, Tel: 505-881-2000, TELEX: 948421, FAX: 508-881-6729; Empl.: 1000; *Sls. Mgr.:* F. R. Shea

Fenwal Electronics
Division of Kidde Inc.
american power devices

FAX: 617-473-6035

FENWAL ELECTRONICS/APD, Kidde, Inc., 450 Fortune Blvd., Milford, MA 01757, Tel: 617-478-5255, TELEX: 299550; Empl.: 500; *Sls. Mgr.:* W. M. Minnucci; *Dist. Mgr.:* Chester Tricca ..... **B•1846**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assocs., Inc.	205-883-9630
AZ	Phoenix, Dorton Entprs., Inc.	602-944-2957
CA	Cupertino, Codella Mktg. Grp., Inc.	408-257-2561
CA	Garden Grove, Eisco Elctrns., Inc.	714-891-4621
CO	Denver, Spectrum Mktg. Assocs., Inc.	303-480-9991
CT	Southington, The Orion Grp. Inc.	203-621-8371
FL	Orlando, Datarep, Inc.	305-843-5224
GA	Norcross, Macro Mktg. Assocs., Inc.	404-662-5580
IL	Chicago, Century Elctrns. Corp.	312-777-9700
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	South Bend, Valentine & Assocs.	219-288-7070
IA	Cedar Rapids, Palatine Engrg. & Sls., Inc.	319-365-8071
MD	Gaithersburg, Naudain Assoc. So., Inc.	301-258-5040
MA	Wakefield, The Orion Grp., Inc.	617-245-5220
MI	Ferndale, Hilltronics, Inc.	313-398-5556
MN	So. St. Paul, Northport Engrg., Inc.	612-457-8000
MO	Blue Springs, Palatine Engrg. & Sls., Inc.	816-229-4007
MO	Hazelwood, Palatine Engrg. & Sls., Inc.	314-839-0800
NY	Huntington, CDB Entprs.	516-692-5200
NY	Penfield, Upstate Comps. Sls., Inc.	716-381-6070
NC	Charlotte, Prime Comps., Inc.	704-522-1150
OH	Cleveland, Arthur H. Baier Co.	216-461-6161
OH	Dayton, Arthur H. Baier Co.	513-276-4128
OH	Westchester, Arthur H. Bair Co.	513-779-2395
OH	Worthington, Arthur H. Baier Co.	614-764-1144
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
PA	Wynnewood, Metz-Benham Assoc., Inc.	215-896-7300
TX	Austin, W. Pat Fralia Co. & Assoc., Inc.	512-835-7911
TX	Evless, W. Pat Fralia Co. & Assoc., Inc.	817-267-3577
TX	Houston, W. Pat Fralia Co. & Assoc., Inc.	713-772-1572
UT	Ogden, Spectrum Mktg. Assocs., Inc.	801-972-8552
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WI	Milwaukee, Century Elctrns. Corp.	414-645-3680
EXP	MA, Milford, Fenwal Elctrns.	617-478-5255
Can	Que., John G. Weiss Co., Ltd.	514-337-5022

Local Distributors

CA	Chatsworth, Mil-Comm Distr.	818-998-3111
CA	San Jose, Rose Elctrn. Distr.	408-263-9700
CO	Denver, Newark-Denver Elctrn. Supp.	303-757-3351
CO	Englewood, Indl. Elctrns. Corp.	303-694-9444
FL	Ft. Lauderdale, Newark Elctrns.	305-587-2372
GA	Norcross, Newark Elctrns.	404-448-1300
IL	Chicago, Newark Elctrns. Corp.	312-784-5100

IN Indianapolis, Bell Inds. 317-634-8202
MD Cheverly, Newark Elctrns. 301-699-8880
MA Woburn, Newark Elctrns. 617-935-8350
MI Grand Rapids, Newark Elctrns. 616-455-9190
MI Oak Park, Newark Elctrns. 313-967-0600
MN Hopkins, The Joel Co. 612-935-6202
MN Minneapolis, Stark Elec. 612-332-1325
NJ Union, Newark Elctrns. 201-851-2290
NY Buffalo, Summit Dists. 716-887-2800
NY Huntington, CDB Dev. Corp. 516-692-5200
NY Melville, Arrow Elctrns., Inc. 516-467-1000
NY Rochester, Summit Elctrns. 716-334-8110
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Warrensville Hgts., Newark Elctrns. ... 216-587-1700
OK Tulsa, Radio, Inc. 918-587-9123
PA Wynnewood, Metz-Benham Assoc., Inc. 215-896-7300
TX Fort Worth, Patco Supply 817-429-8596
TX Garland, Newark Elctrns. 214-487-8144
UT Salt Lake City, Standard Supp. 801-486-3371
WI Mequon, Lake-View Elctrns. Corp. 414-377-8250
Can Que., John G. Weiss Co., Ltd. 514-337-5022

FERNO-SALESMAKER, Ferno-Washington, Inc., 70 Weil Way, Wilmington, OH 45177, Tel: 513-382-1451, TELEX: 214282; Empl.: 300

FERRANTI ELEC., 87 Modula Ave., Commack, NY 11725, Tel: 516-543-0200, TWX: 510-226-1490; *Sls. Mgr.:* Mike Kennett

FERRANTI INTERDESIGN, INC., 1500 Green Hills Rd, Scotts Valley, CA 95066, Tel: 408-438-2900, TELEX: 4940840, TWX: 910-339-9374; Empl.: 240

FERRETEC INC., 544 Gibralter Dr., Milpitas, CA 95035-6315, Tel: 408-263-1216, TWX: 910-338-2353; FSC No.: 7W279; Empl.: 65; *Sls. Mgr.:* Allen E. Rosenzweig

Local Sales Offices & Reps
AL Huntsville, Gentry Assocs. 205-837-0692
AZ Phoenix, Blackhart Assocs. 602-893-3488
CA Cupertino, Allis Assocs. 408-252-2883
CA Westlake Vl., HyTech Assocs., Inc. 818-336-1234
CO Parker, Exelcis Engrg. Reps. 303-841-4305
CT Norwalk, Nemarco Assocs. 203-852-9117
FL Orlando, Gentry Assocs. 305-859-7450
GA Atlanta, Gentry Assocs. 404-998-2828
IL Wauconda, Cudahy Sls. Co. 312-526-2484
MD Severna Park, Delmarva Engrg. Assocs. 301-647-8007
MA Chelmsford, BBC 617-452-7211
MO Leasburg, EIR Co. 314-245-6860
NJ Palisades Pk., Nemarco Assocs. 201-224-2768
NY E. Islip, Nemarco Assocs. 516-277-5831
NC Burlington, Gentry Assocs. 919-227-3639
PA N. Wales, Scientific Dvcs.-PA 215-699-7707
SC Columbia, Gentry Assocs. 803-772-6786
TX Garland, McBride Scientific Sls. 214-494-5000
WA Bellevue, James Findlay Co. 206-455-9597

FERRO CORPORATION, Coated Fabrics Division, 34 Smith St., Norwalk, CT 06852, Tel: 203-853-2123, TELEX: 96-5929; *Sls. Mgr.:* Wally Kimball; *Dist. Mgr.:* John Sandusky, Sls. Coord.

FERRO CORPORATION, Coatings Div., 4150 East 56th St., Cleveland, OH 44101, Tel: 216-641-8580, TELEX: 98-0165

FERRO CORPORATION, Complas Thermoplastics Div., 5001 O'Hara Dr., Evansville, IN 47711, Tel: 812-423-5218; *Sls. Mgr.:* L. Steven Edge

FERRO CORPORATION, Electronic Materials Div., 27 Castilion Dr., Santa Barbara, CA 93117-3092, Tel: 805-968-5000, TELEX: 98-0165; Empl.: 49; *Sls. Mgr.:* Terry H. Baker

FERRO CORPORATION, Houston Thermoplastics Div., 1370 E. 40 St., Houston, TX 77022, Tel: 713-691-1407; *Sls. Mgr.:* Larry Lynch; *Dist. Mgr.:* Robert Dobecki, G/M

FERRO CORPORATION, Stryker Thermoplastics Div., 3 Railroad Ave., Stryker, OH 43557, Tel: 419-682-3311; *Sls. Mgr.:* Bruce Heine

FERRO CORPORATION, Transelco Div., P.O. Box 217, Penn Yan, NY 14527-0127, Tel: 315-536-3357, TELEX: 98-0165; *Sls. Mgr.:* James F. Arthur

FERRO INDUSTRIAL PRODUCTS LTD., Canadian Thermoplastics Division, 354 Davis Road, Oakville, ONT. L6J 2X1, Tel: 416-845-4277, TELEX: 06-982218; *Sls. Mgr.:* J. Zeman

FERRONICS, 52 N. Main St., Fairport, NY 14450, Tel: 716-388-1020, TELEX: 256549, FAX: 716-388-0036; FSC No.: 33062; Empl.: 35; *Sls. Mgr.:* Thayne Wilbur

FERROTRAN ELCTRNS. CO., INC., 11 W. 25th St., New York, NY 10010, Tel: 212-691-3610; *Sls. Mgr.:* H. King

FERROXCUBE, Amperex Electronic Corp., 5083 Kings Hwy., Saugerties, NY 12477, Tel: 914-246-2811, TWX: 510-247-5410, FAX: 914-246-2811(Ext 427); FSC No.: 02114; Empl.: 400; *Sls. Mgr.:* B. Grindle; *Dist. Mgr.:* Terry Parisian

FG ENGINEERING, Box 476, Fredonia, AZ 86022, Tel: 602-643-7375; Empl.: 6; *Sls. Mgr.:* F. Griswold

FIBERGUIDE INDUSTRIES INC., 1 Bay St., Stirling, NJ 07980, Tel: 201-647-6601, TWX: 510-100-9180, FAX: 201-647-8464; Empl.: 25; *Sls. Mgr.:* Kelly Moran

FIBEROPTICS TECHNOLOGY, INC., Quassett Rd., Pomfret, CT 06258, Tel: 203-928-0443, FAX: 203-928-7664; *Sls. Mgr.:* J. H. Castonguay

FAX: 805-583-4018

FIBEROPTIC SYSTEMS, INC., 4680-B E. Los Angeles Ave., Simi Valley, CA 93063, Tel: 805-583-2088; Empl.: 30; *Sls. Mgr.:* Richard Lockett ..... **B•1167**

FIBRONICS INTERNATIONAL INC., Communications Way, Independence Park, Hyannis, MA 02601-1892, Tel: 617-778-0700, TELEX: 951297; Empl.: 500; *Sls. Mgr.:* Gary Scrupps

FAX: 301-881-0530

FIC CORP., 12216 Parklawn Dr., Rockville, MD 20852, Tel: 301-881-8124, 800-638-6594, TWX: 710-828-9809; FSC No.: 3613; Empl.: 46; *Sls. Mgr.:* Robert E. Frye; *Dist. Mgr.:* Robert E. Frye ..... **B•1314**

FIDELITY CHEMICAL PRODUCTS CORP., 472 Frelinghuysen Ave., Newark, NJ 07114, Tel: 201-242-4110, FAX: 201-242-5796; Empl.: 35

FIELD-FAB, 43 School St., N. Springfield, VT 05150, Tel: 802-886-8278; *Sls. Mgr.:* Harold Lombard

FAX: 609-599-9508

FIFTH DIMENSION, INC., 801 New York Ave., Trenton, NJ 08638, Tel: 609-393-8350, TWX: 510-681-8412; Empl.: 60; *Sls. Mgr.:* Dick Clawges, Prod. Mgr. ..... **B•1420-1421, 1710-1711**

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NJ Trenton, Fifth Dimension 609-393-8350

FIL-COIL COMPANY, INC., 800 Axinn Ave., Garden City, NY 11530, Tel: 516-228-9445, TELEX: 960127 SWIFT NYK, FAX: 516-228-9064; FSC No.: 56528; Empl.: 85; *Sls. Mgr.:* William Goldman

FILM MICROELECTRONICS, See General Microcircuits

FILTER CONCEPTS INC., 2624 S. Rousselle, Santa Ana, CA 92707, Tel: 714-545-7003, FAX: 714-545-4607; *Sls. Mgr.:* Les Edelberg ..... **A•1656-1657**

FILTRON CO., INC., Sub. of ARX Inc., 148-E Sweet Hollow Rd., Old Bethpage, NY 11804, Tel: 516-752-1144, FAX: 516-752-0905; FSC No.: 81831; Empl.: 90; *Sls. Mgr.:* Harold Samkoff ..... **A•1659**

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AL Huntsville, Rakes Engrg. & Mktg. 205-533-3763
CA Sunnyvale, Esco Assoc. 408-745-1410
CA Tarzana, High Voltage Sls. 818-881-9194,
CO Boulder, A. Bissell Co. 303-444-1173
FL Winter Pk., Lorenze & Assocs. 305-629-0445
KS Olathe, Technical Sls. Assoc. 913-829-2800,
MD Baltimore, Bernard White & Co. 301-484-5400
MO Ferguson, Technical Sls. Assocs. 314-725-5361,
MS Jackson, Benton Ballard Co. 956-3560
NH Manchester, Charles A. Wallace Co. .. 603-622-5864
NM Albuquerque, WJM Sls. 505-268-9499,
NY Melville, Carnes Assoc. 516-694-1600
NY Syracuse, Material Svcs. 315-437-7093,
PA Huntingdon Valley, Rabal Assoc. 215-947-4825
TX Bedford, De Armond Ent. 817-267-2048

FINCOR, 3750 E. Market St., York, PA 17402, Tel: 717-751-4206, TELEX: 840-432, FAX: 717-751-4372; FSC No.: 3622; Empl.: 700; *Sls. Mgr.:* Robert Spangler

FINISHERS, INC., 517 Aldo Avenue, Santa Clara, CA 94054, Tel: 408-988-0222; Empl.: 10; *Sls. Mgr.:* Harry McRae

FISCHER AMERICA, INC.

FAX: 818-362-7045

FISCHER-AMERICA, INC., 28245 Avenue Crocker, Valencia, CA 91355, Tel: 818-362-9395, TELEX: 499-4182; *Sls. Mgr.:* Steve DeFeo ..... **C•1327-1329**

Local Sales Offices & Reps
CA Fairfield, Baribeault Assocs. 707-428-6095
CA Santa Ana, Wayne Champa Assocs. .. 714-662-2228
CO Englewood, Omega Ltd. 303-762-1921
FL Indian Harbour Bch., Bill Toy & Assocs. 305-773-5805
GA Norcross, Hollingsworth & Still 800-241-5712
IA Marion, MSB Assocs. 319-377-6261
KS Roland Pk., MSB Assocs. 913-432-2131
MA Newton, M. A. Olson Assocs. Inc. 617-244-4030
MN Minneapolis, Electro tec Assocs. 612-927-5878
MO St. Louis, MSB Assocs. 314-946-5577
NJ Ho-Ho-Kus, D. J. Fisher Inc. 201-652-0090
EXP Switzerland/CH-1143 Apples, W. W. Fischer SA 021-800-3711
Can Oakville, Ont., Haltronics 416-844-2233

FISHERCAST, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962943, FAX: 705-745-8818; Empl.: 1800; *Sls. Mgr.:* Larry Hatfield

FISHERTECH, Fisher Gauge Limited, 194 Sophia Street, P.O. Box 179, Peterborough, Ontario, Canada K9J 6Y9, Tel: 705-748-9522, TELEX: 06-962838, FAX: 705-748-6312; Empl.: 2000; *Sls. Mgr.:* Larry Curtis

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AL Huntsville, Reynolds & Assocs. 305-259-7000
AZ Phoenix, J. Smith & Assocs., Inc. 602-267-0981
CA Cupertino, T. Louis Snitzer Co. 408-257-8333
CA Del Mar, T. Louis Snitzer Co. 619-226-0305
CA Los Angeles, T. Louis Snitzer Co. 213-836-6170
CO Colorado Springs, J. Smith & Assocs., Inc. 303-597-5343
FL Melbourne, Reynolds & Assocs. 305-259-7000
GA Lilburn, Reynolds & Assocs. 305-259-7000
IL Wheeling, Ed Joyner & Co. 312-520-1200
IN Noblesville, R & D Elctrns. 317-849-2026

MD	Burtonsville, Eastern Instrmn. Corp.	301-384-8500
MN	Edina, Dytec Instrs. Inc.	612-831-7169
MN	St. Paul, Dytec Instrs. Inc.	612-645-5816
NM	Albuquerque, J. Smith & Assocs., Inc.	505-345-6501
NY	Great Neck, Industron Assocs., Inc.	516-487-2620
NY	Rochester, Tae-Rep	716-586-8710
NY	Whitney Pt., Tae-Rep	607-692-3705
NC	Raleigh, Reynolds & Assocs.	305-259-7000
PA	Doylestown, Tech. Instr. Sls. Co.	215-345-4110
TX	Austin, Thorson Co.	512-345-1985
TX	Dallas, Thorson Co.	214-233-5744
WA	Seattle, Datacom Assocs.	206-285-2525
Can	Burnaby, B.C., Atelco, Inc.	604-299-9331
Can	Calgary, Alberta, Atelco, Inc.	403-230-1697
Can	Markham, Ont., Atelco, Inc.	416-497-8590
Can	Montreal, Que., Atelco, Inc.	514-481-7733
Can	Ottawa, Ont., Atelco, Inc.	613-596-5894

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FITCHBURG COATED PRODUCTS, Technographics, Inc., P.O. Box 1106, Scranton, PA 18501, Tel: 717-347-2035; Empl.: 300

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FLAMBEAU PRODUCTS CORP., P. O. Box 97, Middlefield, OH 44062, Tel: 216-632-1631, FAX: 216-632-1581; Empl.: 184; *Sls. Mgr.:* Elmer J. Sunyog

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FLEXCO MICROWAVE, INC., P.O. Box 174, Karrville Rd., Port Murray, NJ 07865, Tel: 201-689-3020, TELEX: 467439; FSC No.: 52214; Empl.: 50

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MORLAN & ASSOCIATES, INC.

FAX: 614-876-8538

FLEX-CORE DIV., Morlan & Assocs., Inc., 6625 McVey Blvd., Worthington, OH 43235, Tel: 614-889-6152; Empl.: 7; *Sls. Mgr.:* D. Morlan ..... **A•2229**

FLEX-KEY CORP., Sub. of Astronics Corp., 18 Sargent St., Gloucester, MA 01930, Tel: 617-281-2040, TELEX: 94-0333, FAX: 617-281-4730; FSC No.: 51163; Empl.: 50; *Sls. Mgr.:* Philip P. Bodoni ..... **B•1817**

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IA	Cedar Rapids, Tech. Elctrns. Inc.	319-366-5443
KS	Wichita, Bud Johnson & Assocs.	316-838-9345
MI	Birmingham, Riley-Cotter Sls.	313-644-0161
NY	Huntington, J. A. Keeneth Co.	516-351-7008
Can	Mississauga, Ont., Lloyd A. Meredith	416-535-1832

FLIGHT CONNECTOR, Trans-Technology Electronics, 233 E. Manville St., Rancho Dominguez, CA 90220-9006, Tel: 309-693-3355, TWX: 510-390-3691; FSC No.: 28680; *Sls. Mgr.:* John Williams; *Dist. Mgr.:* John Williams

FL JENNINGS, FL Inds., 970 McLaughlin Ave., San Jose, CA 95122-2696, Tel: 408-292-4025, TELEX: 34-6311, TWX: 910-338-0159, FAX: 408-286-1789; FSC No.: 73905; Empl.: 350; *Sls. Mgr.:* E. V. Valehrach ..... **A•1085; B•1422-1425; D•1253**

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CA	Encino, King-Way Assocs.	818-788-4124
CO	Denver, Lindberg Co.	303-758-9033
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Arlington Hgts., Berndt Assocs.	312-632-0900
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Shawnee Mission, Lowell-Kangas & Assoc.	913-631-3515
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Haverhill, L.K. Assocs.	617-373-1313
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Lowell-Kangas & Assoc.	314-821-4050
NJ	Flanders, K&R Engrg. Sls.	201-584-5235
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Kingston, Micro-Tech Mktg.	914-338-7588
NY	N. Syracuse, Micro-Tech Mktg.	315-458-5254
NY	Rochester, Micro-Tech Mktg. Inc.	716-328-3000
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Cleveland, Covert, Newman & Co.	216-449-8845
OH	Dayton, Covert & Newman & Co.	513-439-5788
PA	Huntingdon Valley, Omega Elctrns.	215-947-4135
PA	Pittsburgh, Covert & Newman & Co.	412-531-2022
TX	Houston, Barry Sales	713-784-5860
TX	Richardson, Barry Sales	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WI	Milwaukee, Berndt Assocs.	414-545-8400

Local Distributors

CA	Carlsbad, Surcom Assocs.	619-438-4420
IL	La Fox, Richardson Elctrns., Ltd.	312-456-0600

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FAX: 602-748-0908

FLOTEK CORPORATION, 1300 E. Floriza St., Ste. 101, Tucson, AZ 85714, Tel: 602-294-9222, TWX: 510-601-6723, ESYLNK: 62936530; Empl.: 8; *Sls. Mgr.:* Eric Richards ..... **D•1370-1371, 2166**

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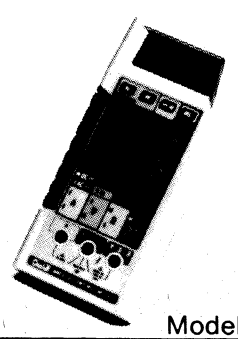
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IL	Downers Grove	312-971-8600
NC	Charlotte	704-554-1551
PA	Philadelphia	215-299-5846
TX	Dallas	214-783-0877

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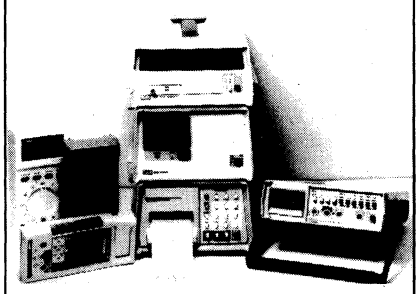
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Local Sales Offices & Reps

AL	Owens Cross Rds., CMR Cross Assocs.	205-883-5991
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CO	Littleton, MRC	303-794-4684
CO	Longwood, A-OK Tech. Reps.	305-682-6313
IA	Bettendorf, Weisler & Assocs.	319-355-5911
MO	Ballwin, Weisler & Assocs.	314-394-4543
MO	Kansas City, Weisler & Assocs.	816-421-1679
NJ	Budd Lake, Guido Assocs.	201-347-4643
OH	Dayton, Santer Sls.	513-434-8212
PA	Erie, Frandot Co.	814-455-9751
TX	Dallas, Weisler & Assocs.	214-437-2386
TX	Houston, Weisler & Assocs.	713-467-1847
WI	Genoa City, Vine Tech. Sls.	414-279-3871

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FAX: 813-693-1554

FOX ELECTRONICS, 5842 Corporation Circle, Ft. Meyers, FL 33905, Tel: 813-693-0099, TWX: 510-951-7386; FSC No.: 61429; *Sls. Mgr.:* E. L. Fox, Jr./Mason Flake ..... **A•1397**

Local Sales Offices & Reps

AL	Huntsville, Beacon	205-881-5031
AZ	Tempe, System Sls. of Arizona	602-829-9338
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mountain View, Brooks Tech. Grp.	415-960-3880
CO	Englewood, Megatronix	303-799-3700
CT	Orange, Access Sys.	203-877-5891
FL	Altamonte Springs, Semtronics Assocs.	303-831-8233
FL	Clearwater, Semtronics Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronics Assocs.	305-731-2484
GA	Atlanta, Electronic Mktg. Assocs. Inc.	404-448-1251
IL	Itaska, Janus Inc.	312-250-9650
IN	Indianapolis, Wilson Tech. Sls. Inc.	317-872-2513
LA	Hammond, Design Mktg.	504-294-3076
MD	Randallstown, Beacon North Inc.	703-478-2480
NH	Nashua, Access	603-888-8160
MI	Benton Harbor, McNab & Assoc.	616-925-2166
MN	Minnetonka, Gibb Elctrn.	612-935-4600
MO	St. Louis, Reps Inc.	314-298-8262
NJ	Medford, Component Consultants	609-654-5300
NJ	Parsippany, HLM NJ	201-263-1535
NM	Albuquerque, System Sls. of New Mexico	505-889-2901
NY	Northport, HLM NY	516-757-1606
NY	Syracuse, Pitronics	315-455-7346
NC	Raleigh, Electronic Mktg. Assocs. Inc.	919-847-8800
OH	Cleveland, Covert & Newman Co.	216-449-8845
OH	Dayton, Covert & Newman Co.	513-439-5788
OR	Portland, E. S. Chase	503-292-8840
PA	Pittsburgh, Covert & Newman Co.	412-531-2002
SC	Greenville, Elctrn. Mktg. Assocs. Inc.	803-233-4637
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TX	Dallas, Design Mktg.	214-480-8151
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WA	Kirkland, E. S. Chase	206-823-9535
Can	Nepean, Ont., Electro Source	613-726-1452
Can	Rexdale, Ont., Electro Source Inc.	416-675-4490

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CA	Chatsworth, CETEC/Future	818-700-0914
CA	Irvine, CETEC/Future	714-250-4141
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Cypress	619-535-0011
CA	San Diego, CETEC/Future	619-278-5020
CA	San Jose, Distel Inc.	408-432-9290
CA	San Jose, Future	408-435-9100
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Santa Clara, Cypress	408-980-2500
CA	Santa Clara, CETEC/Future	408-434-1114
CA	South Gate, CETEC/Future	213-773-6521
CA	Westlake Vl., Distel Inc.	805-495-9998
CO	Denver, Integrated Corp. Hdqtrs.	303-292-6121
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CO	Westminster, Future Elctrns.	303-650-0123
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CT	Bethel, Future Elctrns.	203-743-9594
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MI	Grand Rapids, EC Elctrns.	616-530-0576
MI	Livonia, Reptron	313-525-2700
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	St. Louis, Franklin Elctrns.	314-993-5333
NH	Salem, Cronin Elctrns.	603-898-4440
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NJ	Mount Laurel, Future Elctrns.	609-778-7600
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NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, CAM/RPC	716-427-9999
NY	Rochester, Future Elctrns.	716-272-1120
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NY	Syracuse, Add	315-437-1836
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OH	Cleveland, CAM/RPC	216-461-4700
OH	Solon, Reptron	800-445-7476
OH	Worthington, Reptron	614-436-6675
OR	Beaverton, Cypress Elctrns.	503-641-2233
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Beaverton, Integrated Elctrns. Corp.	503-641-1690
PA	Pittsburgh, CAM/RPC	412-782-3770
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TX	Dallas, Cypress Elctrns.	214-869-1435
TX	Farmer Branch, Force Elctrns. of Texas	214-247-9955
TX	Ft. Worth, C & W Elctrns.	817-831-0395
TX	Houston, Force Elctrns. of Texas	713-561-8644
TX	Richardson, Future Elctrns.	214-437-2437
TX	Richardson, Jaco	214-235-9575
UT	North Salt Lake, Integrated Elctrns.	801-298-1868
UT	Salt Lake City, Future	801-972-8489
WA	Bellevue, Almac Elctrns.	206-643-9992
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bothell, Cypress Elctrns.	206-483-1144
WA	Redmond, Future Elctrns.	206-881-8199
WA	Spokane, Almac	509-924-9500
WI	Mequon, Lake-View Elctrns.	414-377-8250
WI	Milwaukee, Progressive Image inc.	414-321-4722
Can	Downsview, Ont., Future Elctrns.	416-638-4771
Can	Nepean, Ont., Carsten Elctrns.	613-726-9250
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Laurent, Que., Carsten Elctrns.	514-334-8321
Can	Vancouver, B.C., Future Elctrns.	604-294-1166

FRAMAR METAL PRODUCTS CO., INC., 345 Carnegie Avenue, Kenilworth, NJ 07033, Tel: 201-241-0710, FAX: 201-241-1876; Empl.: 7; *Sls. Mgr.:* John W. Moore, Jr.

FRAZIER, 1930 Valley View La., Dallas, TX 75234, Tel: 214-241-3441; Empl.: 20; *Sls. Mgr.:* W. A. Wadkins

FREDERICK COMPONENTS INTL., 20806 Plummer St., Chatsworth, CA 91311, Tel: 818-882-0868, 800-354-0660, TELEX: 691531

FREDERICK ELECTRONICS CORP., 7630 Hayward Rd., P.O. Box 502, Frederick, MD 21701-0502, Tel: 301-662-5901, TELEX: 197639, 248862; FSC No.: 197639, 64682; Empl.: 350; *Sls. Mgr.:* John W. Seniff

FREED TRANSFORMER, 1718 Weirfield St., Ridgewood, NY 11385, Tel: 212-386-1300; FSC No.: 73386; Empl.: 200; *Sls. Mgr.:* M. Salzberg

FTS

FAX: 508-927-4099

FREQUENCY AND TIME SYSTEMS, INC., DATUM, INC., 34 Tozer Rd., Beverly, MA 01915, Tel: 508-927-8220, TELEX: 94-0518 FTS BVLY; FSC No.: 56219; Empl.: 126; *Sls. Mgr.:* Martin W. Levine ..... **D•1254**

Local Sales Offices & Reps

AL	Huntsville, Southern Mktg. Assocs.	205-534-6020
AZ	Phoenix, Tech. Mktg. Specialists	602-582-4800
CA	Anaheim, Datum Timing	714-533-6333
CA	Costa Mesa, Ward Davis Assocs.	714-556-7466
CA	Redondo Bch., Ward Davis Assocs.	213-643-6977
CA	San Diego, Ward Davis Assocs.	619-292-1000
CA	Santa Clara, Ward-Davis Assocs.	408-245-3700
FL	Largo, Electrocraft	813-530-4749
FL	Longwood, Southern Mktg. Assocs.	305-682-7317
GA	Marietta, Southern Mktg. Assocs.	404-565-0603
IL	Park Ridge, Electronic Instr. Assocs.	312-298-2290
IN	Indianapolis, Electronic Instr. Assocs.	317-257-7231
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Rockville, Creative Mktg. Assocs., Ltd.	301-251-4100
MA	Tewksbury, Del-Con Sls.	617-851-9911
MN	Minneapolis, Electronic Instr. Assocs.	612-374-5628
NJ	Haddonfield, G. L. Williams Assocs.	609-428-6060
NJ	Union, Friedman Assocs., Inc.	201-964-6204
NY	Liverpool, R & D Assocs.	315-457-0100
NC	Greensboro, Southern Mktg. Assocs.	919-282-6001
OH	Centerville, Micro Sls. Corp.	513-433-8171
TX	Houston, Lear Assocs., Inc.	713-488-7893
TX	Richardson, Lear Assocs., Inc.	214-231-5388
WA	Seattle, Comptronics	206-284-4842

FREQUENCY CONTROL PRODUCTS, INC., American Time Products Div., 430 Commack Rd., Deer Pk., NY 11729, Tel: 516-243-5730, TWX: 710-581-0014, FAX: 516-243-5745; FSC No.: 59559;03040; Empl.: 100; *Sls. Mgr.:* A. Caggiano

FAX: 617-521-1839

FREQUENCY DEVICES, INC., 25 Locust St., Haverhill, MA 01830, Tel: 617-374-0761, TWX: 710-347-0314; Empl.: 40; *Sls. Mgr.:* Frank J. DeGiso ..... **A•1660-1661**

Local Sales Offices & Reps

CA	San Diego, K/Rep Sls.	619-457-9654
CA	San Ramon, Tech. Consultants, Inc.	415-830-0829
CA	Upland, HAB Assocs.	714-981-0529
FL	Orlando, Digital Analog Intl. Sls.	305-299-7754
IL	Chicago, Kingston Comps.	312-477-7800

MD College Park, Ken Geary & Son, Inc. .. 301-935-5055
MA Holbrook, McLellan Assocs. 617-767-4771
NJ East Brunswick, Winch Sls. Assocs. ... 201-613-1515
NY DeWitt, DB Environmental, Inc. 315-446-0220
NY Roslyn Heights, Winch Sls. Assocs. ... 516-681-3163
OH Chagrin Falls, Hester Assocs. 216-247-6655
PA Sellersville, Tech-Com Mktg. 215-723-0820
TX Houston, TCI Elctrns. 713-774-5019
WA Seattle, Brett Assocs. 206-431-8090
Can Don Mills, Ontario, R. D. Assocs. 416-444-0959

FAX: 516-794-4340

FREQUENCY ELECTRONICS, INC., 55 Charles Lindbergh Blvd., Mitchel Field, NY 11553, Tel: 516-794-4500, TWX: 510-223-0418; Empl.: 950; *Sls. Mgr.:* John Cuthbertson ..... **A•1398-1399**

Local Sales Offices & Reps

CA Mountainview, Disman-Baker 415-969-3010
CO Englewood, Western Sls., Inc. 303-798-0945
FL Orlando, Truex Assoc. 305-859-2160
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Cochituate, High-Tech Sls. 617-653-3838
NJ East Windsor, Micro Lambda 609-443-3113
NY E. Syracuse, EM-Tech Assocs., Inc. ... 315-437-7052
OH Cleveland, Tiby Co. 216-371-5335
VA Charlottesville, Marktron 804-973-5874

FREQUENCY SELECTIVE NETWORKS, 69-20 Garfield Ave., Woodside, NY 11377, Tel: 718-424-7500, FAX: 718-424-3459; FSC No.: 56662; Empl.: 30; *Sls. Mgr.:* Michael L. Izzolo ..... **A•1400**

Local Sales Offices & Reps

FL Melbourne, Aschbacher Elec. 305-729-0628
NY Huntington, Carnes Assocs. 516-694-1600
OH Dayton, Aschbacher Assocs. 513-252-7785
VA Alexandria, Tech-Rep Inc. 703-370-2600

FREQUENCY SOURCES, INC., Semiconductor Div., 16 Maple Rd., Chelmsford, MA 01824, Tel: 617-256-4113/8101, TWX: 710-343-0404, FAX: 617-256-8227; FSC No.: 26629; Empl.: 90; *Sls. Mgr.:* D. Langan

FREQUENCY WEST, INC., Subsidiary of LORAL Corporation, 214 Devcon Dr., San Jose, CA 95112-4210, Tel: 408-436-4500, TWX: 910-338-0163; FSC No.: 8F150; Empl.: 130; *Sls. Mgr.:* John Tarvin

Local Sales Offices & Reps

AL Huntsville, E. G. Holmes & Assocs. 205-859-4199
AZ Phoenix, Odyssey I 602-246-8846
CA Cupertino, Allis Assocs., Inc. 408-252-2883
CO Englewood, Odyssey I 303-773-8176
FL Orlando, E. G. Holmes & Assocs. 305-281-0067
GA Atlanta, E. G. Holmes & Assocs. 404-451-6161
IL Arlington Hgts., Dytec/Central, Inc. 312-394-3380
IN Indianapolis, Dytec/Central, Inc. 317-297-5988
KS Lenexa, Midtec Assocs., Inc. 913-541-0505
MD Laurel, Electronic Mktg. Assocs. 301-725-6500
MA Burlington, Tritek, Inc. 617-272-4550
MN New Hope, Baltz Assocs. 612-546-8520
MO St. Louis, Midtec Assocs, Inc. 314-275-8666
NM Albuquerque, IMEC 505-883-9010
NY Smithtown, Metro M.I.C.S. 516-361-6134
NC Cary, E. G. Holms & Assocs. 919-469-8850
OH Centerville, Micro Sls. Corp. 513-433-8171
PA Plymouth Meeting, Elctrn. Mktg. Assocs. 215-828-7400
TX Dallas, Data Mktg. Assocs. 214-661-0300
WA Kirkland, Allis-Northwest 206-828-0444
WI Brookfield, Dytec/Cen., Inc. 414-792-0320

FRESNEL OPTICS, Div. of Alliance Tool Corp., 1300 Mt. Read Blvd., Rochester, NY 14606, Tel: 716-647-1140, TELEX: 97-8322; *Sls. Mgr.:* Helmut Walter

FRONTIER ELECTRONICS, 6311 DeSoto Ave., Ste. K, Woodland Hills, CA 91367, Tel: 818-888-6242, TELEX: 294582, FAX: 818-888-5239; Empl.: 200

FRONT PANEL DEVICES, INC., 38-7 Raymor Ave., Ronkonkoma, NY 11779, Tel: 212-471-9800, TELEX: 645-580; Empl.: 20; *Sls. Mgr.:* Maureen Quinn

FSI/FORK STANDARDS, INC., 666 Western Ave., Lombard, IL 60148, Tel: 312-231-3511, 312-932-9380, FAX: 312-932-0016; FSC No.: 14986; Empl.: 20; *Sls. Mgr.:* Alfredo J. Ramirez; *Dist. Mgr.:* A. E. Toht

FTS SYSTEMS, INC., Rte. 209, P.O. Box 158, Stone Ridge, NY 12484, Tel: 800-824-0400, TWX: 510-247-0547, FAX: 914-687-7481; Empl.: 100; *Sls. Mgr.:* Brian Adams

FUJI ELECTRIC CORP. OF AMERICA, 727 W. 7 St., Ste. 235, Los Angeles, CA 90017, Tel: 213-622-4490, TELEX: 677318, FAX: 213-488-9382; Empl.: Yasuko Suzuki; *Sls. Mgr.:* Atsuo Noguchi; *Dist. Mgr.:* Masano Deguchi

FUJITSU AMERICA, INC., Computer Products Group, 3055 Orchard Dr., San Jose, CA 95134, Tel: 408-432-1300, TWX: 910-338-2193; *Sls. Mgr.:* David Krevanko; *Dist. Mgr.:* Bill Clark ..... **D•1082-1091**

Local Sales Offices & Reps

CA Irvine, Fujitsu America 714-553-1250
CA San Jose, Fujitsu America 408-434-9250,
CA Sherman Oaks, Fujitsu America 818-905-1985
FL Ft. Lauderdale, Fujitsu America 305-771-7705,
GA Atlanta, Fujitsu America 404-953-0130
IL Itasca, Fujitsu America 312-250-8230,
MA Burlington, Fujitsu America 617-273-1341,
MN Minnetonka, Fujitsu America 612-932-9800,
NJ Manasquan, Fujitsu America 201-223-8222,
OR Beaverton, Fujitsu America 503-643-6098,
PA Malvern, Fujitsu America 215-648-3958
TX Austin, Fujitsu America 512-343-4514,
TX Richardson, Fujitsu America 214-437-9377,
Can Mississauga, Fujitsu Canada 416-673-8666

Local Distributors

AL Huntsville, Gentry Assocs. 205-837-0692
AZ Phoenix, Wyle Laborotories 602-866-2888,
CA Gardena, Schweber Elctrns. 213-327-8409,
CA Irvine, Wyle Laborotories 714-863-9953,
CA Richmond, Gates Distrbg. 415-526-4444,
CA Santa Clara, Wyle Laboratories 408-727-2500
CO Englewood, R2 Mktg. 303-799-9292
CT Danbury, Schweber Elctrns. 203-748-7080,
FL Ft. Lauderdale, Gentry Assocs. 305-791-8405
GA Atlanta, Gentry Assocs. 404-998-2828
IL Bensenville, Avnet Computer Technlgs. 312-350-2480,
IL Elmhurst, Fast Access 312-530-2450
IA Cedar Rapids, Data Link 314-395-0245
LA Gretna, Gentry Assocs. 504-367-3975
MD Gaithersburg, Mesa Technlg. 301-948-4350
MA Bedford, Schweber Elctrns. 617-275-5100,
MI Detroit, Cranel, Inc. 313-855-0166
MN Minneaplis, Datalink 612-944-3456
NJ Summit, Hopkins Assocs. 201-273-2770
NY Rochester, Cameron Computers 716-427-8190
OH Cleveland, Cranel, Inc. 216-589-4744
OH Columbus, Cranel, Inc. 614-433-0045
OK Tulsa, Dallas Digital 918-622-5708
OR Hillsboro, Wyle Laborotories 503-640-6000,
PA W. Conshocken, Hopkins Assocs 215-828-7191
TX Houston, Dallas Digtal 713-469-7151
TX Plano, Dallas Digital 214-424-2800
UT Salt lake, R2 Mktg. 801-595-0631
WA Redmond, Gates Distrbg. 206-883-8575,

FUJITSU

FAX: 408-980-1042

FUJITSU COMPONENTS OF AMERICA, 3320 Scott Blvd., Santa Clara, CA 95054, Tel: 408-727-1700, TWX: 910-338-0190; Empl.: 40; *Sls. Mgr.:* Jack Foster (acting); *Dist. Mgr.:* Hal Mumma ..... **B•1032, 1070, 1427-1446; C•1330-1369**

Local Sales Offices & Reps

AL Huntsville, C.S.R. Elctrn. 205-533-2444
CA San Diego, Earle Assocs., Inc. 619-278-5441
CA Santa Clara, Norcomp 408-727-7707
CA Tustin, Hi-Tech Rep Co.(HTRC) 714-730-9561
CA Westlake Village, Hi-Tech Rep Co.(HTRC) 818-706-2916
CO Lakewood, Candal 303-935-7128
CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Altamonte Springs, Semtronics Assocs. 305-831-8233
FL Clearwater, Semtronics 813-461-4675
FL Ft. Lauderdale, Semtronics 305-731-2484
GA Atlanta, C.S.R. Elctrns. 404-396-3720
IL Highland Park, Brensky Sls. 312-433-2375
IA Cedar Rapids, Electromec Sls., Inc. ... 319-362-6413
KS Overland Pk., Kebco 913-541-8431
MD Baltimore, Comp. Sls. Inc. 301-484-3647
MA Woburn, Mill-Bern Assocs., Inc. 617-932-3311
MI Farmington Hills, W. R. Hummon Assocs. 313-474-0661
MN Burnsville, Electromec Sls., Inc. 612-894-8200
MO St. Louis, Kebco 314-576-4111
NJ Fairfield, Tech. Applications & Mktg. 201-575-9130
NJ Marlton, BGR Assocs. 609-983-1020
NM Albuqueque, F.P. Sls. 505-345-5553
NY Rochester, H.C. Johnson Agy. 716-586-0777
NC Raleigh, C.S.R. Elctrn. 919-878-9200
OH Columbus, McFadden Sls. Inc. 614-761-3177
OR Beaverton, L-Squared Ltd. 503-629-8555
PA Glenshaw, H.C. Johnson Agy. 412-487-1246
TN Knoxville, C.S.R. Elctrn. 615-577-1317
TX Carrollton, Tech. Mktg. Inc. (TMI) 214-387-3601
TX Houston, Tech. Mktg. Inc. 713-783-4497
TX Round Rock, Tech. Mktg. 512-244-2291
WA Seattle, L-Squared Ltd. 206-827-8555
WI Cedarburg, Bransky Sls. 414-377-6837
Can St. Laurent, Que., John G. Weiss Co. .. 514-337-5022
Can Vancouver, Davetek Mktg. 604-430-3680

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FUJITSU MICROELECTRONICS, INC., Sub. of Fujitsu Limited, 3545 North First St., San Jose, CA 95134, Tel: 408-922-9000, TWX: 910-338-0190; FSC No.: 408-980-1047; Empl.: 350; *Sls. Mgr.:* Rich Christopher; *Dist. Mgr.:* Dan Buist

FURANE PRODS. CO./ISOCHEM OPERS., A Ciba-Geigg Co., 99 Cook St., Lincoln, RI 02865, Tel: 401-723-2100, TWX: 510-601-1913, FAX: 401-723-2930; Empl.: 26; *Sls. Mgr.:* W. Lott

FURMAN SOUND, INC., 30 Rich St., Greenbrae, CA 94904, Tel: 415-927-1225, FAX: 415-927-4548; Empl.: 22; *Sls. Mgr.:* Joe Desmond; *Dist. Mgr.:* Joe Desmond

FURNAS ELEC., 1197 McKee St., Batavia, IL 60510, Tel: 312-879-6000, TELEX: 72-0458; Empl.: 1360; *Sls. Mgr.:* R. Doty; *Dist. Mgr.:* P. Welch

FUSECOM, 14864 NE 95th St., Redmond, WA 98052, Tel: 206-881-2442; *Sls. Mgr.:* Bruce Barndt

FUSES UNLIMITED, 9300 Mason Av., Chatsworth, CA 91311, Tel: 818-882-1515; Empl.: 35; *Sls. Mgr.:* Bruce Barndt; *Dist. Mgr.:* Pat White

FUSION INC., 4658 E. 355th. St., Willoughby, OH 44094, Tel: 216-946-3300, TELEX: 275300; Empl.: 85; *Sls. Mgr.:* Raymond C. Yuhasz

FUTABA CORPORATION OF AMERICA, Electronic Components Division, 711 East State Pkwy., Schaumburg, IL 60173, Tel: 312-884-1444, TELEX: 206-833, TWX: 910-291-1057, FAX: 312-884-1635; *Sls. Mgr.:* Bill Lichtner; *Dist. Mgr.:* Bill Lichtner

GABRIEL ELECTRONICS, Box 70, Scarborough Indl. Pk., Scarborough, ME 04074, Tel: 207-883-5161, TELEX: 95-0113, ESYLNK: 62042511, FAX: 207-883-4469; Empl.: 225; *Sls. Mgr.:* D. B. Crisman

GALILEO ELECTRO-OPTICS CORP., Galileo Pk., Sturbridge, MA 01518, Tel: 617-347-9191, TELEX: 4999014; FSC No.: 28719; Empl.: 600; *Sls. Mgr.:* Lawrence T. Guzowski

GALIL MOTION CONTROL, INC., 1054 Elwell Ct., Palo Alto, CA 94303, Tel: 415-964-6494, TELEX: 171409, FAX: 415-964-0426; Empl.: 10; *Sls. Mgr.:* Lisa Wade

GALITE, 2 Tower Dr., Wallingford, CT 06492, Tel: 203-265-7126, TWX: 710-476-0764; FSC No.: 56447; *Sls. Mgr.:* James W. Campbell, Jr.

GAMBLE, CHARLES T., INDS., 605 Perkins La., Delanco, NJ 08075, Tel: 609-461-1900, FAX: 609 461-8216; Empl.: 150; *Sls. Mgr.:* Chuck Gamble

FAX: 914-667-5225

GAMMA HIGH VOLTAGE RESCH. INC., 30 N. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-5050; Empl.: 15 ..... **D•1728-1731**

Local Sales Offices & Reps

CA Pasadena, A-F Sls. Engrg. 213-681-5631
CA Santa Cruz, Le Rep 408-458-0667

IL Chicago, Comtel Midwest 312-539-4838,
IN Indianapolis, Comtel Midwest 317-253-1681,
IA Cedar Rapids, Comtel Midwest 319-377-9434,
KS Shawnee Mission, Comtel Midwest ... 913-268-0762,
MN Wayzata, Comtel Midwest 612-476-1551,
MO St. Louis, Comtel Midwest 314-991-5363,
NJ Nutley, Irwin Brill Sls. 201-667-0653
NM Albuquerque, Cleveland Entprs. 505-265-7893
TX Houston, Elctrl. Mktg. Assocs. 713-523-8602,
WI New Berlin, Comtel Midwest 414-544-6042,

GAMMA SCIENTIFIC INC., 3777 Ruffin Rd., San Diego, CA 92123, Tel: 619-279-8034, TELEX: 69-7938; Empl.: 65; *Sls. Mgr.:* Robert Ruff

GANDALF DATA INC., Gandalf Technologies Inc., 1020 S. Noel Ave., Wheeling, IL 60090, Tel: 312-541-6060, 800-GANDALF, TWX: 910-651-4951, FAX: 312-541-6060 (ext 411); Empl.: 3500; *Sls. Mgr.:* Kerry Hawkins

GANDALF TECHNOLOGIES, INC, See Gandalf Data, Inc.

GAP INSTRUMENT CORP., 40 Oser Ave., Hauppauge, NY 11787, Tel: 516-273-0909, TWX: 510-227-6237; FSC No.: 00607; Empl.: 50

GARDINER SOLDER CO., Div. of Gardiner Metal Co., 4820 S. Campbell Ave., Chicago, IL 60632, Tel: 312-847-0100, TWX: 910-221-2510; Empl.: 100; *Sls. Mgr.:* Daniel Frailey

GAR ENTERPRISES, 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0785; Empl.: 45

GARNER GLASS CO., 177 S. Indian Hill Blvd., Claremont, CA 91711, Tel: 714-624-5071, FAX: 714-624-7212; FSC No.: 53101; Empl.: 50; *Sls. Mgr.:* Joseph C. Hyatt

GARRY ELECTRONICS, Div. of Brintec Corp., 9 Queen Anne Ct., Laghorne, PA 19047, Tel: 215-949-2300; Empl.: 100; *Sls. Mgr.:* Tom Malek; *Dist. Mgr.:* Kate Simpson ..... **C•1370-1373, 1739; D•1112**

Local Sales Offices & Reps

AL Huntsville, Macro Mktg. 205-883-9630
AL Huntsville, R & G Sls. 205-536-6300
AZ Phoenix, Oasis Sls. 602-277-2714
CA El Segundo, Varigon Assocs. 213-322-1120
CA El Toro, Par Mktg. 714-768-6021
CA Mountain View, Westmark Assocs. 415-969-1700
CA San Jose, Eclipse Sls. 408-437-7575
CO Denver, Seale & Assocs., Inc. 303-756-8855
FL Altamonte Springs, Semtronics 305-831-8233
FL Ft. Lauderdale, Hutto, Hawkins & Peregoy 305-971-5750
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-577-9950
MD Glen Burnie, New Era Sls. 301-768-6666
MD Severna Pk., New Era Sls. 301-544-4100
MA Framingham, Gerald Rosen Co. 617-879-5505
MA Needham Hgts., Todino Engrg. 617-444-7925
MI Livonia, Amtech Reps., Inc. 313-474-8300
MN Edina, Grayden & Flemmer 612-941-1120
MN Mankato, El Sls. 507-345-5786
MO St. Louis, Ensco-Rep. Inc. 314-567-3935
NY Mount Vernon, Friedman Smith Elec. Sls. 914-664-4866
NY Syracuse, I. A. Hotze 315-479-6641
NC Raleigh, J & B Sls. 919-783-9440
OH Chagrin Falls, J. J. Bair & Assocs. 216-247-8244
OH Dayton, A.D. Dircksen & Assoc. 513-256-0351
OR Beaverton, Eclipse Mktg. 503-642-1661
PA Southeastern, Quality Comps. 215-687-3553
TX Austin, Richmar Elctrns. 512-251-7582
TX Dallas, Sundance Sls. 214-699-0451
TX Plano, Richmar Elctrns. 214-424-8388
WA Redmond, Eclipse Mktg. 206-885-6991
WA Redmond, Freed Assocs. 206-883-4828
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors

AL Huntsville, Arrow/Kierulff 205-837-6955
AL Huntsville, Hammond 205-830-4764
AZ Phoenix, Arrow/Kierulff 602-437-0750
AZ Phoenix, R.V. Weatherford Co. 602-272-7144
AZ Tempe, Time 602-967-2000
CA Anaheim, R.V. Weatherford Co. 714-634-9600
CA Aurora, Time 303-690-6696
CA Belmont, Lodan 415-592-4600
CA Buena Pk., Cypress 213-744-0355
CA Canoga Park, Afcom 213-703-6161
CA Chatsworth, Arrow/Kierulff 818-701-7500
CA Chatsworth, Jaco Elctrns. 213-998-2200
CA El Segundo, Zentron 213-322-1120
CA Glendale, R.V. Weatherford Co. 213-849-3451
CA Irvine, Integrated Elctrns. 714-837-9960
CA Irvine, Jaco Elctrns. 714-540-5600
CA Los Angeles, March Elctrns. 213-390-8893
CA Mt. View, Time/Nor Cal 415-965-8000
CA Pomona, R.V. Weatherford Co. 714-623-1261
CA Sacramento, Arrow/Kierulff 916-424-5297
CA San Diego, Arrow/Kierulff 619-565-4800
CA San Diego, Cypress 619-535-0011
CA San Diego, R.V. Weatherford 619-278-7400
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CA San Jose, Jaco Elctrns. 408-263-1100
CA Santa Barbara, R.V. Weatherford 805-965-8551
CA Sunnyvale, Arrow/Kierulff 408-745-6600
CA Sunnyvale, R.V. Weatherford 408-738-8694
CA Tustin, Arrow/Kierulff 714-838-5422
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Arrow/Kierulff 303-790-4444
CO Englewood, R.V. Weatherford Co. 303-770-9762
CT Greenwich, Wise Comps. 203-531-4880
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FL Casselberry, Afcom 305-831-6630
FL Deerfield Bch., Arrow/Kierulff 305-429-8200
FL Ft. Lauderdale, Hammond 305-973-7101
FL Ft. Lauderdale, Peerless Radio 305-566-5966
FL Ft. Lauderdale, Time 305-974-4800
FL Orlando, Hammond 305-849-6060
FL Palm Bay, Arrow/Kierulff 305-725-1480
GA Norcross, Arrow/Kierulff 404-449-8252
GA Norcross, Hammond 404-524-7502
IL Arlington, Lodan 312-398-5311
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IL Itasca, Arrow/Kierulff 312-250-0500
IN Indianapolis, Arrow/Kierulff 317-243-9353
IA Cedar Rapids, Arrow/Kierulff 319-395-7230
KS Lenexa, Arrow/Kierulff 913-541-9542
MD Columbia, Arrow/Kierulff 301-995-6002
MD Columbia, Technico 301-995-1995
MD Laurel, Makuria Supply 301-953-7617
MD Savage, Pyttronics 301-792-0780
MA Ashland, March Elctrns. 617-881-6715
MA Billerica, A. W. Mayer Co. 617-229-2255
MA Framingham, Now Elctrns. 617-872-5876
MA Waltham, March 617-899-4220
MA Waltham, Vantage Elctrn. 617-894-8690
MA Wilmington, Arrow/Kierulff 617-935-5134
MA Wilmington, RC/JACO 617-273-1860
MA Woburn, Time Elctrns. 617-935-8080
MI Ann Arbor, Arrow/Kierulff 313-971-8220
MI Grand Rapids, Arrow/Kierulff 616-243-0912
MI Grand Rapids, Caulder Elctrns. 616-949-2900
MI Grand Rapids, S-F Elctrns. 616-459-0216
MN Edina, Arrow/Kierulff 612-830-1800
MO St. Louis, Arrow/Kierulff 314-567-6888
MO St. Louis, Ensco Distr. Co. 314-567-3935
NH Hudson, Interconnect of N.E. 603-883-1515
NH Manchester, Arrow/Kierulff 603-668-6968
NJ Clifton, Afcom 201-365-2700
NJ Marlton, Arrow/Kierulff 609-596-8000
NJ Parsippany-Troy Hills, Arrow/Kierulff 201-538-0900
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Arrow/Kierulff 505-243-4566
NM Albuquerque, Elctrn. Devices 505-293-1935
NY Bohemia, March Elctrns. 516-563-6000
NY Hauppauge, Arrow/Kierulff 516-231-1000
NY Hauppauge, Jaco Elctrns, ... 516-273-5500
NY Lynbrook, Peerless Radio 516-593-2121
NY Mt. Vernon, Asap 914-699-2727
NY Rochester, Arrow/Kierulff 716-427-0300
NY Rochester, Rochester Radio 716-454-7800
NY West Hempstead, March 516-486-6511
NC Greensboro, Hammond 919-275-6391
NC Raleigh, Arrow/Kierulff 919-876-3132
NC Winston-Salem, Arrow/Kierulff 919-725-8711
OH columbus, Arrow/Kierulff 614-436-0928
OH Centerville, Arrow/Kierulff 513-435-5563
OH Solon, Arrow/Kierulff 216-248-3990
OK Tulsa, Arrow/Kierulff 918-252-7537
OR Beaverton, Arrow/Kierulff 503-645-6456
OR Beaverton, Integrated Elec. 503-641-1690
PA Broomall, Time 215-359-1200
PA Monroeville, Arrow/Kierulff 412-856-7000
PA Montgomeryville, Pyttronics 215-643-2850
TX Austin, Arrow/Kierulff 512-835-4180
TX Carrollton, Arrow/Kierulff 214-380-6464
TX Dallas, Afcom 214-238-7845
TX Dallas, R.V. Weatherford Co. 214-980-1110
TX Houston, Arrow/Kierulff 713-530-4700
TX Houston, Lenert 713-225-1465
TX Houston, R.V. Weatherford 713-688-7406
UT N. Salt Lake City, Integrated Elctrns. .. 801-298-1869
UT Salt Lake City, Arrow/Kierulff 801-973-6913
VA Roanoke, Technico 703-563-4975
WA Bellevue, Integrated Elctrns. 206-455-2727
WA Bellevue, Jaco Elctrns. 206-455-2727
WA Kent, Arrow/Kierulff 206-575-4420
WA Seattle, R.V. Weatherford Co. 206-575-1340
WI Brookfield, Arrow/Kierulff 414-792-0150
WI Mequon, Taylor Elctrns. 414-241-4321
PR Hato Rey, Arrow/Kierulff 809-764-4384
Can Mississauga, Ont., Pyle National 416-822-3710

GASKET INTERNATIONAL INC., 49 Ackerman St, Bloomfield, NJ 07003, Tel: 201-338-6814; Empl.: 5; *Sls. Mgr.:* Russell L. Steinman

GATES, GEO. W., & CO., INC., 1209 Hempstead Tpke., Franklin Sq., NY 11010, Tel: 516-352-2904; Empl.: 10; *Sls. Mgr.:* T. E. Schulz, Jr

Gates Energy Products

FAX: 904-462-4726

GATES ENERGY PRODUCTS, P.O. Box 114, Gainesville, FL 32602, Tel: 904-462-3911, TWX: 810-836-8500; Empl.: 3300; *Sls. Mgr.:* C. W. Garstang; *Dist. Mgr.:* K. Sparks ..... **D•1460-1466**

Local Sales Offices & Reps

CA Newport Bch. 714-852-9033
CT Meriden 203-238-6812
GA Atlanta 404-458-8755
IL Des Plaines 312-827-9130

Local Distributors

CA Los Angeles, Battery Specialties 213-437-1809
CA San Diego, Tauber Elctrns. 619-274-7242
CA San Jose, Rose Elctrns. 408-263-2934
GA Norcross, Applied Power 404-263-0421
IL Chicago, Joseph Elctrns. 312-297-4200
IL Chicago, Power-Pak, Inc. 312-966-6000
MA Boston, Adcour 617-784-8123
MI Brighton, Applied Power 313-227-3604
MN St. Paul, Shelley-Ragon 800-328-9427
NJ Clifton, Engineered Assemblies 201-340-0600
NC Raleigh, Engrd. Assemblies 919-790-9700
OH Columbus, Promark 614-876-8885
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Southwest Elctrns. 713-240-4000
WA Redmond, Priebe Elctrns., Inc. 206-881-2363
WA Seattle, Priebe Electronics 206-821-4695

GAVITT WIRE & CABLE, Brookfield, MA 01506, Tel: 617-867-6476, FAX: 617-867-5126; Empl.: 75

GAYNOR ELECTRIC CO., 135 South Main St, P.O. Box 316, Thomaston, CT 06787-0316, Tel: 203-283-4388, FAX: 203-283-4107; Empl.: 50; *Sls. Mgr.:* John Swanson; *Dist. Mgr.:* John Swanson

GC-THORSEN, 1801 Morgan St., P.O. Box 1209, Rockford, IL 61105-1209, Tel: 815-968-9661, TELEX: 383956 GC Elect; Empl.: 260; *Sls. Mgr.:* Larry Adams, VP Sls.; *Dist. Mgr.:* Raymond D. Camacho

GEBEX CORPORATION, 2221 Walnut Hill Ln., Irving, TX 75038, Tel: 214-550-8955, FAX: 214-580-0173; Empl.: 35

GECO, 145 Penn St., Millheim, PA 16854, Tel: 814-349-5656; Empl.: 21

FAX: 507-263-4887

GEMINI, 103 Mensing Way, Cannon Falls, MN 55009, Tel: 507-263-3957, 800-533-3631; *Sls. Mgr.:* Gary Pearson ..... **C•1054-1055**

Local Sales Offices & Reps

AR North Little Rock, Leo Barker Co. 501-834-2537
CA Orange, XBX Sls., Inc. 714-998-8200
CA Sacramento, Gemini, Inc. 916-927-7776
CA San Diego, Qualtronics 619-560-8955
CO Broomfield, Conners Co. 303-466-9628
FL Oviedo, Tech. Sls. & Applications, Inc. 305-365-2233
GA Lilburn, Tech. Sls. & Applications, Inc. 404-925-1276
IL Palatine, JRS Assocs. 312-991-6626
IN Noblesville, R & D Elctrns. 317-849-2026
LA Slidell, Leo Barker Co. 504-643-4751
MD Glen Burnie, Freedman-Malta Assocs. 301-837-3155

MA Brookline, Harman Assocs. 617-232-6687
MI Dearborn, Pitcher-Poulin, Inc. 315-582-5450
MO St. Louis, Harris Hanson Co. 816-763-6200
NY Buffalo, Leonard D. Allen, Inc. 716-542-2728
NY Rochester, Leonard D. Allen, Inc. 716-377-3530
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Kernersville, Wallace ELctrns. Sls. 919-996-2742
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
OR Forest Grove, Doran Sls., Inc. 503-357-3333
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
TX Dallas, J. Clay Co. 214-350-1281
TX Taylor, Gemini, Inc. 512-352-5207
UT Salt Lake City, Medex 801-266-4545
WA Redmond, Doran Sls., Inc. 206-885-1885
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Markham, Ont., Avotronics, Ltd. 416-475-2024

GEN/COMP INC., 6 Algonquin Rd., Canton, MA 02021, Tel: 617-828-2008; *Sls. Mgr.:* G. Nutter

GENCO PRECISION CORP., 247 Skidmore Road, Deer Park, NY 11729, Tel: 516-242-3006, FAX: 516-242-3118

GENERAL AUTOMATIC CORP., See E-Tron Corp.

GENERAL BUSINESS TECH., 1891 McGaw Ave., Irvine, CA 92714, Tel: 714-261-1891, FAX: 714-261-8285; Empl.: 44; *Dist. Mgr.:* Barbara A. Foy

GENERAL CABLE CO., Fiber Optics Div., 160 Fieldcrest Ave., P.O. Box 7810, Edison, NJ 08818-7810, Tel: 201-225-4780, TELEX: 642892; *Sls. Mgr.:* Pieter deBruijn

GENERAL COMPUTERS, 1624 Veteran Ave., Los Angeles, CA 90024; Empl.: 10

Distributor

GENERAL CONTROLS, INC. 2350 Brickvale Ave., Elk Grove Vollage, IL 60007, Tel: 312-595-2152; FAX 312-595-2271 ..... 775, 796

GENERAL CONTROL CO., 11 Cote Indl. Pk., Goffston, NH 03045, Tel: 603-669-2844; Empl.: 7

Local Sales Offices & Reps
NH Goffstown, Gen. Control Co., Inc. 603-669-2844

GENERAL DEFENSE CORPORATION, Tactical Systems Division, Box 500, Pinellas Pk., FL 34290-0500, Tel: 813-541-6681, TWX: 810-866-0433, FAX: 813-544-4944; FSC No.: 1M813; Empl.: 250; *Sls. Mgr.:* Sam Gray

GENERAL DEVICES
Electronic Hardware Manufacturers

FAX: 317-898-2917

GENERAL DEVICES CO., INC., Box 39100, Indianapolis, IN 46239-9632, Tel: 317-897-7000; Empl.: 250; *Sls. Mgr.:* Jack Bradford; *Dist. Mgr.:* Dan McCauley ..... **C•1057**

Local Sales Offices & Reps
AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Phoenix, Snyder Engrg. 602-279-2010
CA Fullerton, Groh Assoc. 714-837-9871
CA Mountain View, G. Woempner Co. 415-964-5454
CO Boulder, R. F. Mayo Assoc. 303-499-2155
CT North Haven, Coakley, Boyd & Abbett 203-481-2828
FL Lighthouse Point, J. Krutek & Assoc. .. 305-427-4202
FL Maitland, J. Krutek 305-628-4837
GA Norcross, Hughes Assocs., Inc. 404-622-1587
IL Glencoe, Howard Benjamin 312-272-2900
IN Noblesville, Century Elctrns. 317-849-2026
KS Overland Pk., Thomas Dowell & Assocs. 913-648-7373
MD Elicott City, Eastern Tech. Corp. 301-461-7720
MA Needham, Coakley, Boyd & Abbett 617-444-5470
MN St. Paul, Northport Engrg. 612-457-8000
MS Corinth, Hughes Assocs., Inc. 601-287-2915
MO St. Louis, Thomas Dowell & Assocs. .. 314-849-4234
NH Plaistow, Coakley, Boyd & Abbett 617-444-5470
NJ Mountainside, Henry G. Richter 201-233-4615
NY Fayetteville, H.G. Richter 315-637-6713
NC Raleigh, Hughes Assocs., Inc. 919-782-2065
OH Cleveland, Electronic Comps., Inc. 216-331-5330
OH Dayton, Electronic Comps., Inc. 513-866-3340
OK Tulsa, Advance Tech. Sls. 918-664-0482
TN Morristown, Hughes Assocs., Inc. 615-587-2433
TX Austin, Advance Tech. Sls. 512-440-7677
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
WA Olympia, Bergford & Assocs. 206-866-2001

Local Distributors
AZ Tempe, Acacia/VWR Elctrns. 602-894-2874
CA Irvine, Acacia/VWR Elctrns. 714-660-0834
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
MA Newton, In-Stock Products Co. 617-964-6200
NJ Atlantic Highlands, Freedom Elctrns., Inc. 201-872-2300

GENERAL DIGITAL CORP., 160 Chapel Rd., Box 1657, Manchester, CT 06040, Tel: 203-647-9700; Empl.: 50

GENERAL DIGITAL INDUSTRIES INC., 6705 Odyssey Dr., Huntsville, AL 35806, Tel: 205-837-2200; Empl.: 29; *Sls. Mgr.:* John Robinson

GENERAL ELECTRIC CO., Accessory Equipment Plant, 1285 Boston Ave., Bridgeport, CT 06602, Tel: 203-382-2000, TELEX: 96-4209; Empl.: 700; *Sls. Mgr.:* H. C. Wallace

GENERAL ELEC. CO., Electromaterials Dept., 1350 South Second Street, Coshocton, OH 43812, Tel: 614-622-5310, TELEX: 810-255-2921; Empl.: 600; *Sls. Mgr.:* Dick Hurlbut

GENERAL ELECTRIC CO., Instrument Prods. Section, See Yokogawa Corp. of America

GE MICROELECTRONICS CENTER, GE Aerospace, P.O. Box 13049, Research Triangle Park, NC 27709, Tel: 919-549-3100, FAX: 919-549-3598; Empl.: 500; *Sls. Mgr.:* Don B. Dickerman, Jr.

POWER SUPPLY OPERATION, General Electric Co., 1701 College Street, Fort Wayne, IN 46801, Tel: 219-420-2000; *Sls. Mgr.:* Stan Williams or Chris Copestake

GENERAL ELECTRIC SOLID STATE DIV., G.E. Corporation, Route 202, Somerville, NJ 08876, Tel: 201-685-6530, FAX: 201-685-7008; FSC No.: 19089; *Sls. Mgr.:* Edward Parker; *Dist. Mgr.:* Thomas Piterra

GENERAL ELECTRIC CO., Specialty Mktg. Oper., Nela Park, Clevland, OH 44112, Tel: 216-266-3494; *Sls. Mgr.:* W. D. Wells

GENERAL ELECTRIC CO., RELAY OPERATION, See Genicom Corp.

GENERAL FIBER OPTICS, INC., 98 Commerce Rd., Cedar Grove, NJ 07009, Tel: 201-239-3400, TELEX: 132741, FAX: 201-239-3400; *Sls. Mgr.:* Herb Berkowitz

GENERAL HARDWARE MFG., 80 White St., New York, NY 10013, Tel: 212-431-6100, FAX: 212-431-6499; *Sls. Mgr.:* Tom McGannon

GENERAL INDUSTRIES, Taylor & Olive St., Elyria, OH 44035, Tel: 216-323-3136, TWX: 810-424-2109; Empl.: 1100

GENERAL INSTRUMENT, Govt. Systems, 600 W. John St., C. S. 710, Hicksville, NY 11802-0709, Tel: 516-933-3000, TELEX: 311512, TWX: 510-221-1865, FAX: 516-933-3432; Empl.: 768; *Sls. Mgr.:* A. Heckler/C. Turner

GENERAL INSTRUMENT

FAX: 704-328-2400

GENERAL INSTRUMENT, NETWORK CABLE DIV., P. O. Box 1729, Hickory, NC 28603, Tel: 704-324-2200, 800-438-3331, TELEX: 802-166; *Sls. Mgr.:* Nita Hunsucker ..... **C•1844-1849**

Local Sales Offices & Reps
CA Los Angeles, Richard Bolf 213-305-1025
IL Palatine, Gregg Winn 312-705-9190
KS Overland Pk., Bob Barker 913-888-6270
NH Nashua, Dan Heffernan 603-673-4908
NC Hickory, Kathy Miller 704-327-0509
TX Plano, Steve Britton 214-596-6065

GENERAL INSTR., Optoelctrns. Div., 3400 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-0400, TELEX: 348430, TWX: 910-373-1767; FSC No.: 58361; Empl.: 500; *Sls. Mgr.:* J. Beach; *Dist. Mgr.:* W. Clark

GENERAL LASER, INC., 7950 E. Redfield Rd., Scottsdale, AZ 85260, Tel: 602-991-0674, FAX: 602-991-1462

GENERAL MAGNETICS, 211 Grove St., Bloomfield, NJ 07003, Tel: 201-743-2700; FSC No.: 99165; Empl.: 20

GENERAL MANUFACTURING, 724 Ruberta Ave., Glendale, CA 91201, Tel: 818-243-2069; FSC No.: 10454

GENERAL MIRCOCIRCUITS, 780 Boston Rd., Billerica, MA 01821, Tel: 508-663-9101, FAX: 508-663-9132; Empl.: 40; *Sls. Mgr.:* Michael Lioz

FAX: 516-226-8966

GENERAL MICROWAVE CORPORATION, 5500 New Horizons Blvd., Amityville, NY 11701, Tel: 516-226-8900, TELEX: 310-287-780; FSC No.: 11332; Empl.: 300 ..... **A•1770; D•1255**

Local Sales Offices & Reps
AL Huntsville, Saber Assocs. 800-327-0853
CA Los Angeles, RF Assocs. 213-478-1586
CA Palo Alto, RF Assocs. 415-494-3331
FL Apopka, Saber Assocs. 800-432-6288
FL Bradenton, Saber Assocs. 800-432-6288
FL Coral Springs, Saber Assocs. 800-432-6288
FL Melbourne, Saber Assocs. 305-724-0920
FL Palm Bch., Saber Assocs. 800-432-6288
GA Atlanta, Saber Assocs. 800-327-0853
IL Mt. Prospect, Cain Forlaw 312-253-3578
MA Burlington, Microwave Mktg. Specialists 617-272-7530
NJ West Orange, EF Tech. Sls. 201-731-7203
NY Huntington Sta., EF Tech. Sls. 516-549-1818
NY Rochester, TCS (Technical Comp. Sls.) 716-342-2406
NC Clayton, Saber Assocs. 800-327-0853
OH Lancaster, Cain Forlaw 614-654-4800
PA Newtown, Hes Assocs. 215-860-9338
TX Dallas, Cain & Co. 214-247-3901

GENERAL NUMERIC CORPORATION, 390 Kent Avenue, Elk Grove Village, IL 60007, Tel: 312-640-1595, TELEX: 210036, FAX: 312-228-5490; Empl.: 125; *Sls. Mgr.:* James Scott

GENERAL OPTRONICS CORP., 2 Olsen Ave., Edison, NJ 08820, Tel: 201-549-9000, TELEX: 240302, FAX: 201-549-3926; FSC No.: 7W944; Empl.: 175; *Sls. Mgr.:* H. R. Moeller

GENERAL POWER SYS., 1045 S. East St., P.O. Box 65008, Anaheim, CA 92805-8508, Tel: 714-956-9321, TELEX: 678870; FSC No.: 04801; Empl.: 200; *Sls. Mgr.:* Ernest R. Murillo; *Dist. Mgr.:* Ernest R. Murillo

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Local Sales Offices & Reps

Instruments

AL	Birmingham, SESCO	205-988-8304
AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Long Beach, Saber Entprs.	213-595-5646
CA	Mountain View, Gado Instr. Sls.	415-961-2222
CA	San Diego, Saber Entrps.	619-271-1523
CO	Littleton, Radco	303-794-4279
CT	Cheshire, MECO, Inc.	203-271-0026
FL	St. Petersburg, SESCO	813-576-6991
GA	Altanta, SESCO	404-458-6423
IL	Des Plaines, Marsland Assocs.	312-694-2262
IA	Cedar Rapids, Marsland Assocs.	319-365-1908
LA	Baton Rouge, SESCO	504-928-4951
MD	Joppa, Electra-Tech	301-877-0344
MA	Reading, MECO, Inc.	617-944-6660
MI	Mt. Clemens, O'Hara Assocs.	313-791-7140
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Marsland Assocs.	314-991-1399
NJ	Hillsdale, CB Associates	201-664-6230
NM	Albuquerque, Qualtech	505-243-5605
NY	Rochester, TAE-REP	716-586-8710
NY	Schenectady, Tae-Rep, Inc.	607-692-3705
NY	Whitney Point, TAE-REP, Inc.	607-692-3705
NC	Cary, SESCO, INC.	919-467-7482
OH	Dayton, RIXAN Assocs.	513-278-4216
OH	Stow, Rixan Assocs.	216-686-2909
OK	Tulsa, SESCO	918-622-3868
SC	Greenville, SESCO, Inc.	803-297-8306
TN	Maryville, SESCO, Inc.	615-977-8239
TX	Austin, SESCO	512-892-2490
TX	Dallas, SESCO	214-231-9364
TX	Houston, SESCO	713-999-3510
TX	Plano, SESCO, Inc.	214-867-8880
VA	Dumfries, Electra-Tech	703-670-6962
WA	Seattle, Datacom Assocs.	206-285-2525
WI	New Berlin, Marsland Assocs.	414-786-6611

Components

AZ	Tempe, Qualtech, Inc.	602-967-4655
CA	Saratoga, TESTCO	408-253-1900
CO	Golden, J. F. Hurlbut Co.	303-279-7796
MD	Randallstown, Beacon North, Inc.	703-591-1300
MI	Farmington, W. R. Hummon & Assoc.	313-474-0661
OH	Dayton, RIXAN Assocs.	513-278-4216
OH	Stow, Rixan Assocs.	216-686-2909
TX	Dallas, Blackburn Assocs.	214-750-8927
TX	Houston, Blackburn Assocs.	713-463-1354
UT	Salt Lake City, J. F. Hurlbut Co.	801-531-7472
VA	Sterling, Beacon North, Inc.	703-478-2480

Local Distributors

CA	Saratoga, TESTCO	408-253-1900
OH	Dayton, RIXAN Assocs.	513-278-4216

GENERAL SCANNING, 500 Arsenal St., P.O. Box 307, Watertown, MA 02272, Tel: 617-924-1010, TELEX: 443-0105, FAX: 617-926-0708; Empl.: 275; *Sls. Mgr.:* Richard Colonna ..... **D•1418**

Local Sales Offices & Reps

CA	Redondo Bch., Gen. Scanning	213-543-4525

GENERAL SEMICONDUCTOR IND., INC., Square D Company, 2001 W. 10 Pl, Tempe, AZ 85281, Tel: 602-968-3101, TELEX: 910-950-1942; FSC No.: 24444;19500; Empl.: 625; *Sls. Mgr.:* Harold Blomquist; *Dist. Mgr.:* Howard Israel

GENERAL TECHNOLOGY CORP., 6816 Washington Avenue, NE, Albuquerque, NM 87109, Tel: 505-345-5591, FAX: 505-344-3227; Empl.: 75; *Sls. Mgr.:* Ralph H. Anderson

GENERAL TRANSISTOR CORP., 216 W. Florence Av., Inglewood, CA 90301, Tel: 213-673-8422, TELEX: 653474; FSC No.: 1P738; Empl.: 39; *Sls. Mgr.:* Al Barrios

GENERAL WIRE PRODUCTS, INC., 425 Shrewsbury Street, Worcester, MA 01604, Tel: 617-752-8260, FAX: 617-753-2173; FSC No.: 5F262; Empl.: 58; *Sls. Mgr.:* Thomas P. Andrews, Jr.

GENICOM

FAX: 703-949-1416

GENICOM CORP., 1 Genicom Dr., Waynesboro, VA 22980, Tel: 703-949-1471, TWX: 710-839-0407; FSC No.: 01526; Empl.: 2300; *Sls. Mgr.:* W. O. Bare ..... **B•1448-1451**

Local Sales Offices & Reps

AZ	Tempe, Genicom Corp.	602-968-6999
CA	Bell Canyon, Genicom Corp.	818-884-1638
CA	Fremont, Genicom Corp.	415-796-7600
CA	Santa Ana, Genicom Corp.	714-549-5101
CA	Westlake, Genicom Corp.	805-373-8509
CT	Meriden, Genicom Corp.	203-238-6876
GA	Norcross, Genicom Corp.	404-449-1021
IL	Rolling Meadows, Gencicom Corp.	312-577-1100
MD	Rockville, Genicom Corp.	301-770-4434
MA	Woburn, Genicom Corp.	201-737-9696
MN	Bloomington, Genicom Corp.	612-854-2909
NJ	Edison, Genicom Corp.	201-738-9696
NY	Hauppauge, Genicom Corp.	516-434-8228
TX	Dallas, Genicom Corp.	214-387-5774
Can	Nepean, Ont., Genicom Corp.	613-726-0215

Local Distributors

CA	Santa Ana, Norstan	800-854-8344
CA	Santa Ana, Norstan Elctrns.	714-540-4168
FL	Orlando, T & T Prods., Inc.	305-857-2282
FL	Orlando, T & T Products	305-857-2282
MD	Towson, Electronic Comp. Sls.	800-638-4221
NY	Farmingdale, Midway Indl. Elctrns.	516-293-6800
NY	Farmingdale, Midway Indl. Elctrns., Inc.	516-293-6800
NY	Rochester, Aquas Elctrns.	716-454-7800
NC	Charlotte, Electronics Mktg. Corp.	704-394-6195
OH	Cleveland, Electronics Mktg. Corp.	216-442-3441
OH	Columbus, Electronics Mktg. Corp.	614-299-4161
OH	Dayton, Elctrns Mktg. Corp.	513-278-5745
OH	Highland Heights, Electronics Mktg. Corp.	216-442-3441
TX	Dallas, Associated Aircraft Supp. Co.	214-331-4381
WA	Redmond, Pan Pacific Elctrns.	206-881-7252
WA	Redmond, Pan Pacific Elctrns., Inc.	206-881-7252

GENISCO MEMORY PRODS. CORP., 10874 Hope St., Cypress, CA 90630, Tel: 714-220-0720, TWX: 910-347-6773, FAX: 714-952-1932; FSC No.: 96682; Empl.: 248; *Sls. Mgr.:* John Krill

GENISCO TECHNOLOGY CORP., Eldema Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 03797; Empl.: 450; *Sls. Mgr.:* W. R. Esser

GENISCO TECHNOLOGY CORP., Filters Div., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 07294; Empl.: 450; *Sls. Mgr.:* T. Cantine

GENISCO TECHNOLOGY CORP., 18435 Susana Rd., Rancho Dominguez, CA 90221, Tel: 213-537-4750, TWX: 910-346-6773; FSC No.: 13946; Empl.: 450; *Sls. Mgr.:* F. Schodlbauer

GENISCO TECHNOLOGY CORP., Transducers Products Div., 650 Easy St., Simi Valley, CA 93065, Tel: 805-581-3985, TWX: 910-494-4782; FSC No.: 65998; Empl.: 450; *Sls. Mgr.:* John E. Smith

GENNUM CORPORATION, Linear Technology Inc., P.O. Box 489, Sta. A, Burlington, ON, Canada L7R 3Y3, Tel: 800-263-9353, 416-632-2996, TELEX: 061-8525, FAX: 416-632-2055; Empl.: 180; *Sls. Mgr.:* C. Marshall/I. H. Scott

GENRAD, INC., 300 Baker Ave., Concord, MA 01742, Tel: 617-369-4400

GENROCO, INC., 205 Kettle Moraine Drive North, Slinger, WI 53086-9407, Tel: 414-644-8700, TELEX: 158279420, FAX: 414-644-6667; *Sls. Mgr.:* Donald D. Woelz; *Dist. Mgr.:* Barbara Pick

GENSTAR REI SALES COMPANY

FAX: 818-715-9249

GENSTAR RENTAL ELECTRONICS, INC., 6307 De Soto Ave., Suite J, Woodland Hills, CA 91367, Tel: 800-331-3440 (in CA), 800-227-8409 ..... **D•1257**

GENTEX, Box 315, Carbondale, PA 18407, Tel: 603-434-0311, TELEX: 831-883; FSC No.: 97427; *Sls. Mgr.:* Ture Heline

GENTRON CORP., 6667 N. Sidney Pl, Milwaukee, WI 53209, Tel: 414-351-1660, TELEX: 26881, FAX: 414-351-4573; FSC No.: 270-7400; Empl.: 100; *Sls. Mgr.:* William Tennie; *Dist. Mgr.:* W. Schmidt/D. Janes/B. Foye

Local Sales Offices & Reps

CA	Alhambra, M. W. Riedel & Co.	213-283-7694
CA	Fullerton, Robert Arnstein-Gentron Sls.	714-773-0843
DE	Clinton, Selmark Assoc., Inc.	203-573-9088
IL	Berkeley, ESA Tech. Mktg.	312-544-0120
MA	Millis, Selmark Assocs.	617-376-2914
MN	Minneapolis, Furber Sls.	612-881-3620
MO	Grandview, R. R. Burton & Assocs.	816-763-5385
NH	Hopkinton, Selmark Assocs.	603-746-3299
NJ	Wyckoff, North East Comps. Co., Inc.	201-848-1102
OH	Columbus, Tom Mulligan Co.	614-457-2242
OR	Portland, SPS Elctrns.	503-297-6919
TX	Dallas, John B. Guenther, Inc.	214-691-8500
WA	Redmond, SPS Elctrns.	206-323-4140

Local Distributors

CA	San Francisco, Steven Engrg.	415-588-9200
MA	Hingham, Sager Elec. Supp. Co.	617-749-6700
MI	Madison Hgts., Galco	800-521-1615
MI	Mount Clemens, Excel	313-463-3811
NC	Gastonia, JMT Elctrn. Supply Co.	704-867-4401
TX	Fort Worth, Allied Elctrns.	817-336-5401
WI	Milwaukee, Seaker Elctrns.	414-878-3727
WI	Salem, DST/Drive Sys. Technlg.	414-843-3177

GEOPHYSICAL SURVEY SYSTEMS, INC., 15 Flagstone Dr., Hudson, NH 03051, Tel: 603-889-4841, TELEX: 953038; FSC No.: 02-0278634; Empl.: 45; *Sls. Mgr.:* J. V. Rosetta, Jr.

FAX: 703-368-1078

GEORATOR CORP., Box 70, Manassas, VA 22110-0070, Tel: 703-368-2101, TELEX: 892-431; Empl.: 49; *Sls. Mgr.:* Charles E. Trefzger ..... **D•2110-2112**

GERMANIUM POWER DEVICES, Box 3065, Shawsheen Village Sta., Andover, MA 01810, Tel: 617-475-5982, TELEX: 94-7150, FAX: 617-470-1512; FSC No.: 53399; Empl.: 100; *Sls. Mgr.:* R. W. Kassiotis

GETTYSBURG TRANSFORMER CORPORATION, 1380 Old Harrisburg Rd., P.O. Box 99, Gettysburg, PA 17325, Tel: 717-334-2191, FAX: 717-334-4961; Empl.: 55; *Sls. Mgr.:* Charles A. Ritter

GEYER SYSTEMS, See GSI Corp.

GFC/HAMMOND ELECTRONICS, INC., Hammond Manufacturing Co., 1690 Walden Ave., Buffalo, NY 14225, Tel: 716-894-5710, FAX: 716-894-1156; *Sls. Mgr.:* Dave Oliver

GGB INDUSTRIES, INC., Picoprobe Division, P.O. Box 125, Gillette, NJ 07933, Tel: 201-464-1749, TELEX: 136692 GGB, FAX: 201-647-2460; *Sls. Mgr.:* Greg Boll

Local Sales Offices & Reps

MN	Minneapolis, Marketiers	612-890-5406
NJ	New Foundland, Bob Most Assoc.	201-697-0800

GHIELMETTI, INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770, Tel: 213-463-5111, TWX: 910-321-2903; Empl.: 4; *Sls. Mgr.:* David Mendoza

GIANNINI PETRO MARINE, 9474 Chesapeake Dr., San Diego, CA 92123, Tel: 619-569-1668; FSC No.: 24727; Empl.: 10

GIBSON/EGAN, See Textool Test & Interconnect Prods. Dept., 3M; Electronic Prods. Div.

GIC THERMODYNAMICS, 2611 Parmenter, Royal Oak, MI 48073, Tel: 313-280-1648, TELEX: 23-5714, FAX: 313-280-0998; Empl.: 20; *Sls. Mgr.:* Denny Desmond

GIDDINGS & LEWIS ELECTRONICS, A Unit of AMCA International, 666 S. Military Rd., P.O. Box 1658, Fond du Lac, WI 54935, Tel: 414-921-7100, TELEX: 26-2722, TWX: 910-275-1100; Empl.: 200; *Sls. Mgr.:* Jim Wickert

GILTRONIX, 3780 Fabian Way, Palo Alto, CA 94303, Tel: 415-493-1300, TELEX: 345542, FAX: 415-493-5410; *Sls. Mgr.:* Dave Littlefield

Gilway Technical Lamp

FAX: 617-938-5867

GILWAY TECHNICAL LAMP, 800 W. Cummings Pk., Woburn, MA 01801, Tel: 617-935-4442, TELEX: 287617 GWAY UR; FSC No.: 3T059; Empl.: 17; *Sls. Mgr.:* Clark Benjamin III; *Dist. Mgr.:* W. C. Fotino ..... **B•1126-1129**

GIMIX, INC., 1337 W. 37th Place, Chicago, IL 60609, Tel: 312-927-5510, TWX: 910-221-4055; Empl.: 14; *Sls. Mgr.:* Richard Don

GLAR-BAN, A MARK IV COMPANY, 199 Wales Ave., Tonawanda, NY 14150, Tel: 716-694-5076, TELEX: 91578; Empl.: 50; *Sls. Mgr.:* William H. Scoville

GLASGAL COMMUNICATIONS, INC., 151 Veterans Dr., Northvale, NJ 07647, Tel: 201-768-8082, TWX: 710-991-8585; Empl.: 130; *Sls. Mgr.:* Al Harnish

FAX: 201-534-5672

GLASSMAN HIGH VOLTAGE INC., P.O. Box 551, Salem Indl. Pk., Whitehouse Sta., NJ 08889, Tel: 201-534-9007, TWX: 710-480-2839; Empl.: 60; *Sls. Mgr.:* John R. Belden ..... **D•1732-1743**

GLATZER INDUSTRIES CORP., 15 River St., New Rochelle, NY 10801, Tel: 914-576-2700; Empl.: 25; *Sls. Mgr.:* Patricia M. Wyllie

GLENAIR INC., 1211 Air Way, Glendale, CA 91201-2497, Tel: 818-247-6000, TELEX: 67-3485, TWX: 910-437-2066, FAX: 818-500-9912; FSC No.: 06324; Empl.: 485; *Sls. Mgr.:* Ronald E. Platz

GLENMARC MANUFACTURING INC., 970 Woodlands Pkwy., Vernon Hills, IL 60061, Tel: 312-634-6080, TELEX: 754427 GLEN UD, FAX: 312-634-9527; Empl.: 13; *Sls. Mgr.:* David Greenwood

GLEN MILLS INC., 203 Brookdale St., Maywood, NJ 07607, Tel: 201-845-4665, TELEX: 134 656, FAX: 201-487-8469; Empl.: 11; *Sls. Mgr.:* Stanley I. Goldberg

GLENRO, INC., 39 McBride Ave. Extension, Paterson, NJ 07501, Tel: 201-279-5900, 800-922-0106, FAX: 201-279-9103; Empl.: 50; *Sls. Mgr.:* Sterling Pitt

GLOBAL SPECIALTIES, Interplex Electronics, Inc., 70 Fulton Terrace, P.O. Box 1942, New Haven, CT 06509, Tel: 203-624-3103, FAX: 203-468-0060; Empl.: 70; *Sls. Mgr.:* Dan Marley

GLOBAL TECHNOLOGY INTERNATIONAL, INC., 917-134th Street S.W., Everett, WA 98204, Tel: 206-742-9111, ESYLNK: 759633, FAX: 206-743-7420; Empl.: 61; *Sls. Mgr.:* Ruskin A. Whaley, V.P. Sls. & Mktg.

GLOBE BATTERY DIV., See Johnson Controls, Globe Battery Div.

GLOBE MOTORS, 2275 Stanley Avenue, Dayton, OH 45404, Tel: 513-228-3171, TELEX: 288-224, TWX: 810-459-1642, FAX: 513-229-8531; Empl.: 580; *Sls. Mgr.:* Bill Pelfrey; *Dist. Mgr.:* Tom Coyle

GLOBE PLASTICS, 1342 S. Signal Dr., Pomona, CA 91766, Tel: 714-623-2747; FSC No.: 21071; Empl.: 23; *Sls. Mgr.:* J. R. Humphreys

Local Distributors

CA	Fremont, Alatec Prods.	408-279-8895
CA	N. Hollywood, Alatec Prods.	818-764-5600
NJ	Pine Brook, Alatec Prods.	201-227-8140
TX	Arlington, APX Plastics	817-275-3883

GLOBE UNION, See Johnson Controls, Globe Battery Div.

GM NAMEPLATE, INC., 2040 15th Ave. West, Seattle, WA 98119, Tel: 206-284-2200, FAX: 206-284-3705; Empl.: 340; *Sls. Mgr.:* Ed Westfall ..... **B•1819**

Local Sales Offices & Reps

AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Orange, GM Nameplate	818-574-6960
CA	Redwood City, G. R. McKnight Co., Inc.	415-365-3703
CA	San Jose, GM Nameplate, Inc.	408-435-1666
CO	Loveland, GM Nameplate, Inc.	303-688-4154
GA	Atlanta, Electramark, Inc.	404-446-7915
FL	Deerfield Bch., Jack Krutek & Assocs.	305-427-4202
HI	Honolulu, Menehune Unltd.	808-737-3472
ID	Eagle, GM Nameplate	208-939-7202
IL	Elgin, Custom Engineered Parts, Inc.	312-741-8556
IN	Zionsville, Custom Engineered Parts, Inc.	317-873-5626
MI	Southfield, E & A Inds.	313-647-0330
MO	St. Louis, Halpin D. Burke & Son	314-968-2727
NH	Mont Vernon, GM Nameplate, Inc.	603-673-9737
NJ	Pitman, Colrud Corp.	609-589-5866
NJ	W. Caldwell, Grimm, Siegel Assocs.	201-575-9300
NC	Raleigh, Eastern Elctrns.	919-876-7591
OH	Akron, Augnat Assocs.	216-239-2499
OR	Eugene, Charles Huntington	503-726-1835
TX	Irving, Elctrn. Dev. & Sls.	214-929-8140
VA	Reston, Colrud Corp.	703-620-6612
WA	Bellevue, American Intl. Entprs.	206-455-4697
EXP	Singapore, S & T Entprs.	065-745-9235

GMR CO., 8801 Sepulveda Blvd., Los Angeles, CA 90045, Tel: 213-216-9516, TELEX: 499 2468; Empl.: 87; *Sls. Mgr.:* Harvey Mushman

GNB INCORPORATED, 2010 Cabot Blvd. W., Langhorne, PA 19047, Tel: 215-750-2600, TELEX: 4761219 GNBLAHN

GPE

FAX: 714-993-6023

GOLDEN PACIFIC ELECTRONICS, INC, 560 S. Melrose St., Placentia, CA 92670, Tel: 714-993-6970; Empl.: 15; *Sls. Mgr.:* Pat Waldron ..... **D•1029, 1467, 1744**

Local Sales Offices & Reps

CA	Garden Grove, ELSCO Elctrns	714-891-4621
CA	Norwalk, Ed Rivers Assocs.	213-868-1471
CA	San Jose, Applied Eltcrns Mktg	408-971-9377
CO	Longmont, Butler Tech. Sls.	303-651-7703
IL	Arlington Heights, M.J. Peterson & Assocs.	312-577-8220
NH	Londonderry, Bennetron	603-432-9092
NJ	Wayne, Breen Assocs	201-696-8683
NY	Syracuse, Northeastern Elctrns., Inc.	315-455-7561
OR	Beaverton, Core II Mktg	503-641-0877
UT	Bountiful, Duven Assocs	801-295-0353

GOOD-ALL ELECTRIC, INC., 3725 Canal Drive, Fort Collins, CO 80524, Tel: 303-484-3080, 800-826-7891, TWX: 910-930-9015, FAX: 303-484-8649; FSC No.: 22096; Empl.: 100; *Sls. Mgr.:* David J. Wilkening

GOODNIGHT SYSTEMS, 18523 Collins, Ste. 4, Tarzana, CA 91356, Tel: 818-703-1524; *Sls. Mgr.:* Jim Goodnight

GORDON CO., 5710 Kenosha St., Richmond, IL 60071, Tel: 815-678-2211, TELEX: 72-2427; Empl.: 260

GORDON, L., PACKAGING, 1050 S. Paca St., Baltimore, MD 21230, Tel: 301-539-6537; Empl.: 150

GORDON PRODUCTS, 67 Del Mar Dr., Brookfield, CT 06804, Tel: 203-775-4501; Empl.: 45; *Sls. Mgr.:* Leon Najman; *Dist. Mgr.:* Leon Najman

GORDOS CORPORATION

FAX: 501-636-2305

GORDOS CORPORATION, Reed Relay Division, 1903 Town West Drive, P.O. Box 824, Rogers, AR 72757, Tel: 501-636-2111, TWX: 910-720-7998; Empl.: 350; *Sls. Mgr.:* B. Garlock, Prod. Mgr. ..... **B•1452-1463, 1712**

Local Sales Offices & Reps

CA	Milpitas, Maxim Elctrns. Sls.	408-946-6001
CA	Westminster, West Elctrn. Sls.	213-493-5569
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Woodbury, Anacon Sls. Assocs.	203-266-0707
FL	Tampa, Florida Comp. Sls., Inc.	813-960-7044
IL	Schaumburg, Martan, Inc.	312-303-5660
IN	Indianapolis, Hi-Tek Sls.	317-887-2564
IA	Marion, Ensco Reps., Inc.	319-377-8551
KS	Countryside, Ensco Reps., Inc.	913-384-0840
KS	Wichita, Ensco Reps., Inc.	316-683-1070
MD	Glen Burnie, Tri-Mark	301-761-6000
MA	Wilmington, Anacon Sls. Assocs.	617-270-3712
MO	Maryland Hgts., Ensco Reps., Inc.	314-423-3935
NJ	Budd Lake, Guido Assocs.	201-347-4643
NJ	Lawrenceville, D.V.S. Co.	609-896-1112
NM	Albuquerque, Syntech	505-266-7951
NY	Pittsford, Noeth-Honsinger Assocs.	716-586-9002
NC	Silver City, Crossroads Elctrn. Assocs.	919-742-2372
OH	Centerville, Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	513-434-5507
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
TX	Austin, Advanced Tech. Sls.	512-225-6304
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	613-440-3888
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Grafton, Martan, Inc.	414-377-6640

GORDOS CORPORATION, A Flint Industries Company, 1000 N. Second St., P.O. Box 824, Rogers, AR 72757, Tel: 501-636-5000, TWX: 910-720-7998, FAX: 501-636-2305 ..... **A•1736; B•1452-1463**

Local Sales Offices & Reps

CA	Costa Mesa, Jim Pancake	714-751-6760
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CA	San Diego, West Elctrn. Sls. Co.	619-233-0236
CA	Westminster, West Elctrn. Sls. Co.	213-493-5569
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Woodbury, Anacon Sls. Assocs.	203-266-0707
FL	Deerfield Bch., Florida Comps., Inc.	305-429-1758
FL	Tampa, Florida Comps., Inc.	813-960-7044
IL	Schaumberg, Martan, Inc.	312-303-5660
IN	Indianapolis, Hy-Tek Sls. Co.	317-887-2564
MD	Glen Burnie, Tri-Mark	301-761-6000
MA	Wilmington, Anacon Sls. Assocs.	617-270-3712
MI	Troy, Pyramid Integrated Control Sys.	313-362-5375
MO	Maryland Hgts., Ensco Rep, Inc.	314-423-3935
NJ	Budd Lake, Guido Assocs.	201-347-4643
NJ	Lawrenceville, DVS Co.	609-896-1112
NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Silver City, Crossroads Elctrn. Assocs.	919-742-2372
OH	Centerville (Dayton), Omega Sls., Inc.	513-434-5507
OH	Shaker Hgts., Omega Sls., Inc.	216-751-9600
OK	Tulsa, Advanced Tech. Sls.	918-664-0482
OR	Beaverton, Venture Elctrns., Inc.	503-626-7418
TX	Austin, Advanced Tech. Sls.	512-331-9979
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advanced Tech. Sls.	613-440-3888
WA	Bellevue, Venture Elctrns., Inc.	206-454-4594
WI	Grafton, Martan, Inc.	414-337-6640
WI	Milwaukee, Bill Swanson	414-543-2727
EXP	AZ/Rogers, Gordos	501-636-5000

Local Distributors

AL	Auburn, Interstate Elctrl. Supp.	205-821-3341
AL	Birmingham, Sesco	205-988-8304
AL	Montgomery, Control Comps.	205-264-3325
AL	Tempe, Control Design	602-829-7981
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AZ	Tucson, Future	602-882-0808
CA	Anaheim, Control Design	213-821-1516
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Hayward, Kea Elctrns.	415-887-2900
CA	Irvine, Future	714-250-4141
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Los Angeles, Control Design	213-802-1371
CA	Los Angeles, Elec. Switches	213-660-1310
CA	Riverside, Elctrn. Supp.	714-683-7300
CA	Sacramento, Integrated Elctrns.	916-424-5299
CA	San Carlos, Control Design	415-592-4808
CA	San Diego, Elctrn. Supp.	619-693-8222
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Francisco, Control Design	408-996-9197
CA	San Jose, Future	408-434-1114
CA	San Jose, Integrated Elctrns.	408-435-1000
CA	Santa Ana, Ben-Dec	714-545-3968
CA	Santa Clara, Future	408-748-8550
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Bell	303-424-1985
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Time Elctrns.	303-799-8851
CO	Westminster, Future	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Altamonte Springs, Control Design	305-788-3220
FL	Clearwater, Future	813-578-2770
FL	Ft. Lauderdale, Control Design	305-782-1388
FL	Ft. Lauderdale, Hammond	305-973-7103
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Lakeland, AA Elec.	813-665-6911
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FL	Orlando, Hammond	305-849-6060
FL	Orlando, Time Elctrns.	305-841-6565
FL	St. Petersburg, Sesco	813-576-6991
GA	Atlanta, Sesco	404-458-6423
GA	Columbus, Interstate Elctrl. Supp.	404-324-1000
GA	Norcross, AA Elec.	404-449-8670
GA	Norcross, Future	404-441-7676
GA	Norcross, Time Elctrns.	404-448-4448
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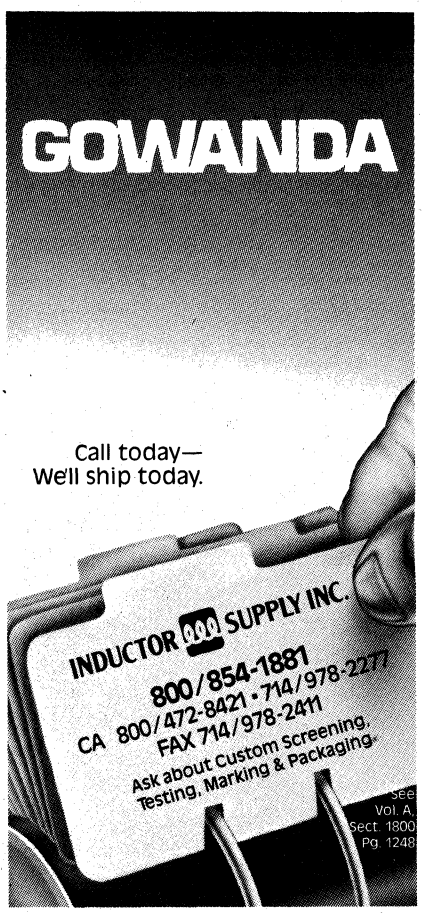
IL	Addison, Pyramid Controls	312-543-0110



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IL	Chicago, Control Design	312-882-7232
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IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IL	Rockford, Pyramid Controls	815-968-8388
IL	Schaumburg, Future	312-882-1255
IL	Wood Dale, Time Elctrns.	312-350-0610
IN	Indianapolis, Control Design	317-788-4559
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LA	Baton Rouge, Sesco	504-928-4951
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MD	Columbia, Jaco	301-995-6620
MD	Columbia, Time	301-964-3090
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MA	Westboro, Future Elctrns.	617-366-2400
MA	Wilmington, North-Star Elctrns.	617-657-5155
MA	Woburn, Control Design	617-932-9404
MI	Ann Arbor, McNaughton-McKay Elec. Co.	313-995-9515
MO	Chesterfield, Advanced Ind. Sys., Inc.	314-532-2477
MI	Detroit, Future	313-261-5270
MI	Detroit, Newark Elctrns.	313-967-0600
MI	Kalamazoo, Pyramid Controls Inc.	616-327-3733
MI	Madsion Hgts., McNaughton-McKay Elec. Co.	313-399-7500
MI	Oak Pk., Newark Elctrns.	313-968-2950
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Eden Prairie, Future	612-944-2200
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Newark Elctrns.	612-331-6350
MO	Ellisville, AIS	314-391-0366
MO	Kansas City, L Comp	816-221-2400
MO	St. Louis, Control Design	314-426-3150
MO	St. Louis, Future	314-537-0688
MO	St. Louis, L Comp	314-291-6200
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	E. Rutherford, AA Elec.	201-777-5477
NJ	Fair Lawn, Relay Specialties	201-337-1000
NJ	Fairfield, Future	201-227-4346
NJ	Mt. Laurel, Future	609-778-7600
NJ	Pennsauken, Resco	609-662-4000
NM	Albuquerque, Elctrn. Dvcs.	505-884-2950
NY	Bohemia, Key Comps.	516-567-7500
NY	Buffalo, Summitt	716-884-3450
NY	Hauppauge, Future	516-234-4000
NY	Hauppauge, Jaco	516-273-5500
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Liverpool, Future	315-451-2371
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NY	Rochester, Simcona	716-328-3230
NY	Rochester, Summitt	716-334-8110
NY	Syracuse, Future	315-432-1355
NY	Syracuse, Time Elctrns.	315-432-1355
NC	Charlotte, Carolina Elec. Supp. Co.	704-527-6555
NC	Charlotte, Control Design	704-588-4410
NC	Charlotte, Future	704-529-5500
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Sesco	919-467-7482
OH	Columbus, Elctrns. Mktg. Corp.	614-299-4161
OH	Dublin, Time Elctrns.	614-761-1100
OH	Highland Hgts., Elctrns. Mktg. Corp.	216-442-3441
OH	Keetering, Elctrns. Mktg. Corp.	513-439-4711
OK	Tulsa, Sesco	918-622-3868
OR	Beaverton, Cascade Data Mktg.	503-641-9266
OR	Beaverton, Future	503-645-9454
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Portland, Bell	503-241-4115
OR	Portland, Time Elctrns.	503-684-3780
PA	Bristol, Aim Elctrns.	215-785-3500
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	Malvern, Control Design	215-296-0150
PA	Newton Sq., QDI	215-359-1000
PA	Philadelphia, Future	609-778-7600
PA	Willow Grove, Resco Elctrns.	215-659-4575
SC	Greenville, Ensco (Hammon)	803-233-4121
SC	Greenville, Sesco	803-297-8306
SC	Spartanburg, Roberts Elec. Supp. Inc.	803-574-0350
TN	Hixson, Techni-Tronics	615-842-0514
TN	Knoxville, B&K Sls.	615-584-2255
TN	Knoxville, Sesco	615-588-5455
TN	Nashville, AA Elec.	615-832-6632
TX	Austin, Sesco	512-892-2490
TX	Carrollton, Time Elctrns.	214-241-7441
TX	Dallas, Control Design	214-358-1441
TX	Dallas, Newark Elctrns.	214-340-3585
TX	Dallas, Sesco	214-231-9364
TX	Houston, GEA of TX	713-781-3005
TX	Houston, Newark Elctrns.	713-782-4800
TX	Houston, Sesco	713-999-3510
TX	Houston, Time Elctrns.	713-530-0800
TX	Richardson, Future	214-437-2437
TX	Richardson, Jaco	214-235-9575
UT	N. Salt Lake City, Integrated Elctrns.	801-298-1869
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Future	801-972-8489
UT	Salt Lake City, Time Elctrns.	801-973-8181
VA	Chester, Virginia Control Equip. Co.	804-796-3081
VA	Roanoke, Virginia Control Equip. Co.	703-342-6927
WA	Bellevue, Bell	206-747-1515
WA	Bellevue, Cascade Data Mktg.	206-747-6190
WA	Bellevue, Future	206-881-8199
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Bellevue, Time Elctrns.	206-641-3640
WA	Redmond, Time Elctrns.	206-882-1600
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GOULD INC., Test and Measurement, 3631 Perkins Avenue, Cleveland, OH 44114, Tel: 216-361-3315, TELEX: 196113GLD RS UT; FSC No.: 96795; Empl.: 550

GOWANDA ELECTRONICS CORP., 1 Industrial Pl, Gowanda, NY 14070, Tel: 716-532-2234, TWX: 710-529-1211; FSC No.: 24226;15305; Empl.: 250; *Sls. Mgr.:* K. Strohmeyer ..... **A•1245**

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CA	Fremont, William Parks Assocs.	415-796-0875
CA	San Diego, Earle & Assocs.	619-278-5441
CA	San Diego, Earle Assocs.	619-278-5441

CA Westminster, West Elctrn. Sls. 714-898-1646
CO Westminster, Western Region Mktg. .. 303-430-8883
FL Longwood, NSL Assocs. 305-629-5226
GA Atlanta, L & D, Inc. 404-395-7079
IL Niles, W. F. Hamilton Co. 312-965-8757
IA Cedar Rapids, Snider Sls. Co. 319-362-4410
KS Overland Park, Barnes MidWest Sls. .. 913-469-9688
MA Reading, Lincoln Assocs. 617-664-4434
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MN Chanhassen, Barnes Sls. Assocs. 612-934-2907
NJ Whippany, Robert Smith Assocs. 201-540-0204
NY Morrisville, Naylor Electric 315-684-9620
NY Plainview, Robert Smith Assocs. 516-681-3155
NC Raleigh, L & D, Inc. 919-876-5301
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OH Cleveland, Stegman Blaine Mktg. 216-572-0003
PA Exton, Linear Sls. 215-524-8080
TX Dallas, Scanlon, Hughes & Assocs. ... 214-739-2888
WA Olympia, Bergford & Assocs. 206-866-2001
Can St. Laurent, Componetics 514-334-1464

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CA Hayward, KEA Elctrns. 415-887-2900
CA Huntington Beach, Inductor Supp. 714-891-4524
CA Stanton, Inductive Comps. & Crystal .. 714-828-4320
CT Bridgeport, Park Distributors 203-366-7200
MN Chanhassen, G&F Distribution 612-934-2907
NY Hauppauge, Broadline Electric 516-231-4100

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NY Tarrytown, Gralex Inds., Inc. 914-631-2978

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IL Chicago, Metermaster 312-593-8650
MA Billerica, Electra Test, Inc. 617-667-8541
MA Boston, Calibron 617-894-6440
NJ S. Hackensack, Concord Elctrns. 201-488-0008, 1-800-222-1298
NY Great Neck, Instr. Mart Inc. 516-487-7430
OH Cleveland, Metermaster 216-651-4100
TX Dallas, Metermaster 214-271-5671

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GRAPHTEC SERVICES, INC., 1600 N.W. Madrid Way, P.O. Box 1380, Boca Raton, FL 33432, Tel: 305-392-3373; Empl.: 7

GRASSLIN CONTROLS CORP., Dieter Grasslin Feinwerktechnik, 45 Spear Rd., Ramsey, NJ 07446, Tel: 201-825-9696, TELEX: 4949211, FAX: 201-825-8694; Empl.: 5

GRAYHILL INC., 561 Hillgrove Ave., La Grange, IL 60525, Tel: 312-354-1040, TELEX: 6871375 GHLG UW, TWX: 910-683-1850; FSC No.: 5930; Empl.: 1000; *Sls. Mgr.:* Richard K. Neumann; *Dist. Mgr.:* Robert J. Ferrel ..... **B•1464-1465, 1713-1719, 1820-1821; C•1375**

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FL Deerfield Beach, Newell-Hynes 305-429-3207
GA Tucker, Rep, Inc. 404-938-4358
IL La Grange, Grayhill, Inc. 312-354-1040
IN Ft. Wayne, Menze Sls. 219-747-5616
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Overland Pk., Spectrum Sls. 913-648-6811
MD Gaithersburg, Naudain Assocs. Southern 301-258-5040
MA Needham Hgts., Newscott Co. 617-444-1923
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NJ Marlton, Naudain Assocs. 609-983-5300
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NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
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NC Raleigh, R. W. Chapman 919-782-2624
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OH Dayton, A. H. Baier Co. & Assocs. 513-276-4128
OR Tigard, Eltech, Inc. 503-684-3458
PA Pittsburgh, Covert & Newman Co. 412-531-2002
SC Greenville, Robert W. Chapman & Co. 803-288-8821
TN Jefferson City, Rep, Inc. 615-475-9012
TX Austin, W. Pat Fralia Co. 512-835-7911
TX Euless, W. Pat Fralia Co. 817-267-3577
TX Houston, W. Pat Fralia Co. 713-772-1572
UT Salt Lake City, Lindberg Co. 801-277-2643
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Can Pickering, Ont., A. C. Simmonds & Sons Ltd. 416-839-8041

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AZ Tempe, D C Elctrns. 602-438-1234
AZ Tempe, Harper SID 602-967-1464
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CA Garden Grove, Richey/Western 714-895-0060
CA Gardena, Calif. Switch 213-770-2330
CA Los Angeles, Electric Switches 213-660-1310
CA Riverside, Electronic Supp. 714-683-7300
CA San Diego, Electronic Supply 619-693-8222
CA San Diego, Harper S.I.D. 619-578-2500
CA San Diego, Richey/Western Electrns. 619-271-4511
CA San Jose, Powell Elctrns. 408-943-9020
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Santa Clara, Richey/Western Electrns. 408-432-7100
CA Santa Monica, Master Distributors 213-452-1229
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID, Inc. 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Industrial Elctrns. 303-694-9444
CO Englewood, Shelley Ragon, Inc. 303-762-0670
CT Wallingford, Midan Elctrns. 203-265-2077
CT Wallingford, Sager 203-265-4600
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Orlando, Hammond Elctrns., Inc. 305-849-6060
FL Pompano Beach, Peerless Radio 305-973-4141
GA Norcross, Hammond Elctrns., Inc. 404-449-1996
GA Norcross, Pioneer/Georgia 404-448-1711
HI Honolulu, Precision Radio 808-537-5291
IL Chicago, Newark Elctrns. 312-784-5100
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IL Chicago, Waldom Elctrns. 312-585-1212
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IN Indianapolis, Bell Ind./Graham Div. ... 317-875-8200
IN Indianapolis, PEI/Genesis 317-637-5571
IA Cedar Rapids, Advent Elctrns. 319-332-8407
IA Cedar Rapids, Dee Elctrns., Inc. 319-365-7551
MD Baltimore, Rescoe/Baltimore 301-529-0500
MD Columbia, Powell Elctrns. 301-621-8080
MD Gaithersburg, Pioneer/Wash. 301-921-0660
MD Jessup, Treeko S/S, Inc. 301-792-0112
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elctrns. 617-749-6700
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MI Livonia, R.S. Elctrns. 313-525-1155
MI Oak Park, Newark/Detroit Elctrns. 313-967-0600
MI St. Clair Shores, Spemco 313-771-2700
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MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, LComp, Inc. 816-221-2400
MO Maryland Hgts., LComp, Inc. 314-291-6200
MO St. Charles, Finnigan Elctrns., Inc. 314-946-6201
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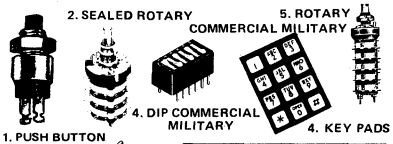

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VA	Richmond, Sterling Elctrns.	804-226-2190
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FAX: 609-261-0921

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IL	Crystal Lake, J. D. Noble & Assocs., Inc.	815-455-5084
MD	Poolesville, Westerly Assocs. Inc.	301-972-8176
MA	Burlington, Omni-Rep	617-245-4511
MN	Bloomington, Paul Ericson & Assocs.	612-831-5016
MO	St. Louis, Abrams & Assocs.	314-569-0447
NJ	Ho-Ho-Kus, D. J. Fisher Co., Inc.	201-652-0090
OH	Rocky River, Norm Case Assocs.	216-333-0400
RI	Cumberland, Omni-Rep	401-333-2353
TX	Irving, Elctrn. Dev. & Sls.	214-570-5122
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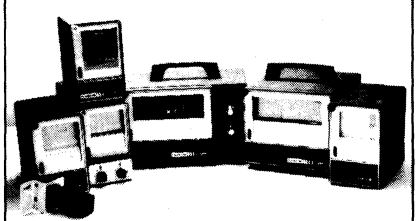

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PA Elkins Park, Edwin F. Gregg 215-635-0450
TN Knoxville, Robert Olsen Co. 615-688-4038

HARRIS CORP., Computer Systems Div., 2101 W. Cypress Creek Rd., Ft. Lauderdale, FL 33309, Tel: 305-974-1700, TWX: 510-956-3096; FSC No.: 29436; Empl.: 1000

HARRIS CORP., Dracon Div., 809 Calle Plano, Camarillo, CA 93010, Tel: 805-987-9511, TELEX: 182327; Empl.: 325; *Sls. Mgr.:* Tom Erdmann; *Dist. Mgr.:* Keith Boutillier

HARRIS MICROWAVE SEMICONDUCTOR, 1530 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-433-2222, TWX: 910-338-2247, FAX: 408-432-3268; *Sls. Mgr.:* Vic Kovacevic

HARRIS SEMICONDUCTOR, Box 883, Melbourne, FL 32901, Tel: 305-724-7400, TWX: 510-959-6259; FSC No.: 34371; Empl.: 2300; *Sls. Mgr.:* Dan McCranie; *Dist. Mgr.:* Charles H. Beaty

HARTLEY PRODUCTS, 1200 N. 23rd St., Ste. 105, Wilmington, NC 28405, Tel: 919-763-7422; *Sls. Mgr.:* R. Schmetterer

HARTMANN, 10097 Tyler Place, Ijamsville, MD 21754, Tel: 301-831-1055, FAX: 301-831-8072; Empl.: 2; *Sls. Mgr.:* Nancy Schwartz ..... **B•1722**

Local Sales Offices & Reps

AZ Tempe, Hans Tech. Assocs. 602-838-3545
CA Torrington, Phoenix Sls. 203-496-7709
CT Torrington, Phoenix Sls. 203-496-7709
IA Cedar Rapids, Tech. Elctrns., Inc. 319-366-5443
PA Frazer, Indl. Comps. 215-889-0650
TX Dallas, Edward Aymond Co. 214-826-7620
WI Milwaukee, Taylor Mktg. 414-332-1211

HARTMAN SYSTEMS, Figgie Intl., 360 Wolf Hill Rd., Huntington Sta., NY 11746, Tel: 516-427-7500, TWX: 510-226-6982; FSC No.: 92220; Empl.: 310; *Sls. Mgr.:* Robert Griffith

HARTWELL CORP., 900 S. Richfield Rd., Placentia, CA 92670, Tel: 714-993-4200, TELEX: 683-485, TWX: 910-596-1294; FSC No.: 83014; Empl.: 425

HARWIL, 1548 17th St., Santa Monica, CA 90404, Tel: 213-829-2310, FAX: 213-829-2259; Empl.: 10

HASCO COMPONENTS, INC., 247-40 Jericho Tpke., Bellrose Village, NY 11001, Tel: 516-328-9292, TWX: 710-582-5750, FAX: 516-326-9125; Empl.: 30; *Sls. Mgr.:* Tab Hauser ..... **B•1468-1476, 1723**

Hathaway

FAX: 918-438-7629

HATHAWAY CORPORATION, Motor Products Div., 10837 E. Marshall, Tulsa, OK 74116, Tel: 918-438-7800; Empl.: 80; *Sls. Mgr.:* Karl Jacobsen ..... **B•1213**

HAUMAN, INC., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TWX: 510-101-2820, FAX: 408-434-9832; *Sls. Mgr.:* Tom Trieu ... **D•1413, 1746-1747**

Local Sales Offices & Reps

AL Huntsville, B & C Instruments, Inc. 205-883-6530
CA Canoga Pk., RAG Elctrns., Inc. 818-998-6500
CA Hayward, Allied Elctrns. 415-770-0590
CA Laguna Hills, ISI Svcs. 714-582-9180
CA San Diego, Instr. Engrs. 619-268-8344
CO Broomfield, Instr. Repair Labs. 303-469-5375
CT Newtown, Connecticut Cal Labs 203-270-1263
FL Tampa, Tampa Instrmn. 813-623-3979
GA Norcross, Allied Elctrns. 404-377-3555
IL Elgin, Allied Elctrns. 312-697-8200
IN Indianapolis, Loren Green 317-293-9827
KS Lenexa, A-Tech 913-268-9644
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA N. Billerica, Electra Test 617-667-8541
MN Minneapolis, Tonka Tech. Labs. 612-593-1770
NJ Clarksburg, Accutest Instrs. 609-259-0460
NY Great Neck, Instr. Mart 516-487-7430
NY Mineola, Allied Elctrns. 516-248-2360
NC Raleigh, Allied Elctrns. 919-876-5845
OR Portland, Westcon Inc. 503-283-0132
PA New Hope, John Bell 215-862-3762
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Garland, Tucker Elctrns. 214-348-8800
WA Redmond, Vanguard Elctrns. 206-823-4111

HAVERLY SYSTEMS, INC., 78 Broadway, Box 919, Denville, NJ 07834, Tel: 201-627-1424, TELEX: 710-987-8402; Empl.: 33; *Sls. Mgr.:* Wm. Parkins

HAYDON SWITCH & INSTRUMENT, 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-756-7441, TELEX: 643852 - HSIINTLWBY; FSC No.: 02005; Empl.: 350; *Sls. Mgr.:* Christopher Bertellotti

HAZELTINE CORP., Emerson Electric Co., Cuba Hill Rd., Greenlawn, NY 11740, Tel: 516-261-7000, TELEX: 96-7800, TWX: 510-226-0239; Empl.: 2,300

HBS EQUIPMENT CORPORATION, 3000 Supply Ave., Los Angeles, CA 90040, Tel: 213-726-3033, TWX: 910-580-3179, FAX: 213-888-9982; Empl.: 50; *Sls. Mgr.:* D. Daniel

HC Power

FAX: 714-261-6584

HC POWER INC., 1801 E. Carnegie Ave., Santa Ana, CA 92705, Tel: 714-261-2114; *Sls. Mgr.:* Jack Graham ..... **D•1749**

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CA	Laguna Hills, Electro-Venture	714-581-9244
CA	Los Alamitos, Power Specialists	213-594-9418
CA	San Jose, Electro-Venture	408-727-1553
CA	Santa Clara, Electro Venture	408-927-1553
CA	Vista, Power Specialists	619-726-4799
CO	Englewood, Taylor Mktg.	303-850-0207
FL	Land-O-Lakes, A.J.'s Power Source	813-996-2583
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MN	Minneapolis, Electro-Serv	612-338-3475
OH	Brunswick, Roberts Elctrns.	216-238-1711
OR	Lake Oswego, Power Sys.	503-274-1800
TX	Dallas, Dyna Mark Sls.	214-437-3333
UT	Ogden, Taylor Mktg.	801-546-9570

HDR POWER SYSTEMS, INC., 600 Oakland Park Ave., Columbus, OH 43214, Tel: 614-262-6832; Empl.: 90; *Sls. Mgr.:* Harlan W. Bates

HDS INC., 12310 Pinecrest Rd., Reston, VA 22091, Tel: 703-620-6200, TELEX: 64585, FAX: 703-620-3169; Empl.: 110

HEADWAY RESEARCH, INC., 3713 Forest La., Garland, TX 75042, Tel: 214-272-5431, TELEX: 73-0257; Empl.: 50

HEATH CO., Hilltop Road, St. Joseph, MI 49085, Tel: 616-982-3200, TELEX: 72-9421; Empl.: 2000

HEAT SYSTEMS-ULTRASONICS, INC., 1938 New Hwy., Farmingdale, NY 11735, Tel: 516-694-9555, TELEX: 825-339; Empl.: 35; *Sls. Mgr.:* Irwin Leibson

HECON CORP., 31 Park Rd., Tinton Falls, NJ 07724, Tel: 201-542-9200, TELEX: 13-2457; Empl.: 200; *Sls. Mgr.:* P. Shine; *Dist. Mgr.:* R. Drum

HEI CORPORATION, 350 E. Randy Road, Carol Stream, IL 60188, Tel: 312-665-5500; Empl.: 10

HEI, INC., Hybrid Electronics Div., 1495 Steiger Lake Ln., Victoria, MN 55386, Tel: 612-443-2500, ESYLNK: 62940281, FAX: 612-443-2668; Empl.: 200; *Sls. Mgr.:* Dale Nordquist ..... **A•1737; B•1272-1273**

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FAX: 612-443-2668

HEI, INC., Optoelectronics Div., 1495 Steiger Lake La., P.O. Box 5000, Victoria, MN 55386, Tel: 612-443-2500, TWX: 510-601-7785, ESYLNK: 62940281; Empl.: 200; *Sls. Mgr.:* Dale Nordquist ..... **A•1737; B•1272-1273**

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AL	Huntsville, REP, Inc.	205-881-9270
AZ	Phoneix, Toward Engrg.	602-955-3193
CA	Mountain View, Leddy Assocs.	415-969-6313
FL	Orlando, Werndli & Assocs.	305-851-1923
GA	Tucker, REP, Inc.	404-938-4358
KS	Kansas City, A-Tronic	816-224-2131
IL	Chicago, Synmark Sls.	312-390-9696
TX	Houston, Matthews & Assocs.	713-498-1747
NH	Nashua, Bell Controls Inc.	603-882-6984
NJ	Pitman, Colrud Corp.	609-589-5866
TX	Austin, Matthews & Assocs.	512-346-2969
NC	Raleigh, REP, Inc.	919-851-3007
TX	Dallas, Mathews & Assocs.	214-248-7881
VA	Reston, Colrud Corp. South	703-620-6612

HEINEMANN ELECTRIC CO., Brunswick Pike, Alt. Rte. 61, P.O.Box 6800, Lawrenceville, NJ 08648-0800, Tel: 609-882-4800, TELEX: 843431; FSC No.: 74193; Empl.: 480; *Sls. Mgr.:* N. J. Alzamora ..... **B•1315-1318**

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AL	Birmingham, Austin Brown Assocs. Inc.	205-822-6198
AL	Mobile, Austin Brown Assocs., Inc.	205-344-0728
AZ	Phoenix, O'Donnell Assocs. SW	602-944-9542
CA	San Diego, O'Donnell Assocs., Inc.	619-578-1645
CA	San Jose, O'Donnell Assocs. No.	408-432-1940
CA	Torrance, O'Donnell Assocs., Inc.	213-539-9664
CO	Englewood, CompuTech Mktg.	303-773-3981
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Decatur, Austin Brown Assocs. Inc.	404-457-6381
ID	Boise, Temco Northwest	208-345-2051
IL	Northbrook, D. Dolin Sls.	312-498-6770
IN	Ft. Wayne, O.H. Bromberg & Assocs.	219-456-6010
IA	Hiawatha, Ard Sls. Co.	319-393-6392
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MA	Southboro, Sullivan Tech. Sls.	617-485-2215
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, Furber Sls. Co., Inc.	612-881-3620
MO	Creve Coeur, Hill & Co.	314-432-1136
MO	Kansas City, Hill & Co.	816-561-2593
NJ	Ridgewood, Ballou, Inc.	201-444-6990
NM	Albuquerque, O'Donnell Assocs. SW	505-883-1030
NY	Farmington, Canavan-Scanlon	716-924-7450
NY	Syracuse, Canavan-Scanlon	315-437-1271
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cleveland, Brown Elect. Prod.	216-331-2072
OH	Dayton, KW Elctrn. Sls.	513-890-2150
OH	Dayton, O. H. Bromberg & Assocs.	513-434-8788
KY	Louisville, O.H. Bromberg & Assocs.	502-456-1498
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Allison Park, KW Electrn. Sls.	412-487-4300
NJ	Lawrenceville, DVS Co.	609-896-1112
TN	Brentwood, Austin Brown Assocs. Inc.	615-373-2068
TX	Dallas, Glidden Electro Equip.	214-341-0610
TX	Houston, Glidden Electro Equip.	713-681-1415
WA	Kirkland, Temco Northwest	206-821-5434
WA	Spokane, Temco Northwest	509-534-8635
WI	Milwaukee, Key Entpr.	414-453-9462

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CA	San Jose, Cazco Sls.	408-263-6503
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CO	Denver, CSID Inc.	303-292-9594
CO	Denver, Newark Elctrns.	303-757-3351
CT	Hartford, L. E. Whelan Co.	203-728-5800
CT	New Haven, Green Shaw Co.	203-397-0710
FL	Oviedo, Dixie Sls.	305-365-5211
GA	Atlanta, Georgia Control Cen.	404-876-8833
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Morton Grove, Nedco Elctrns.	312-966-6000
IL	Northbrook, Classic Comps. Supp.	312-272-9650
IN	Indianapolis, Graham Elctrns.	317-634-8202
KS	Edwardville, C. Tennant & Sons	913-441-1801
MD	Columbia, Aztech Elctrns.	301-995-6800
MA	Newton, Green Shaw Co.	617-969-8900
MA	Woburn, Apparatus Svc.	617-933-5999
MI	Oak Pk., Newark Elctrns.	313-967-0600
MI	Southfield, Michigan Lectrols Corp.	313-353-1350
MI	Troy, I/O Corp. of Detroit	313-583-9066
MN	Minneapolis, Newark Elctrns.	612-331-6350
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Lawrenceville, Riverside Comps. Supp.	609-896-1611
NY	Johnson City, Help Elctrns., Inc.	607-729-3528
NY	Melville, Arrow Elctrns.	516-694-6800
NY	Roslyn, I/O Corp. of NY	914-964-1940
NY	Whitestone, Power Electro Supp. Co.	212-767-1447
NC	Charlotte, Joyce Sls. Co.	704-377-1555
OH	Cleveland, I/O Corp. of NY	216-432-2664
OH	Dayton, Duellman Elec.	513-461-5010
OH	Dayton, Stotts Friedman Co.	513-298-5555
OH	Shandon, Cartessa Corp.	513-738-4477
OH	Solon, REH Electrns.	216-248-1636
OH	Valley View, Newark Elctrns.	216-447-8860
OR	Portland, Taylor Elec.	503-233-5321
PA	Conshohocken, I/O Corp. of America	215-825-4610
PA	Erie, REM Elctrns.	814-453-5626
PA	West Chester, West Chester Elec. & Electrn.	215-696-7500
TN	Hixson, Techni-Tronics, Inc.	615-842-0514
TX	Dallas, Geeco Sls. Co.	214-341-2626
TX	Garland, Newark Elctrns.	214-494-5911
TX	Houston, Newark Elctrns.	713-782-4800
VA	Ashland, Hanover Controls & Supp. Corp.	804-798-2007
VA	Charlottesville, Va. Radio Supp. Co. Inc.	804-296-4184
WA	Seattle, H. C. Campbell Co.	206-433-1900
WI	Milwaukee, Hunt Co.	414-383-1781

HEITZ, KARL, INC., P.O. Box 427, Woodside, NY 11377, Tel: 718-565-0004; Empl.: 15

HELICAL PRODS. CO., INC., Box 1069, Santa Maria, CA 93456-1069, Tel: 805-928-3851, TWX: 910-351-5856, FAX: 805/928-2369; FSC No.: 13201; Empl.: 55; *Dist. Mgr.:* John Ricker

HELIONETICS, INC., DECC Div., 17312 Eastman St., Irvine, CA 92714, Tel: 714-261-8313, FAX: 714-261-0413; *Sls. Mgr.:* Charles Carter

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HERAEUS INC., Temp. Measurement Group, 111A Corporate Blvd., S. Plainfield, NJ 07080, Tel: 201-755-4800, FAX: 201-754-9494; Empl.: 250

HERBERT PRODS. INC., 180 Linden Ave., Westbury, NY 11590-0384, Tel: 516-334-6500, TWX: 510-222-5963, FAX: 516-334-6538; Empl.: 98; *Sls. Mgr.:* B. J. Simmons

HERMETIC SEAL CORP., 4232 Temple City Blvd., Rosemead, CA 91770, Tel: 213-283-0411, TWX: 910-587-3352, FAX: 818-443-6610; FSC No.: 04820; Empl.: 200

HERMETIC SWITCH, Box 1325, Hwy. 92, Chickasha, OK 73018, Tel: 405-224-4046, TELEX: 796125 Hermetic CKSA; FSC No.: 65623; Empl.: 150; *Sls. Mgr.:* R. Helms/Darla Ballard ..... **B•1724**

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KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Timonium, Heller Sls.	301-252-4780
MA	Canton, New England Elctm. Sls.	617-828-4835
MN	Minneapolis, Peterson Sls. & Assocs.	612-835-5281
MO	St. Louis, Midtec Assocs.	314-275-8666
NY	Oceanside, Current Inds.	516-678-3895
NY	Rochester, Electronic Mktg. Assocs.	716-427-8115
OR	Beaverton, LD Elctms.	503-684-8221
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WA	Spokane, LD Elctms.	509-922-4883

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AZ	Tucson	602-573-7400
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CA	Fresno	209-252-9652
CA	Fullerton	714-999-6700
CA	Goleta	805-685-6100
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CA	Los Angeles	213-337-8000
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NY	Wappinger Falls	914-298-9125
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NC	Charlotte	704-527-8780
NC	Greensboro	919-852-1800
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Can	Edmonton, Alberta	403-486-6666
Can	Kirkland, Que.	514-697-4232
Can	London, Ont.	519-686-9181
Can	Mississauga, Ont.	416-678-9430
Can	Moncton, New Brunswick	506-855-2841
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AL	Huntsville, BJR Mfrs. Reps.	205-881-3569
AZ	Tucson, Ross IV Assocs.	602-885-1046
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CA	San Diego, Ross IV Assocs.	619-485-7341
CA	Simi Valley, Ross IV Assocs.	805-526-6261
CA	Sunnyvale, J. F. Pell Co.	408-730-5869
CO	Denver, Production Equip. Sls.	303-650-0344
CT	E. Woodstock, H & M Assocs.	203-928-2703
FL	Rockledge, J. A. Kennedy Co.	305-639-4810
IL	Schaumburg, Technimark Inc.	312-397-9494
KS	Kansas City, Louis E. Bruns	913-287-5242
MD	Phoenix, B&W Mktg.	301-592-8907
MN	Edina, Pec/Levi	612-944-8540
NH	So. Merrimack, H & M Assocs.	603-882-1620
NJ	Clifton, W. D. Blood & Co.	201-365-0210
NJ	Jersey City, Dunn & Bryan	201-963-4478
NY	Massapequa Park, Dunn & Bryan	516-541-0938
NY	New Hartford, V. Clair	315-735-8122
NY	Westbury, Dunn & Bryan	516-334-5640
NC	Pinehurst, Russell Bransford	919-295-2185
OH	Solon, KDF Co.	216-248-8010
OR	Gladstone, Northcoast Mfrs. Agy. II	503-657-9427
PA	West Chester, B&W Mktg.	215-692-7155
SC	Simpsonville, Russell C. Bransford III	803-963-1736
TX	El Paso, Ross IV Assocs.	915-594-7253
TX	Plano, D.G. Mktg. Co.	214-867-5395
WA	Bothell, Northcoast Mfrs. Agy.	206-486-1496

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CA	Garden Grove, HW Eckhardt	800-221-8761
CA	Hayward, Arow Fasteners	415-487-2100
CA	Lakeside, Mouser Elctms.	619-449-2229
CA	Los Angeles, Lighting Parts Inc.	213-233-8111
CA	Riverside, Elctms. Supp.	714-787-9220
CA	San Jose, Pro Fasteners	408-943-9177

IL Shaumberg, Engrd. Fasteners 312-980-4082
IN Elkhart, La Vanture Prods. Co. 219-264-0658
MD Baltimore, Jandorf Elec. & Mfg. 301-358-5550
MA Newton, In-Stock Prods. 617-964-6200
MN St. Paul, Arden Fasteners 612-483-6681
MO St. Louis, Engrd. Fastener Co. 314-434-2888
NJ Manasquan, Kulka-Smith Inc. 201-223-9400
NY Amityville, Yorkville Inds. Inc. 516-225-2100
OK Oklahoma City, Wesco 405-232-5521
TN Nashville, Arden Fasteners 615-889-7043
TX Houston, Rainbow 713-957-0500
WI Waukesha, Cable Comps. 800-558-4388

HGA ELECTRONICS, 519 S. Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-5393; Empl.: 2

HH CONTROLS CO., INC., 16 Frost St., Arlington, MA 02174, Tel: 617-646-2626; Empl.: 13

HHK IND., Telan Int., Rte. 611, P. O. Box 690, Plumsteadville, PA 18949, Tel: 215-766-0990; *Sls. Mgr.:* Fred Yodis; *Dist. Mgr.:* Fred Yodis

HICKOK ELECTRIC INSTRUMENT, 10514 DuPont Ave., Cleveland, OH 44108, Tel: 216-541-8060; Empl.: 450; *Sls. Mgr.:* Norm Holliday; *Dist. Mgr.:* Jeff Snider

HICO HORIZONS INTL. CO., See Maxon Precision Motors

HI-G COMPANY, A Subsidiary of Nytronics Inc., 101 Locust St., Hartford, CT 06114, Tel: 203-522-8600, TELEX: 643394, TWX: 710-425-1379, FAX: 203-524-8540; FSC No.: 02289; Empl.: 550; *Sls. Mgr.:* J. Parsons ..... **B•1478-1493**

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AL Huntsville, 20th Century Mktg. 205-533-9281
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CA Anaheim, Westrep 213-404-3881
CA San Diego, Westrep 619-566-6580
CA Santa Clara, Westrep 408-988-8833
CO Englewood, Omega 303-762-1921
CT Bloomfield, Friedman Sls. 203-243-3122
FL Longwood, Beacon 305-647-3498
GA Norcross, 20th Century Mkt. 404-446-1999
IL Highland Park, Bransky Sls. 312-433-2375
IN Fort Wayne, TX Sls. 219-489-4447
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Olathe, Advanced Tech. Sls. 913-782-8702
MD Monkton, Imagitron Sls. Co. 301-374-5600
MA Woburn, Friedman Sls. 617-459-7399
MI Ann Arbor, Jordan-Elliott Inc. 313-662-4087
MN St. Paul, Repco 612-642-2828
MO St. Louis, Advanced Tech. Sls. 314-878-2921
NE Omaha, Pattison Sls. 402-895-4431
NJ Wayne, Astrorep 201-696-8200
NY Babylon, Astrorep 516-422-2500
NY E. Rochester, Tri-Tech Elctrns. 716-385-6500
NC Gary, 20th Century Mkt. 919-481-3370
OH Miamisburg, Elctrns. Comps., Inc. 513-866-3340
OK Tulsa, Bonser-Philhower Sls. 918-744-9964
OR Lake Oswego, RTS 503-244-4123
PA Maple Glen, Imagitron Sls. Co. 215-540-9122
TN Knoxville, 20th Century Mkt. 615-966-2099
TX Richardson, Bonser - Philhower Sls. 214-234-8438
WA Vashon, RTS 206-285-1363
WI Cedarburg, Bransky Sls. 414-377-6837
Can Downsview, Ont., Designtronics 416-747-1171

Local Distributors

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AZ Phoenix, Hallmark Elctrns. 602-437-1200
AR Little Rock, Electro Entprs. 501-562-6936
CA Buena Pk., Cypress Elctrns. 213-744-0355
CA Canoga Park, Hall-Mark Elctrns. 818-716-7300
CA Citrus Hgts., Hall-Mark Elctrns. 916-722-8600
CA Irvine, Integrated Elctrns. 714-660-1055
CA San Diego, Hallmark Elctrns. 714-268-1201
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Hall-Mark Elctrns. 408-946-0900
CA Santa Ana, Norstan Elctrns. 714-250-4903
CA Torrance, Hall-Mark Elctrns. 213-217-8400
CA Tustin, Hallmark Elctrns. 714-359-0330
CO Denver, Integrated Elctrns. 303-292-6121
CO Englewood, Hallmark Elctrns. 303-790-1662
CT Wallingford, Hallmark Elctrns. 203-269-0100
FL Clearwater, Hallmark Elctrns. 305-530-4543
FL Orlando, Hallmark Elctrns. 305-855-4020
FL Pompano, Hallmark Elctrns. 305-971-9280
GA Norcross, Hallmark Elctrns. 404-447-8000
IL Northbrook, Classic Comps. 312-272-9650
IL Wood Dale, Hallmark Elctrns. 312-860-3800
IN Indianapolis, Hallmark Elctrns. 317-876-7165
KS Lenexa, Hallmark Elctrns. 913-888-4747
KS Wichita, Lee Prods. 316-264-2172
MD Columbia, Hallmark Elctrns. 301-988-9800
MD Columbia, Vantage Comps. 301-720-5100
MA Billerica, Hallmark Elctrns. 617-667-4129
MA Woburn, A.C.I. Elctrns. 617-935-7230
MN Eden Prairie, Hallmark Elctrns. 612-941-2600
MN St. Paul, Shelley/Ragon 612-642-2828
MO Maryland Heights, Hallmark Elctrns. 314-291-5350
NJ Clifton, Vantage Comps. 201-777-4100
NJ Fairfield, Hallmark Elctrns. 201-575-4415
NJ Mt. Laurel, Hallmark Elctrns. 609-235-1900
NJ Oakland, Relay Specialties 201-337-1000
NY Commack, Vantage Comps. 516-543-2000
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Ron Kon Koma, Hallmark Elctrns. 516-737-0600
NC Raleigh, Hallmark Elctrns. 919-872-0902
OH Solon, Hallmark Elctrns. 216-349-4632
OH Worthington, Hallmark Elctrns. 614-888-3313
OK Oklahoma City, Electro Entprs. 405-427-6591
OK Tulsa, Hallmark Elctrns. 918-665-3200
OR Beaverton, Integrated Elctrns. 503-641-1690
TX Austin, Hallmark Elctrns. 512-258-8848
TX Dallas, Hallmark Elctrns. 214-553-4300
TX Houston, Hallmark Elctrns. 713-781-6100
UT West Valley City, Hall-Mark Elctrns. 801-972-1008
WA Bellevue, Integrated Elctrns. 206-455-2727
WI New Berlin, Classic Comps. 414-786-5300
Can Pointe Claire, Future 514-694-7710

HIGH ENERGY, Inductotherm Industries, Lower Valley Rd., Parkesburg, PA 19365, Tel: 215-593-2800, TELEX: 759888, TWX: 510-0663-0332; Empl.: 100

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HIGH REL BURN-IN, Riverside Assoc. Inc., 1710 Ringwood Ave., San Jose, CA 95131, Tel: 408-437-0300, FAX: 408-437-1918; FSC No.: 4Y548; Empl.: 30; *Sls. Mgr.:* Beth Pagano

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HIGH VOLTAGE TECHNOLOGY INC., 127 Hillcrest Ave.:P.O. Box 437, Yonkers, NY 10705, Tel: 914-423-6636, TELEX: 4998104, FAX: 914-779-8731; *Sls. Mgr.:* Pete Gonzalez

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MA Natick, 3H Inds. 617-532-5660
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CO Parker, Equal Elec. Inc. 303-841-8982
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FL Daytona Bch. Shores, W. Rihm Assocs. 904-761-7130
GA Griffin, Hipotronics 404-228-9222
HI Honolulu, B. F. Wittenberg 808-833-1602
IL Hawthorne Woods, Ryan & Assocs. 312-438-2905
MO St. Louis, Fitzgerald Sls. Co. 314-862-1660
MN Edina, Ainslie Co. 612-920-2996
NJ Union, Friedman Assocs., Inc. 201-964-6200
NM Albuquerque, Brytec Sls. Inc. 505-884-1123
NY Le Roy, Hasgo Power Equip. 716-768-8500
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UT Salt Lake City, Riter Engrg. Co. 801-973-9063
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Can Halifax, B.C., D. C. Keddy Ltd. 902-453-1711
Can Weston, Ont., U-Tek Svcs. & Supp. 416-747-1879

HI-Q CRYSTALS, Hybrids International Ltd., 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-4544, TWX: 910-743-0029, FAX: 913-764-6400; Empl.: 18; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1478**

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Local Distributors

TX Houston, Lenert Co. 713-225-1465

HIROSE ELECTRIC U.S.A., INC. (HRS), Div. of Hirose Electric Co. Ltd. (Japan), 9254 Deering Avenue, Chatsworth, CA 91311, Tel: 818-709-1247, FAX: 818-341-4158; Empl.: 25 (USA), 720 (Japan); *Sls. Mgr.:* Jim Erickson

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FAX: 201-835-8354

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PA Bristol, AIM Elctrns. 215-785-3500
TX Richardson, Centurion Mktg. 214-783-6762

HISONIC, INC., 249 N. Troost, P.O. Box 1130, Olathe, KS 66061, Tel: 913-782-0012, TELEX: 4-2562, ESYLNK: 62829955, FAX: 913-782-0562; FSC No.: 11402; Empl.: 140; *Sls. Mgr.:* W. S. Bonebright ..... **A•2239**

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MO St. Louis, Florence & Meyer 913-722-5210
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MA Lynn, Maher Assocs. 617-581-3244
MI Sheridan, MacDougall and Assocs. ... 517-291-3334
MN Minneapolis, Elec. Comp. Sls. 612-933-2594
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NJ Rochelle Pk., Maher Assocs. 201-587-1354
NC Fairview, Maher Assocs. 704-628-2191
OH Seven Hills, Nenadal Entprs. 216-524-4293
TN Chattanooga, Wade Prods. Co. 615-266-2262
WA Spokane, Cripe Co. 509-448-5349

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HITRAN CORP., Agex, 362 Highway 31, Flemington, NJ 08822-9301, Tel: 201-782-5525; FSC No.: 27672; Empl.: 120; *Sls. Mgr.:* Karl Newquist ..... **A•2240; D•1753, 2118-2119**

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ID Boise, Calvert Controls 208-345-3082
IL Elmhurst, Hedge Assocs., Inc. 312-530-1146
LA Metairie, RAPCO Assocs., Inc. 504-887-9500,
MA Hopedale, Motion Controls Assocs. ... 617-473-3543,
MO St. Charles, Drives Plus 314-441-7765,
NY Syracuse, Lachut Elctrl. Sls. 315-458-6486,
NC Charlotte, Servicon Sls. Corp. 704-525-4800,
OH Broadview Hgts., MC, Inc. 216-526-6511,
OR Eugene, Calvert Controls 503-683-2018
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RI Providence, WALCO Elec. Co. 401-467-6500,

HMW ENTERPRISES, INC., 604 Salem Road, Etters, PA 17319, Tel: 717-938-4691, TWX: 510-650-3536, FAX: 717-938-4095; FSC No.: 06A150; Empl.: 40; *Sls. Mgr.:* Gerhard Schmutz

HOBART ENGINEERING, 4143 Cheshire Dr., Cypress, CA 90630, Tel: 714-827-2135; *Sls. Mgr.:* D. C. Hobart

HOBSON BROS., 4940 W. Lawrence Ave., Chicago, IL 60630-3884, Tel: 312-283-3600, FAX: 312-283-3606; Empl.: 75; *Sls. Mgr.:* Betty Maager

HODGE MANUFACTURING CO., INC., 55 Fisk Ave., Springfield, MA 01107, Tel: 413-781-6800, TWX: 710-350-7583, FAX: 413-733-6573

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HOFFMAN ENGINEERING CORP., 20 Acosta St., Stamford, CT 06902, Tel: 203-325-8933, TELEX: 643621; FSC No.: 06097; Empl.: 49; *Sls. Mgr.:* Jeffrey O. Brown

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HOLMBERG ELCTRNS., Asheville Hwy., Inman, SC 29349, Tel: 803-472-4141, TWX: 810-690-2302; Empl.: 300; *Sls. Mgr.:* Kerry Holmberg ..... **C•1385-1387**

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CA El Monte, Cook Entprs. 213-686-2120, 818-442-3884
CA Solana Bch., Cook Entprs., Inc. 619-584-0936
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MO Florissant, Spectrum Sls. 314-831-1775
NJ Clifton, R.O.I. Sls. Co., Inc. 201-340-1515
NC Raleigh, Beacon 919-787-0330
OH Cleveland, JFCO, Inc. 216-398-6300
OH Dayton, JFCO, Inc. 513-890-8322
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Philadelphia, Check Assocs. 215-487-3007
PA Pittsburgh, JFCO, Inc. 412-823-5400
TX Austin, Erickson Sls., Inc. 512-244-3068
TX Dallas, Erickson Sls., Inc. 214-739-5833
TX Houston, Erickson Sls., Inc. 713-266-1604
UT Salt Lake City, Electrodyne 801-486-3801
VA Herndon, Stinson Assocs. 703-620-0088
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WA Spokane, Eclipse Mktg. Grp. 509-922-3972
PR Caguas, K.D. Tronics 809-746-0275
Can Burlington, Ont., White Radio Ltd. 416-632-6894

Local Distributors
AL Huntsville, Marshall Inds. 205-881-9235
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Bell Inds. 602-966-7800
CA Anaheim, Pacesetter 714-777-4711
CA Belmont, Lodan, Inc. 415-592-4600
CA Buena Pk., Cypress/R.P.S. Elctrns. 714-521-5230

CA Riverside, Elctrn. Supp. 714-787-9220
CA Sacramento, Integrated Elctrns. 916-424-5297
CA San Diego, Elctrn. Supp. 619-693-8222
CA Santa Ana, El-Com Sls. 714-432-6630
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Denver, CSID Elctrns. 803-292-9594
CO Wheat Ridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Schaal Assocs. 203-269-3779
FL Ft. Lauderdale, K.S.M. Elctrns. 305-971-5900
FL Largo, Lodan Elctrns., Inc. 813-586-2851
FL Winter Pk., Deanco 305-671-5100
GA Atlanta, K.S.M. Elctrns. 404-458-2013
GA Marietta, Deanco 404-429-0126
IL Arlington Hgts., Lodan Elctrns. 312-398-5311
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Lisle, Components, Inc. 312-852-7707
IN Indianapolis, Mar Elctrns. 317-633-6699
MD Baltimore, Resco/Baltimore 301-529-0500
MD Baltimore, Whitney Distrs. 301-944-8080
MD Beltsville, Resco/Washington 301-937-9100
MD Gaithersburg, Deanco 301-948-5444
MA Burlington, Deanco, Inc. 617-272-1506
MA Burlington, Schaal Assocs. 617-272-7940
MA Hopedale, Tec-Con Elctrns., Inc. 617-478-8544
MI Farmington Hills, Advent Elctrns., Inc. 313-477-1650
MN Minneapolis, Bergquist Co. 612-835-2322
MO St. Charles, Finnigan Elctrns. 314-946-6201
NJ Fairfield, Deanco 201-575-7960
NJ Rockaway, Tonar Inds. 201-586-9000
NY Hauppauge, Schaal Assocs. 516-434-7100
NY Ithaca, Deanco 607-257-4444
NY Mt. Vernon, QAR Indl. Elctrn. Sls., Inc. 914-699-2224
NY Rome, Rome Elctrns. ... 315-476-2033,800-448-4403
NC Raleigh, Century Elctrns. 919-782-2116
NC Raleigh, Deanco 919-851-2065
OH Dayton, Televox, Inc. 513-454-1225
OR Beaverton, Murphy Elctrns. 503-642-2001
OR Lake Oswego, Bell Inds. 503-241-4115
PA McKean, Advacom, Inc. 814-476-7774
PA Norristown, Century Elctrn. Comps. ... 215-631-5400
TX Addison, Connec/Tek, Inc. 214-733-4411
TX Dallas, Texas Connector Corp. 214-484-7508
VA Virginia Bch., Deanco 804-460-3558
WA Bellevue, Bell Inds. 206-747-1515
WA Redmond, Murphy Elctrns. 206-881-1234
EXP Irvine, CA, Product Supp. Co. 714-250-0622
Can Calgary, Alb., L. A. Varah, Ltd. 800-352-8250
Can Edmonton, Alb., L. A. Varah, Ltd. 800-661-7223
Can London, Ont., C. M. Peterson Co., Ltd. 519-434-3204
Can Nepgan, Ont., L. A. Varah, Ltd. 613-726-8884
Can Oakville, Ont., L. A. Varah, Ltd. 416-842-8484
Can Scarborough, Ont., Carsten Elctrns., ltd. 416-495-7705/9999
Can Vancouver, BC, L. A. Varah, Ltd. 604-873-3211
Can Winnipeg, Manitoba, L. A. Varah, Ltd. .. 800-665-7372

HOLT INC., 9351 Jeronimo Rd., Irvine, CA 92718, Tel: 714-859-8800, TELEX: 182704, FAX: 714-859-9643; FSC No.: 44270; Empl.: 90; *Sls. Mgr.:* Nina K. Abbott

HOLUB INDS., See Blackburn, Div. of F L Industries

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HOMALITE, INC., 11 Brookside Dr., Wilmington, DE 19804, Tel: 302-652-3686, TWX: 510-600-0874; Empl.: 35; *Sls. Mgr.:* Susan Stepchuck ..... **B•1072**

HONDA CONNECTORS, See Mhotronics, Inc.

HONEYWELL INC., Aerospace & Defense Grp., Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5186, TWX: 910-576-2692; Empl.: 15,000

HONEYWELL INC., Commercial Div., MN 27-7246, Honeywell Plaza, Minneapolis, MN 55408, Tel: 612-870-5357; Empl.: 3000; *Sls. Mgr.:* Doyle G. Adams

HONEYWELL INFORMATION SYSTEMS, 200 Smith St., MS 440, Waltham, MA 02154, Tel: 617-895-6000

HONEYWELL MICRO SWITCH DIV., See Micro Switch, a Honeywell Division

HONEYWELL OPTOELECTRONICS, 830 E. Arapaho Dr., Richardson, TX 75081, Tel: 214-470-4271, TELEX: 73-0890, FAX: 214-470-4417; Empl.: 300; *Sls. Mgr.:* Joe Tucker; *Dist. Mgr.:* Dave Kimbrough

HONEYWELL, Test Instruments Div., P.O. Box 5227, Denver, CO 80217-5227, Tel: 303-773-4700, TELEX: 45793 DVR; Empl.: 1000; *Sls. Mgr.:* V. Koppang

HOOSIER MAGNETICS, INC., 110 N.E. 5th St., P.O. Box 753, Washington, IN 47501, Tel: 812-254-1901, TELEX: 650-254-9541, TWX: 812-254-5510; FSC No.: 3160; Empl.: 90; *Dist. Mgr.:* Daniel Sudarsky

HOPKINS ENGRG., 12900 Foothill Blvd., San Fernando, CA 91342, Tel: 818-361-8691, TELEX: 910380-5379; FSC No.: 02777; Empl.: 100; *Sls. Mgr.:* Tom C. Hudson; *Dist. Mgr.:* Tom C. Hudson

HOPT, KARL, CO., 118 First Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-0633, TELEX: 132496; Empl.: 400; *Sls. Mgr.:* G.C. Ellis

HOTPACK CORP., Heinicke Instrs., 10940 Dutton Rd., Philadelphia, PA 19154, Tel: 215-824-1700, 800-523-3608, TWX: 710-670-1694, FAX: 215-637-0519; FSC No.: 66; Empl.: 100

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HOUSE OF METAL ENCLOSURES, 500 W. 9th St., Box 225, Hermann, MO 65041, Tel: 314-486-3111; Empl.: 50; *Sls. Mgr.:* A.P. Brigham

HOUSTON INSTRUMENT, AMETEK, Inc., 8500 Cameron Rd., Austin, TX 78753, Tel: 512-835-0900, TWX: 910-874-2022; Empl.: 450; *Dist. Mgr.:* Rod Schaffner

HOWARD INDUSTRIES, Cyclops Ind., Inc., Box 287, Milford, IL 60953, Tel: 815-889-4105, TWX: 910-642-2950, FAX: 815-889-4313; Empl.: 500; *Sls. Mgr.:* Alan Mancuso

HOWELL INSTRUMENTS, 3479 W. Vickery Blvd., Ft. Worth, TX 76107, Tel: 817-336-7411, TELEX: 75-8233; FSC No.: 98869; Empl.: 180; *Sls. Mgr.:* Luke Hawkins

HARVEY HUBBELL, INC., 50 Edwards St., Madison, OH 44057, Tel: 216-428-1161

HUDSON INDUSTRIES, 36 Executive Drive, Hudson, NH 03051, Tel: 603-880-7712, FAX: 603-880-7155; Empl.: 170; *Sls. Mgr.:* Armand L. Carpenter ..... **C•1060, 1854-1855**

Local Sales Offices & Reps
NH Hudson, Hudson Inds. 603-880-7712

HUDSON TOOL & DIE CO., 18 Malvern St., Newark, NJ 07105, Tel: 201-589-1800, TWX: 710-995-4445; FSC No.: 02875; Empl.: 300

HUGHES AIRCRAFT CO., Connecting Devices Div., 17150 Von Karman Ave., Irvine, CA 92714, Tel: 714-660-5701, TWX: 910-595-2523; FSC No.: 53669; *Sls. Mgr.:* Bill Strobel

HUGHES AIRCRAFT CO., Electron Dynamics Div., 3100 W. Lomita Blvd., P.O. Box 2999, Torrance, CA 90509-2999, Tel: 213-517-6000, TELEX: 67-7064, TWX: 910-347-7321; Empl.: 1827; *Sls. Mgr.:* Jerry H. Herman

HUGHES AIRCRAFT CO., Industrial Products Division, 6155 El Camino Real, Carlsbad, CA 92009, Tel: 619-931-3000, TWX: 910-332-1393

HUGHES AIRCRAFT CO., Microelctrns. Sys. Div., 2601 Campus Dr., Irvine, CA 92715, Tel: 714-752-3800, TWX: 910-595-2435; *Sls. Mgr.:* J. L. Waters

HUGHES MICROELECTRONICS CIRCUITS DIVISION, 500 Superior Ave., P.O. Box H, Newport Beach, CA 92658-8903, Tel: 714-759-2952, TWX: 910-596-1374, FAX: 714-759-2720

HUGHEY & PHILLIPS, INC., 2162 Union Pl., Simi Valley, CA 93065, Tel: 805-581-5591, TELEX: 182900, FAX: 805-581-5032; FSC No.: 94295; Empl.: 21; *Sls. Mgr.:* Peter H. Johnson; *Dist. Mgr.:* Peter H. Johnson

HUGIN INDUSTRIES INC., 745 Distel Dr., Los Altos, CA 94022, Tel: 415-961-2950, FAX: 415-961-6431; Empl.: 5; *Sls. Mgr.:* Peter Hugin

HULL CORP., Davisville Rd., Hatboro, PA 19040, Tel: 215-672-7800, TELEX: 650-296-3800 MCI; Empl.: 200; *Sls. Mgr.:* C. T. Lind; *Dist. Mgr.:* J. T. MacInnes

HUMISEAL DIV., Columbia Chase Corp., 26-60 Bklyn.-Queens Expwy., Woodside, NY 11377, Tel: 718-932-0800, TWX: 710-582-2141, FAX: 718-932-4345; FSC No.: 99109;46058; Empl.: 150

HUMPHREY, INC., 9212 Balboa Ave., San Diego, CA 92123, Tel: 619-565-6631, TWX: 910-335-2001, FAX: 619-565-6873; Empl.: 220

HUNTER STANLEY ELEC., 1813 Church St., Nashville, TN 37203, Tel: 615-321-0500; FSC No.: 21675; Empl.: 10; *Sls. Mgr.:* W. D. Stanley

HUNTER TOOLS, Easco/K-D Tools, 3575 Hempland Rd., Lancaster, PA 17604, Tel: 717-285-4581, TELEX: 848429; *Sls. Mgr.:* George Gard

HUNTINGTON ELECTRIC INC., P.O. Box 366, Dept. EEM 87, Huntington, IN 46750, Tel: 219-356-0778; *Sls. Mgr.:* Robert Smith ..... **A•1942**

Local Sales Offices & Reps
IN Huntington, HEI 219-356-0756
MA Burlington, Tri-Com Assocs., Inc. 617-272-8163
MN St. Louis Park, Parq Sls. 612-920-3643
MO St. Louis, Rep-Tronics 314-576-9816
PA Greensberg, Pro-Mark 412-832-3800

Local Distributors
CA Fountain Valley, Comp. Center 714-979-0433
CA Los Angeles, Cal State Elctrns. 213-933-8187
CA Manhattan Bch., Prime Electro 213-379-3642
CA Monrovia, Daring 818-357-0021
FL Ft. Lauderdale, NRC Elctrns., Inc. 305-772-4500
MO St. Louis, Franklin Elctrns. 314-933-5333

HURRICANE ELECTRONICS LAB, P.O. Box 1280, Hurricane, UT 84737, Tel: 801-635-2003; FSC No.: 64109; Empl.: 14; *Sls. Mgr.:* C. R. Reeve

HURST MANUFACTURING CORP., Emerson Elec. Co., Box 326, Princeton, IN 47670, Tel: 812-385-2564, FAX: 812-386-7504; Empl.: 200; *Sls. Mgr.:* Don Morrow

HUTSON INDUSTRIES, 1000 Hutson Cir., Frisco, TX 75034, Tel: 214-377-3557, TWX: 910-860-5051; *Sls. Mgr.:* Bill Giles

Hybricon

FAX: 508-772-9263

HYBRICON CORPORATION, 12 Willow Road, Ayer, MA 01432, Tel: 508-772-5422, TWX: 710-347-0654; Empl.: 74; *Sls. Mgr.:* Janis K. Parker ..... **C•1727**

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CA	Santa Clara, BSN Inc.	408-727-1800
FL	Longwood, Elctrn. Mfrs. Agts.	305-682-1202
GA	Roswell, Elctrn. Mfrs. Agts.	404-992-7240
IL	Elmhurst, First Rep Co.	312-530-2450
MA	Ayer, Hybricon Corp.	508-772-5422
MN	Minneapolis, George Russell & Assocs.	612-854-1166
NH	Salem, OEM Mktg. & Sls.	603-893-0009
NY	Amsterdam, Traxonics Inc.	518-843-1445
NY	Elmont, Crane & Egert Corp.	516-872-0800
NC	Elctrn. Mfrs. Agts.	704-365-0547
PA	Huntingdon Valley, Lynbar Grp. Inc.	215-947-3554
VA	Alexandria, Scott Data Corp.	703-329-3100

HYBRID ELECTRONICS CORP., 6 DeAngelo Dr., Bedford, MA 01730, Tel: 617-275-5350, FAX: 617-275-3470; Empl.: 12; *Sls. Mgr.:* John Pantazis

HYBRIDS INTERNATIONAL LTD., Thick Film Division, 311 N. Lindenwood Dr., Olathe, KS 66062, Tel: 913-764-6400, TWX: 910-743-0029, FAX: 913-764-6409; Empl.: 18; *Sls. Mgr.:* Abdul Ghafoor ..... **A•1478, 1759**

HYBRID SYSTEMS, Sipex Corporation, 22 Linnell Circle, Billerica, MA 01821, Tel: 617-667-8700, FAX: 617-667-8310

Hybridyne Inc.

FAX: 602-791-3899

HYBRIDYNE, INC., 2155 N. Forbes Blvd., Tucson, AZ 85745, Tel: 602-629-0001; Empl.: 75; *Sls. Mgr.:* Stephen R. McComb ..... **A•1738**

Local Sales Offices & Reps

AZ	Phoenix, Wadsworth/Bryant	602-275-7366
CA	Hacienda Hgts., Wadsworth/Bryant	818-330-5592
CA	San Jose, West Engrg.	408-272-8881
CO	Ft. Collins, Rep Sls.	303-226-1504
IL	Glenview, Crimson Engrg. Sls., Inc.	312-470-0024
IN	S. Bend, Steddick & Assocs., Inc.	219-282-1629
MA	Sudbury, Maroni Assocs.	617-443-2170
PA	Wynnewood, Metz-Benham-Assocs., Inc.	215-896-7300
TX	Dallas, THT Sls. Co.	214-783-1501

HY-CAL ENGINEERING, 9650 Telstar Ave., El Monte, CA 91731, Tel: 818-444-4000, TELEX: 67-5548; FSC No.: 12199; Empl.: 125; *Sls. Mgr.:* D. Z. Chapman

HYCOMP, INC., 165 Cedar Hill St., Marlborough, MA 01752, Tel: 617-485-6300, TWX: 710-347-0385; FSC No.: 34707; Empl.: 65; *Sls. Mgr.:* Steve Rubin

HYLETRONICS, Newtown Rd., Littleton, MA 01460, Tel: 617-486-8911, TWX: 710-347-0656; FSC No.: 22534; Empl.: 82; *Sls. Mgr.:* John W. Perkins

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Local Distributors

CA	Mission Viejo, Microtek	714-770-3059
CA	Santa Clara, Electro Venture	408-727-1553
CT	Fairfield, Tye & Assocs.	203-255-6356
FL	Apopka, MoRoe Co.	305-880-8326
GA	Marietta, MoRoe Co.	404-992-5172
IL	Chicago, Comtel Midwest	312-539-4838
IL	Glenview, Comtel Midwest	312-699-4800
MD	Silver Springs, J E S	301-598-2620
MN	Eden Prairie, PEC/Levi	612-934-4028
NH	Seabrook, Tye Assocs.	603-474-5550
NJ	Rockaway, A & J Assocs.	201-625-3169
OH	Cleveland, Comtel Instrs.	216-442-8880
TX	Richardson, Jim Gray & Assocs.	214-699-9976
EXP	U.K./Stevenage Herfordshire, REL Ltd.	043831-4433
Can	Mississauga, Ont., AQAP, Inc.	416-890-5060

HYPERTRONICS CORP., 16 Brent Dr., Hudson, MA 01749, Tel: 617-568-0451, 800-225-9228, TELEX: 95-1152; FSC No.: 50541; Empl.: 125; *Sls. Mgr.:* E. Dalrymple ..... **C•1388-1392**

Local Sales Offices & Reps

AZ	Scottsdale, TC Elctrns. Sls., Inc.	602-994-5153
CA	Mountain View, Leddy Assocs.	415-969-6313
CA	N. Hollywood, Jewett Co.	818-789-8103
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Bethany, Reps. Corp.	203-393-0024
DC	Washington, Tyler Griffin Co.	EN1-4821
FL	Casselberry, Southern Elctrns. Sls.	305-332-4718
IL	Downers Grove, Momak Sls.	312-936-6400
IN	Indianapolis, CC Elctrns.	317-255-1508
KS	Lenexa, Midwest Tech. Sls.	913-888-1500
MD	Baltimore, Tyler Griffin Co.	EN9-4821
MA	Wellesley, Reps. Corp.	617-237-6476
MN	Bloomington, Murnco, Inc.	612-854-4161
NJ	Wayne, G.T. Assocs.	201-694-6040
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	E. Syracuse, R. D. Sherman	315-433-1165
PA	Greensburg, Pro-Mark	412-832-3800
TX	Richardson, Milco Mktg.	214-783-2716
UT	Salt Lake City, Williams Assocs.	801-485-6511
WA	Bellevue, A.I.E. Inc.	206-455-4697

HY-TEC INDUSTRIES, Div. of Topo Industries, Inc., P.O. Box 91, Shoreham, NY 11786, Tel: 516-924-8686; *Sls. Mgr.:* Tom Poole

HYTEK MICROSYSTEMS, 980 University Ave., Los Gatos, CA 95030, Tel: 408-395-2300, TWX: 910-597-5393; FSC No.: 57474; Empl.: 300; *Sls. Mgr.:* Greg Kizik; *Dist. Mgr.:* Richard Fryhoff

ICC

FAX: 714-998-5910

ICC, INC., 1144 W. Grove Ave., Orange, CA 92665, Tel: 714-998-8310, TELEX: 4992245ICCUSA; Empl.: 25 ..... **C•1394-1396**

Local Distributors

CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Santa Ana, Cabel & Connector Warehouse	714-641-3009
CA	Santa Ana, Vision Elctrns., Inc.	714-261-6777
CO	Denver, Carlyle, Inc.	800-227-5953
CT	Manchester, IMS, Inc.	203-649-4415
CT	Wallingford, Midstate Elctrns.	203-265-9900
MA	Westboro, In Stock Prods.	617-870-5750
MO	St. Louis, Franklin Elctrns.	314-993-5333
PA	Harrisburg, Cumberland Elctrns.	717-232-5989
TX	Houston, Cable & Connector Warehouse	713-690-1241
TX	Irving, Cable & Connector Warehouse	800-232-5875
VA	Virginia Bch., Norfolk Wire & Cable Elec.	804-499-1100
WA	Tukwila, Carlyle, Inc.	206-251-0700

ICI INC., 1901 Petra La., Placentia, CA 92670, Tel: 714-579-7575; Empl.: 10

ICON, 156 Sixth St., Cambridge, MA 02142, Tel: 617-868-5400, TWX: 710-321-1883; Empl.: 81; *Sls. Mgr.:* Irvin L. McKittrick

ICO-RALLY CORPORATION, 2575 E. Bayshore Rd., Palo Alto, CA 94303, Tel: 415-856-9900, FAX: 415-856-8378; FSC No.: 51705; Empl.: 45; *Dist. Mgr.:* Barbara Enad/David Taub

ICS ELECTRONICS CORP., 2185 Old Oakland Rd., San Jose, CA 95131, Tel: 408-432-9009, FAX: 408-943-1745; Empl.: 28; *Sls. Mgr.:* Robert H. Prosin; *Dist. Mgr.:* Robert H. Prosin

IC SENSORS, INC., 1701 McCarthy Blvd., Milpitas, CA 95035, Tel: 408-472-1800, TELEX: 350066, FAX: 408-434-6687; Empl.: 125; *Sls. Mgr.:* Harold Joseph; *Dist. Mgr.:* Harold Joseph

IDEAL INDUSTRIES, 4450 Becker Pl., Sycamore, IL 60178, Tel: 815-895-5181, TWX: 910-639-0613; Empl.: 700; *Sls. Mgr.:* Glenn Hollister

IDEAL PRECISION METER, 214 Franklin St., Brooklyn, NY 11222, Tel: 212-383-6904, TWX: 710-584-2160; FSC No.: 11707;10304-41; Empl.: 150; *Sls. Mgr.:* T. Bell

IDE ASSOCIATES, INC., 35 Dunham Rd., Billerica, MA 01821, Tel: 617-663-6878, TELEX: 4979780; Empl.: 40; *Sls. Mgr.:* James Bender

IDEC CORPORATION, 1213 Elko Drive, Sunnyvale, CA 94089-2211, Tel: 408-747-0550, TELEX: 34-0601, TWX: 910-339-9383, FAX: 408-744-9055; Empl.: 60; *Sls. Mgr.:* Wallace Baldwin, Natl. Sls. Mgr. ..... **B•1073, 1494-1498, 1725**

Local Sales Offices & Reps

AL	Birmingham, Bryco Co.	205-672-9760
AZ	Phoenix, Neal-Miller Sls.	602-274-0898
AR	Jonesboro, Electro-Tech, Inc.	501-932-0366
CA	Laguna Hills, Western Automation	714-859-6988
CA	Sunnyvale, Idec Corp.	408-747-0550
CO	Lakewood, T.M.M.I.	303-232-1516
FL	Oldmar, Boggs & Assocs.	813-855-1812
FL	Sarasota, Boggs & Assocs.	813-351-3338
IL	Hoffman Estates, Bu-Nell Engrg.	312-843-8600
IL	Schaumburg, Idec Corporation	312-882-7887
KS	Overland Park, TMW	913-383-1818
MA	Norwood, Hyland Assocs.	617-762-0345
MN	Minnetonka, S. J. Collins & Assocs.	612-933-7661
NM	Albuquerque, T.M.M.I.	505-298-6893
NY	Mastic, Optimum Sls.	516-758-0644
NY	Syracuse, Lachut Elctrl. Sls. Inc.	315-458-6480
NC	Kernersville, Heritage Sls. Assocs.	919-996-4374
OH	Cincinnati, James Murray & Assocs.	513-574-8500
OH	Cleveland, Matthew Haley Co.	216-892-1820
OH	Perrysburg, Matthew Haley Co.	419-874-0488
OK	Tulsa, Don Plummer Sls. Co.	918-835-0979
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PA	Carnegie, Brown-Yates Elctrl. Equip.	412-221-4200
PA	Philadelphia, Fite-Walker, Inc.	215-233-2100
SC	Taylors, Heritage Sls. Assocs.	803-292-1723
TN	Knoxville, Tubbs Agy.	615-577-0689
TN	Memphis, Electro-tech	901-372-4550
TX	Dallas, SW Mktg. Assocs.	214-341-8631
UT	Salt Lake City, T.M.M.I.	801-487-7676
VA	Alexandria, T.D.I.	703-971-8982
VA	Richmond, Dunnington & Assocs.	804-282-8383
WA	Redmond, SPS Elctrns.	206-323-4140
WI	Appleton, Bu-Nell Engrg.	414-733-4242
WI	Waukesha, Bu-Nell Engrg.	414-784-0994

IDENTATRONICS, INC., 425 Lively Blvd., Elk Grove, IL 60007, Tel: 312-437-2654, 1-800-323-5403, TELEX: 754319 CARD UD; *Sls. Mgr.:* Gregg Powell

IEC ELECTRONICS, 105 Norton St., Newark, NY 14513, Tel: 315-331-7742, TWX: 910-240-8356, ESYLNK: 6290-2827, FAX: 315-331-3547; Empl.: 650; *Sls. Mgr.:* Frank Montabana; *Dist. Mgr.:* Steve Hotchkiss

IEE, See Industrial Elctrn. Engrs., Inc.

IEI-ISKARA ELECTRONICS INC., INC, See Iskara Electronics, Inc.

IERC HEAT SINKS

FAX: 818-848-8872

IERC, 135 W. Magnolia Blvd., Burbank, CA 91502, Tel: 213-849-2481, TWX: 910-498-2206, ESYLNK: 62951515; FSC No.: 98978; Empl.: 97; *Sls. Mgr.:* Jim Smith .... **C•1671**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, BSE Inc.	602-483-0373
CA	Fremont, Vic/Tal Sls.	415-651-6420
CA	San Diego, Coastal Elctrn. Sls.	619-459-4148
CA	Santa Clara, Ross Mktg. Assocs.	408-988-8111
CA	Sherman Oaks, Wes-K Assoc., Inc.	818-990-1302
CO	Denver, Elcom, Inc.	303-337-2300
FL	Boca Raton, Sls. Specialties	305-395-5371
FL	Plant City, Sls. Specialists	813-754-1329
FL	Temple Terrace, Sls. Specialists	813-988-0561
IL	Mt. Prospect, Magnuson & Assocs.	312-956-0700
IN	Indianapolis, Magnuson & Assocs.	317-247-5108
KS	Leawood, Thunderbird Tech. Sls. & Svcs., Inc.	913-642-7220
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MA	Lexington, Hathaway Elctrns., Inc.	617-861-7010
MN	Minneapolis, Magnuson Assocs.	612-521-1235
MO	Maryland Heights, Thunderbird Tech. Sls. & Svcs., Inc.	314-567-6488
NJ	Wayne, G. T. Assocs., Inc.	201-694-6040
NM	Albuquerque, Rep New Tech	505-293-2582
NY	Rochester, Ossman Comp. Sls. Corp.	716-424-4460
NY	Syracuse, Ossman Comp. Sls. Corp.	315-437-7052
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Cleveland, Norm Case & Assocs.	216-333-0400
OR	Portland, Frank Jackson & Assocs.	503-645-8511
PA	Philadelphia, Kenneth B. Erdman Co.	215-224-1833
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Salt Lake City, Elcom, Inc.	801-485-7415
WA	Redmond, Frank Jackson Assocs.	206-881-7277
WI	Milwaukee, Magnuson Assocs.	414-933-8344
Can	Burlington, Ont., White Radio Ltd.	416-632-6894
Can	Montreal, Que., White Radio Ltd.	514-481-0158

Local Distributors

AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Tempe, Betatron Elctrns.	602-252-2112
AZ	Tucson, Elliott Elctrn. Supp.	602-884-7394
CA	Anaheim, DECO Electronics, Inc.	714-630-8252
CA	Canoga Pk., Tim-Co Comp. Sls.	818-992-5040
CA	Chatsworth, Jacon Fasteners & Elctrns.	818-700-2901
CA	Chatsworth, Mil-Comm Distrs.	213-998-3111
CA	City of Industry, Ital Elctrns.	818-968-8515
CA	San Diego, Deco Elctrns.	619-693-1595
CA	San Diego, El-Com	619-566-1988
CA	San Jose, Rose Elctrns.	408-263-9700
CA	Santa Ana, El-Com	714-432-6630
CA	Sunnyvale, Power Supply Components	408-737-1333
CO	Englewood, Indelco	303-694-9444
CT	Bridgeport, Park Distrs., Inc.	203-366-7200
FL	Clearwater, Lynch Gentry Assocs.	813-433-2697
IL	Mt.Prospect, Magnuson & Assocs.	312-956-0700
MD	Towson, Jones-Maryland Elctrns.	301-823-5721
MA	Billerica, A. W. Mayer Co., Inc.	617-229-2255
NH	Hudson, C & H Elctrns., Inc.	603-882-1133
NM	Albuquerque, Betatron Elctrns.	505-344-2381
NM	Albuquerque, Ram Elctrns.	505-262-0888
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Bohemia, Car-Lac Elctrn. Indl. Sls.	516-567-4200
NY	E. Syracuse, Modutex Corp.	315-437-7052
NY	West Hempstead, March Elctrns.	516-485-4700
OH	Englewood, Argent Inds., Inc.	513-836-8633
OR	Portland, United Radio Supp.	503-233-5341
PA	McKeesport, Barno Radio	412-751-5966
RI	Providence, William Dandreta & Co.	401-861-2800
TX	El Paso, ERA	915-855-3600
TX	Fort Worth, C & W Supp.	817-831-0395
TX	Houston, Lenert Co.	713-225-1465
WA	Redmond, Elwood Inds.	206-881-7277
WA	Seattle, Rose Elctrns.	206-721-4997
WA	Seattle, United Radio Supp.	800-547-4557
WA	Spokane, Rose Elctrns.	509-624-8867

IET

FAX: 516-334-5988

IET LABS, INC., 534 Main St., Westbury, NY 11590, Tel: 516-334-5959; FSC No.: 62015; *Sls. Mgr.:* Sam Sheena ..... **D•1268-1274**

DDC ILC DATA DEVICE CORPORATION

FAX: 516-567-7358

ILC DATA DEVICE CORP., 105 Wilbur Pl., Bohemia, NY 11716, Tel: 516-567-5600, TWX: 310-685-2203; FSC No.: 19645; Empl.: 910; *Sls. Mgr.:* J. P. Sheahan; *Dist. Mgr.:* Marshall Lacoff ..... **D•1164-1165**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg.	205-830-0498
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tuscon, Fred Board Assocs.	602-299-1508
CA	Garden Grove, ILC Data Dvcs. Corp.	714-895-9777
CA	Santa Clara, ILC Data Dvcs. Corp.	408-244-0831
CA	Woodland Hills, ILC Data Dvcs. Corp.	818-992-1772
CO	Denver, Quorum 3 Sls. Grp.	303-696-8480
CT	Canton Center, Dynamic Sls. of New Eng.	203-693-6567
FL	Clearwater Beach, Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Des Plaines, Elctrn. Mktg.	312-298-2330
IN	Carmel, Giesting & Assocs.	317-844-5222
IN	Fort Wayne, Giesting & Assocs.	219-486-1912
KS	Lenexa, Dytec/South	913-888-0215
MA	Burlington, Dynamic Sls. of New Eng.	802-863-6665
MI	Coloma, Giesting & Assocs.	616-468-4200
MI	Livonia, Giesting & Assocs.	313-478-8106
MN	Minneapolis, Comprehensive Techn.	612-888-7011
MO	Maryland Hgts., Dytec/South	314-569-2990
NJ	Totowa, ILC Data Dvcs. Corp.	201-785-1734
NM	Albuquerque, Quatra Assocs.	505-821-1455
NY	E. Rochester, Tri Tech Elctrns.	716-385-6500
NY	Endwell, Tri Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri Tech Elctrns.	315-446-2881
NY	Fishkill, Tri Tech Elctrns.	914-897-5611
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
OH	Cincinnati, Giesting & Assocs.	513-385-1105
OH	Euclid, Giesting & Assocs.	216-261-9705
OK	Tulsa, Bonser-Philhower Sls.	918-744-9964
OR	Forrest Grove, Venture Elctrns.	503-357-5112
PA	E. Lancaster, Electro Rep	717-299-5877
PA	Pittsburgh, Giesting & Assocs.	412-963-0727
TX	Austin, Bonser-Philhower Sls.	512-346-9186
TX	Houston, Bonser-Philhower Sls.	713-782-4144
TX	Richardson, Bonser-Philhower Sls.	214-234-8438
UT	Salt Lake City, Quroum 3 Sls. Grp.	801-943-9227
VT	Burlington, Dynamic Sls. of New Eng.	802-863-6665
VA	Vienna, ILC Data Dvcs. Corp.	703-893-7989
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Electron Mktg.	414-547-1505
Can	Montreal, Repco Engrg.	514-694-1877

ILC TECHNOLOGY, INC., 399 Java Dr., Sunnyvale, CA 94089, Tel: 408-745-7900, TWX: 910-339-9389; *Sls. Mgr.:* Robert Turner

ILLINOIS CAPACITOR, INC.

FAX: 312-673-2850

ILLINOIS CAPACITOR, INC., 3757 W. Touhy Ave., Lincolnwood, IL 60645, Tel: 312-675-1760, TELEX: 72-4361; Empl.: 64; *Sls. Mgr.:* C. Kurland .... **A•1086-1087**

Local Sales Offices & Reps

CA	Palo Alto, Mollard Mktg.	415-961-0456
CA	Woodland Hills, Illinois Capacitor, Inc.	800-323-3652
CO	Denver, Lindberg Co.	303-758-5863
CT	Bristol, Technology Prods. Grp.	617-731-0858
FL	Pompano Bch., HHP & Assocs.	305-971-5750
IL	Lincolnwood, Illinois Capacitor, Inc.	312-675-1760
IN	Indianapolis, Precision Elctrn. Comp.	317-842-3740
KS	Overland, AEM Inc.	913-888-0022
KY	Louisville, Precision Elec. Co.	502-897-0989
MA	Brookline, Technology Prods. Grp.	617-731-0858
MI	Farmington Hills, Tritech Sls. Inc.	313-553-7126
MI	Kalamazoo, Tri-Tech West	616-382-5570
MN	Golden Valley, Highland Elctrn. Sls. Co.	612-545-2123
MS	Jackson, Doby Assocs.	601-981-1138
MO	Hazelwood, Jim Moore & Assocs.	314-731-2240
MO	Kansas City, Jim Moore & Assocs., Inc.	816-756-0262
NJ	Englewood Cliffs, Masin-Esco, Inc.	201-569-8868
NM	Albuquerque, Lindberg Co.	505-881-1006
NY	Clinton, Advanced Comps. Corp.	315-853-6438
NY	Endicott, Advanced Comps. Corp.	607-785-3191
NY	Hauppauge, Masin-Esco, Inc.	516-273-3500
NY	N. Syracuse, Advanced Comps. Corp.	315-699-2671
NY	Rochester, Advanced Comps.	716-544-7017
NY	Scottsville, Advanced Comps. Corp.	716-889-1429
NC	Raleigh, Positive Comp. Sls.	919-772-8073
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OH	Worthington, Baehr, Greenleaf & Assocs.	614-847-0220
OR	Beaverton, Luscombe Engrg. Co.	503-636-6664
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Narberth, J. Bresson Assocs.	215-664-6460
TX	Austin, A-I-D Elctrns.	512-450-1938
TX	Irving, A-I-D Elctrns.	214-790-4761
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Renton, Luscombe Engrg. Co.	206-223-1541
WI	Milwaukee, Erdman Sls. Co.	414-281-1330

Local Distributors

AL	Huntsville, Hammond Elctrns.	205-830-4764
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AR	Ft. Smith, Carleton Bates	501-646-8201
AR	Little Rock, Carleton Bates	501-562-9100
AR	Pine Buff, Carleton Bates	501-535-1354
CA	Anaheim, A to Z Elctrns.	714-632-1620
CA	Canoga Pk., Myco/Vickers Elctrn. Supp.	213-340-2025
CA	Huntington Bch., Capacitor Specialtists Intl.	714-843-1815
CA	Milpitas, California Capacitor	408-262-6000
CA	Milpitas, Projections Unltd.	408-942-1717
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Diego, Projections Unltd.	619-453-7900
CA	Tustin, Projections Unltd.	714-544-2700
CO	Colorado Springs, Kimball Elctrns.	303-528-7066
CO	Englewood, Indelco	303-694-9444
CT	Norwalk, Cobra Comps., Inc.	203-847-6442
FL	Ft. Lauderdale, Hammond Elctrns.	305-973-7103
FL	Orlando, Hammond Elctrns.	305-841-1010
GA	Norcross, Hammond Elctrns.	404-449-1996
ID	Boise, Kimball Elctrns.	208-342-3559
ID	Pocatello, Kimball Elctrns.	208-232-2201
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Northbrook, Classic Comps.	312-272-9650
IN	Carmel, Altex Elctrns.	317-848-1323
LA	Shreveport, Carleton Bates	318-636-9975
MD	Beltsville, Resco/Washington	301-937-9100
MD	Columbia, General Radio Supp.	301-995-6744
MA	Hopkinton, ADD Elctrns. Corp.	617-435-5010
MA	Woburn, Lorcor	617-935-5024
MI	Grand Rapids, Calder Elctrns.	616-698-7400
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	Minneapolis, Bergquist Co.	612-835-2322
MO	Kansas City, Walters Indl. Supp.	816-531-7015
MO	Springfield, Carleton Bates	417-862-1699
MO	St. Charles, Finnigan Elctrns.	314-946-6201
NJ	Camden, General Radio Supp. Co.	609-964-8560
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Roselle, Lectron Ind.	201-245-5859
NY	Buffalo, Summit Distrbg.	716-887-2829
NY	E. Syracuse, Add Elctrns.	315-437-1835
NY	Elmsford, Ancar Elctrns.	914-592-7100
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Johnson City, Help Elctrns.	607-729-3528
NY	Victor, Add Elctrns. Corp.	716-924-4760
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Akron, Akron Elctrn. Supp. Co.	216-762-8818
OH	Cincinnati, United Radio, Inc.	513-761-4030
OH	Columbus, AESCO Elctrns.	614-882-6762
OK	Oklahoma City, Carleton Bates	405-681-4446
OK	Tulsa, Altair Elctrns.	918-252-5781
OK	Tulsa, Carleton Bates	918-250-1626
PA	Reading, GRS Elctrns.	215-375-4477
TN	Memphis, Carleton Bates	901-365-3539
TN	Nashville, Carleton Bates	615-244-3562
TX	Austin, Altair Elctrns.	512-837-4490
TX	Houston, Altair Elctrns.	713-462-3029
TX	Richardson, Altair Elctrns.	214-231-5166
TX	Texarcana, Carleton Bates	214-792-6923
UT	Salt Lake City, Kimball Elctrns.	801-328-2075
WI	Milwaukee, Badger Capacitor Sls.	414-281-1330
WI	New Berlin, Classic Comps. Supp. Co.	414-786-5300
WI	New Berlin, NEP Elctrns.	414-785-9100

Illinois Lock Company

FAX: 312-537-1881

ILLINOIS LOCK CO., The Eastern Co. 301 W. Hintz Rd., Wheeling, IL 60090, Tel: 312-537-1800; TWX: 910-651-0221; Empl: 120

Local Sales Offices & Reps

CA	Los Angeles, Spectrum Assocs.	213-641-4255
CT	New Britain, Kevin Kelaher Assocs.	203-224-9234
CT	W. Hartford, M-R Tech Sls., Inc.	203-521-2101
FL	Tampa, SRT Mktg.	813-884-4805
MI	Farmington Hills, Fisher Sls. Assocs.	313-553-9035
MN	Minneapolis, W. F. Just Co.	612-925-1220
MO	St. Louis, Thomas L. Dowell & Assocs.	314-849-4234
NC	Pineville, JWL Assocs.	704-541-5750
NJ	Newark, Northeast Lock	201-777-7500
NY	New York, Cambridge Allen Assocs.	201-464-0203
NY	Rochester, Mullahy-Welch Sls.	716-244-1100
OH	Dayton, Shamrock Elctrn. Sls.	513-258-1227
PA	Philadelphia, Instrmn. Specialties	215-742-0898
TX	Dallas,MGR	214-2385246
WA	Seattle, Frank J. Martin	206-523-7665

Local Distributors

CA	San Leandro, Electro-Components	415-352-5210
NJ	Clifton, Northeast Lock	800-524-2575

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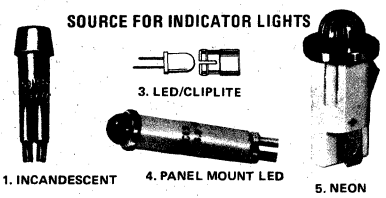

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IMC COMPONENTS CORPORATION, 55 Eddy St, Providence, RI 02903, Tel: 401-273-6900

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IMC MAGNETICS CORP., Eastern Div., 570 Main St, Westbury, NY 11590, Tel: 516-334-7070, TWX: 510-222-4469, FAX: 516-334-7723

IMC MAGNETICS CORP., Florida Division, 14025 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-822-2558, FAX: 305-825-3850

IMC MAGNETICS CORP., IMC/Hansen, Box 23, Princeton, IN 47670-0023, Tel: 812-385-3415, FAX: 812-386-6387; *Sls. Mgr.:* George A. Gilbert

IMC MAGNETICS CORP., Thermal Products Group., 100 Jericho Quad., Ste. 221, Jericho, NY 11753, Tel: 516-938-0800, TWX: 510-221-2126, FAX: 516-938-0752; *Sls. Mgr.:* R. Lavochkin

IMC MAGNETICS CORP., Universal Magnetics Corp., 12627 Hidden Creek Way, Cerritos, CA 90702, Tel: 213-926-0927, TWX: 910-583-1355, FAX: 213-926-2344; *Sls. Mgr.:* Chuck Carlson

IMC MAGNETICS CORP., Western Div., 12627 Hiddencreek Way, Cerritos, CA 90702, Tel: 213-926-0927, TWX: 910-583-1355, FAX: 213-926-2344; FSC No.: 99743; *Sls. Mgr.:* Joe Gute

IMEC CORP., 3065 Beyer Blvd., San Diego, CA 92154, Tel: 619-690-2622; Empl.: 1400; *Sls. Mgr.:* R. L. Hill

IMO DELAVAL INC., 325 Halstead St, Pasadena, CA 91109-7087, Tel: 818-351-4241, TELEX: 200445 RCA, FAX: 818-351-0557; Empl.: 210

IMO DELAVAL, INC., Cowles Rd, Plainville, CT 06062-9990, Tel: 203-677-1311, TELEX: 99-306, FAX: 203-747-4244; Empl.: 203; *Sls. Mgr.:* M. W. Brown; *Dist. Mgr.:* M. W. Brown

I.M.S. EQUIPMENT, INC., See Worldnet Marketing, Inc.

IMTRONICS INDUSTRIES, 11930 31st Ct. N., St. Petersburg, FL 33716, Tel: 813-572-9010, TELEX: 566027 IMTRON CWTR UD, FAX: 813-572-9012; Empl.: 10; *Sls. Mgr.:* Steven B. Cohen

INCONIX CORP, See Hancock Electronics Corp.

ELINA

FAX: 408-433-9330

INDEK CORPORATION, 2360 Qume Dr., No. A, San Jose, CA 95131, Tel: 408-432-1199, TELEX: 176476ELINA; Empl.: 7; *Sls. Mgr.:* Harry Wagner; *Dist. Mgr.:* Harry Wagner ..... **C•1672-1677**

Local Sales Offices & Reps

AZ	Phoenix, Shefler-Kahn Co., Inc.	602-257-9015
CA	San Diego, K-Tronics	619-549-7155
CA	San Jose, Veer Mktg.	408-432-1818
CO	Denver, Lindberg Co.	303-758-9033
IN	Granger, Gregory Sls. Co.	219-272-9626
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Eden Prairie, Elctrn. Innovators Inc.	612-941-0830
MO	Florissant, Deltron Co., Inc.	314-839-0033
NH	Amherst, D. A. Crowley	603-673-7050
NJ	Melville, Dyna Rep	201-685-0135
NY	Clarence Ctr., Nu-Tekneex Mktg., Inc.	716-741-9138
OH	Columbus, Tom Mulligan Co.	614-457-2242
IL	Chicago, Brock & Cushman	312-622-4110
PA	West Chester, PERCO Sales	215-793-1468
TX	Rowlett, Campion Sls.	214-475-8313
VA	Front Royal, Eltron Sls. Inc.	703-635-7201
WA	Belmont, Quadra Sales	206-883-3550
WA	Redmond	
Can	Rexdale, Ont., Bestec Elctms., Ltd.	416-674-1330

Local Distributors

CA	S. San Francisco, Peters-de Laet	408-727-9440
CA	San Jose, Daine Prods.	408-365-9100
CA	Sebastopol, First Source	707-823-0220
CO	Englewood, Industrial Elctrn.	303-694-9444
GA	Norcoss, Applied Power	404-263-0421
IL	Palatine, OHM Electronics	312-359-5500
MA	Newton, In-Stock Prod.	617-870-5750
MO	St. Louis, Beckwith Elec.	314-343-6463
NJ	Camden, G.R.S. Elctrn.	609-964-8560
OH	Columbus, Thompson Elctrn.	614-228-6191

INDEPENDENT CABLE, INC., 43 Broad St., Hudson, MA 01749, Tel: 617-562-9913; Empl.: 120; *Sls. Mgr.:* Gary W. Nace

INDUCTIVE PRODS., INC., 11733 Markon Dr., Garden Grove, CA 92641, Tel: 714-891-2572; Empl.: 10; *Sls. Mgr.:* Timothy J. Scanlon

Distributor

INDUCTOR SUPPLY, 15204 Transistor Lane, Huntington Beach, CA 92649, Tel: 714-891-4524, 800-854-1881, 800-472-8421, TWX: 497 9775; Empl.: 21; *Sls. Mgr.:* Carla Van DerMeulen ..... **A•1231**
694, 716, 725, 783

INDUSTRIAL COMPUTER DESIGNS, INC., 31264 La Baya Drive, Westlake Village, CA 91362, Tel: 818-889-3179; Empl.: 35; *Sls. Mgr.:* Bob Neville

Local Distributors

CA	Los Gatos, Personal Computing Tools	408-395-6600
CA	San Diego, ICS	619-279-0084
CA	San Mateo, Perx	415-573-0801
MA	Danvers, Anasco	617-777-8888

INDUSTRIAL CONTROL CO., 3100 Pineda Ave., Rockledge, FL 32955, Tel: 305-259-7105; Empl.: 15; *Sls. Mgr.:* I. Nobilio

INDUSTRIAL DEVICES CORPORATION, 35 Pamaron Way, Novato, CA 94949-6284, Tel: 415-883-3535, FAX: 415-883-2094; Empl.: 25

INDUSTRIAL DEVICES, INC., 260 Railroad Ave., Hackensack, NJ 07601, Tel: 201-489-8989, TELEX: 12-7459, FAX: 201-489-6911; FSC No.: 91802; Empl.: 200; *Sls. Mgr.:* Michael Diceglie ..... **B•1130-1134**

Local Sales Offices & Reps

AL	Huntsville, E.M.A., Inc.	205-837-7363
CA	Los Angeles, Universal Comps.	213-641-4255
CA	Mountain View, Westech Sls.	415-961-1422
CO	Englewood, Harthun Assocs., Inc.	303-792-5000
FL	Casselberry, Southern Elctrn. Mktg.	305-831-2822
GA	Atlanta, E.M.A., Inc.	404-448-1215
IL	Chicago, K. D. Engle	312-539-1820
IN	Indianapolis, Elctrn. Mktg. Consits.	317-253-1668
MD	Towson, Ernie Stefkovic Assocs.	301-321-6008
MA	Westborough, Anchor Engrg.	617-870-0573
MI	E. Detroit, Fred Harris & Assocs.	313-776-5430
MN	Minneapolis, Elec. Comp. Sls.	612-933-2594
MO	St. Louis, Lowell-Kangas Assocs.	314-821-4050
NJ	Cherry Hill, Ernie Stefkovic Assocs.	609-667-4066
NJ	Manville, Dyno Rep	201-685-0135
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, E.M.A., Inc.	919-847-8800
OH	Dayton, J. C. Hofstetter Co.	513-296-1010

OH Medina, J. C. Hofstetter Co. 216-241-4880
OR Hillsboro, Temco Northwest 503-649-8375
PA Hickory, J. C. Hofstetter Co. 412-356-2305
SC Greenville, E.M.A., Inc. 803-233-4637
TX Austin, R. F. Kimball Co. 512-443-5284
TX Houston, R. F. Kimball Co. 713-890-8810
TX Richardson, R. F. Kimball Co. 214-231-3447
WA Bothell, Temco Northwest 206-821-5434
EXP NY, Hauppauge, Sager Elctrl. Supply Co. 516-348-1300

Local Distributors

AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
CA Cypress, Sager Elctrns. 714-952-8899
CA Fremont, Allied Elctrns. 415-487-5250
CA Gardena, Calif. Switch & Signal 213-770-2330
CA Los Angeles, Elec. Switches 213-664-1141
CA Milpitas, Zack Elctrns. 408-942-5432
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Pasadena, Empire Elctrn. Distr. 213-681-2711
CA S. San Francisco, Steven Engrg. 415-588-9200
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Sigma Elctrns. 714-565-2000
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Quement Elctrns. 408-998-5900
CA San Jose, Rose Elctrn. Distrbg. Co. ... 408-263-9700
CA Santa Monica, Master Distrs. 213-452-1229
CA Tustin, Allied Elctrns. 714-669-4190
CO Arvada, Denver Wintronics 303-431-7161
CO Denver, Allied Elctrns. 303-790-1662
CT Bridgeport, Park Distrs. 203-366-7200
CT Wallingford, Sager Electrical Supp. 203-265-4600
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Tampa, Specialty Distrbg. Co. 813-870-3315
FL W. Palm Beach, Nurmi Elctrn. 305-686-8553
GA Atlanta, Wholesale Indl. Elec. 800-282-1857
IL Elgin, Allied Elctrns. 312-697-8200
IL Rockford, Mid-West Associated 815-962-8036
IL Villa Park, Melvin Elctrns. 312-279-5015
IL Wood Dale, Electro-Kinetics 312-595-6700
IN East Chicago, ACRO Elctrns. 312-375-1269
IN Evansville, Hutch & Son 812-425-7201
IN Fort Wayne, Graham Elctrs. 219-423-3422
IN Indianapolis, Graham Elctrns. 317-634-8202
IN South Bend, Genesis Elctrns. 219-287-2911
IA Cedar Rapids, Bergquist Co. 319-366-8733
IA Cedar Rapids, Iowa Radio Supp. 319-393-4510
KY Bowling Green, Crescent Elctrns. 502-842-2444
LA Lafayette, Ralph's 318-234-4507
MD Rockville, Capitol Radio Whlsrs. 301-881-2270
MA Hingham, Sager Elec. Supp. 617-749-6700
MA N. Wilbraham, Indl. Comps. 413-596-3854
MA Norwood, Gerber Elctrns. 617-329-2400
MA Wilmington, Allied Elctrns. 617-942-0150
MA Worcester, Coghlin Elect. 617-756-8311
MI Flint, Shand Elctrns. 313-743-8940
MI Livonia, Shand Elctrns. 517-799-2527
MI Saginaw, Shand Elctrns. 313-591-3980
MN Minneapolis, Bergquist Co. 612-835-2322
MN Minneapolis, Elctrn. Center 612-371-5200
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Chelsea Inds. 816-842-8556
MO Maryland Hgts., Chelsea Inds. 314-997-7709
MO St. Louis, Van Sickle Radio-Elec. 314-621-5000
NE Lincoln, Scott Elctrn. Supp. 402-466-8221
NV Las Vegas, Kiesub Elctrns. 702-733-3888
NJ Hanover, State Elctrns. Parts 201-887-2550
NJ Oakland, Relay Spec. 201-337-1000
NJ Springfield, Route Elctrns. 201-379-7710
NY Albany, E. E. Taylor Co. 518-438-7811
NY Buffalo, Summit Distrs. 716-887-2800
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hauppauge, Sager Elctrl. Supply Co. .. 516-348-1300
NY Hempstead, Elctrn. Equip. 800-645-1605
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, Q.A.R. Indl. Elctrn. Sls. 914-699-2224
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Southeastern Radio Supp. ... 919-828-2311
OH Cincinnati, Hughes-Peters 513-351-2000
OH Cincinnati, United Radio 513-761-4030
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Stotts-Friedman Co. 513-298-5555
OH Toledo, Warren Radio 419-248-3364
OK Tulsa, PEI Genesis 918-622-8520
OR Portland, United Radio Supp. 503-233-7151
PA Erie, REM Elctrns. 814-453-5626
PA Harrisburg, Cumberland Elctrns. 717-233-5883
PA Philadelphia, PEI/Genesis 215-673-0400
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Randolph & Rice 615-255-5601
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Altair Co. 713-462-3029
TX Richardson, Altair Co. 214-231-5166
TX San Antonio, Sherman Elctrns. Supp. 512-224-1004
UT Salt Lake City, Standard Supp. 801-486-3371
VA Arlington, Arlington Elctrn. Whlsrs. 703-524-6256
VA Glen Allen, Hermitage Distrs. 804-798-3830
WA Redmond, Murphy Elctrns. 206-881-1234
WI Milwaukee, Marsh Elctrns. 414-475-6000

FAX: 703-731-0847

INDUSTRIAL DRIVES, A Kollmorgen Div., 201 Rock Rd., Radford, VA 24141, Tel: 703-639-2495, TWX: 710-875-3743; FSC No.: 11384; Empl.: 343; *Sls. Mgr.:* Wayne Coleman/Robert White Jr.; *Dist. Mgr.:* Hurley Gill ..... **B•1218-1220**

FAX: 818-376-1075

INDUSTRIAL ELECTRONIC ENGINEERS, 7740 Lemona Ave., Van Nuys, CA 91405, Tel: 818-787-0311, TELEX: 4720693/4720120; Empl.: 425; *Sls. Mgr.:* Darryl Bloom/J. Hart/S. Spiegel; *Dist. Mgr.:* J. Hart ... **B•1074**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg., Inc. 205-533-5165
AL Huntsville, TMA Technlg. Mktg. Assocs. 205-883-7893
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Brea, Masco Elctrns., Inc. 714-529-0866
CA Campbell, LCO Tech. Sls. 408-378-9900
CA Los Angeles, Masco Elctrns., Inc. 714-529-0866
CA Vista, Masco Elctrns., Inc. 619-758-5562
CO Lakewood, Cristee-Meade Co. 303-232-0287
CA San Jose, Class One Elctrns. 408-297-8666
CT North Haven, Kitchen & Kutchin, Inc. .. 203-239-0212
FL Largo, TMA Technlg. Mktg. Assocs. ... 813-536-3796
FL Melbourne, TMA Tech. Mktg. Assocs. 305-676-3776
FL Orlando, TMA Tech. Mktg. Assocs. 305-857-3760
FL Pompano Beach, TMA Tech. Mktg. Assocs. 305-977-9006
GA Atlanta, DHR Mktg., Inc. 404-451-9848
GA Norcross, TMA Tech. Mktg. Assocs. ... 404-446-3565
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 312-394-4422
IL Highland Park, Bransky Sls. 312-433-2375
IN Indianapolis, Wilson Tech. Sls. 317-872-2513
KS Lenexa, Midtec 913-541-0505
MD Hunt Valley, Marktron, Inc. 301-628-1111
MD Rockville, Marktron, Inc. 301-251-8990
MA Burlington, Kitchen & Kutchin, Inc. 617-229-2660
MI Southfield, L. H. Dickelman Co. 313-353-8210
MN Burnsville, 2M Sales, Inc. 612-890-7774
NY N. Syracuse, Advanced Comps. Corp., Inc. 315-699-2671
MO St. Louis, Midtec 314-275-8666
NC Raleigh, DHR Mktg, Inc. 919-781-1961
OH Richfield, Geotronix, Inc. 216-659-6100
OH Trotwood, Geotronix, Inc. 513-252-6700
OR Beaverton, Olson Tech. Sls. Corp. 503-643-9488
PA Allison Pk., Geotronix, Inc. 412-487-1770
PA Norristown, RJI 215-631-1414
SC Greenville, DHR Mktg., Inc. 803-235-3594
TX Dallas, MGR Elctrns., Inc. 214-238-5246, 713-759-0187
VA Springfield, Pantech 703-451-5700
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Cedarburg, Bransky Sls. 414-377-6837

Local Distributors

AL Birmingham, American Elctrns. 205-942-4656
AZ Phoenix, Tri-Tek, Inc. 602-371-0860
AZ Tempe, Circuit Specialist Co. 602-966-0764
CA Garden Grove, Richey/Western Elctrns. 714-895-0060,800-227-0060
CA Gardena, California Switch & Signal Co. 213-538-9830
CA Industry, Ital Elctrn. Sls., Inc. 818-968-8515, 714-990-0922
CA Lakeside, Mouser Elctrn. Corp. 619-449-2229
CA San Diego, Richey/Western Elctrns. .. 619-271-4511
CA Santa Clara, Richey/Western Elctrns. 408-727-7411
CA Santa Clara, Waltronic Sls. 408-727-1200
CA Santa Monica, Master Distrs. 213-452-1229
CA Sunnyvale, Target Elctrns. Inc. 408-734-5611
CO Denver, Integrated Elctrns. 303-292-6121
CT East Haven, J. V. Elctrns. 203-469-2321
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Alamonte Springs, Pioneer Technlgs. Grp., Inc. 305-834-9090,800-432-6094
FL Miami, Elctrn. Equip. Co., Inc. 305-871-3500, 800-432-1235
GA Norcross, Whitehead Elctrns. 404-923-6667
IL Bensenville, Voyager Elctrns. Corp. ... 312-860-1300
IL Chicago, Bell Inds. 312-640-1910
IL Chicago, Newark Elctrns. 312-784-5100
IL Elgin, Allied Elctrns. 312-697-8200
IL Elmhurst, Semiconductor Specialists, Inc. 312-279-1005
IL Northbrook, Classic Comps. 312-272-9650
IN Carmel, Altex Elctrns., Inc. 317-848-1323, 800-692-6039
MD Gaithersburg, Pioneer Technlgs. Grp., Inc. 301-921-0660
MD Jessups, Treeko Elctrns., Inc. 301-792-0112
MA Billerica, A. W. Mayer Co., Inc. 617-667-6900
MA Needham, Cronin Elctrns., Inc. 617-449-5000
MI Grand Rapids, S-F Elctrn. Supp. Inc. .. 616-459-0216
MI Southfield, Michigan Lectrols Corp. 313-353-1350, 800-445-5714
MN Minneapolis, Stark Elctrns. 612-332-1325
MO Kansas City, Semiconductor Specialists, Inc. 816-452-3900
MO Maryland Hgts., Chelsea Inds. 314-997-7709
NM Albuquerque, Betatron Elctrns. 505-821-1122
NM Albuquerque, Intl. Elctrns. 505-293-3497
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Farmingdale, S.A.I. 516-293-2710
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Rochester, Masline Elctrns. 716-546-5373
NC Greensboro, Hammond Elec. 919-275-6391
NC Raleigh, So. Eastern. Elctrns. 919-828-2311
NC Winston-Salem, Kirkman Elctrns. 919-722-9131
OH Cleveland, Alpha Distr. Corp. 216-659-7100
OH Dayton, The Stotts-Friedman Co. 513-298-5555
OK Oklahoma City, Electro Entrs., Inc. 405-427-6591
PA Philadelphia, Herbach & Rademan, Inc. 215-426-1700
PA Philadelphia, PEI/Genesis Elctrns. 215-673-0400
SC Greenville, EMSCO 803-233-4121
SC Taylors, Cantrell Whls. 803-268-1194
TN Knoxville, MAC-1 615-966-4143
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, The Altair Co. 512-837-4490
TX Farmers Branch, Force Elctrns. Inc. of Texas 214-247-9955
TX Fort Worth, Allied Elctrns. 817-336-5401
TX Houston, Force Elctrns. Inc. of Texas 713-561-8644
TX Houston, The Altair Co. 713-462-3029
TX Richardson, Southwest Elctrns. 214-234-3050
TX Richardson, The Altair Co. 214-231-5166
TX Stafford, Southwest Elctrns. 713-240-4000
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000

INDUSTRIAL ELECTRONIC HARDWARE CORP., 109 Prince St., New York, NY 10012, Tel: 212-677-1881, TWX: 710-581-4338, FAX: 212-674-1048; FSC No.: 97913; Empl.: 250; *Sls. Mgr.:* Louis Roberts; *Dist. Mgr.:* Louis Roberts ..... **C•1397-1399**

Local Sales Offices & Reps

AL Huntsville, Cartwright-Bean 205-830-1540
AZ Phoenix, Knight Co. 602-994-1311
CA Los Angeles, Knight Co 213-670-2833
CA San Diego, Knight Co. 619-743-5136
CA San Jose, QCI Assocs. 408-432-1070
CO Denver, Advance Technlg. 303-798-4200
FL Orlando, Cartwright-Bean 800-432-6714
GA Atlanta, Cartwright-Bean 404-368-0160
IL Orange, Heartland 312-577-9222
IN Kokomo, Schillinger Assocs. 317-452-4057
KS Kansas City, Midtec 913-541-0505
MD Ellicot City, Techn. Sls. 301-461-2400
MA Plainview, ET Assocs. 617-695-4700
MN Maple Grove, Design Technlg. 612-424-7605
MO St. Louis, Midtec 314-275-8666
NJ Sicklerville, Brown Assocs. 609-629-2240
NJ West Field, Artec 201-233-4113
NY Pittsford, Franklin Sls. 315-793-3161
NY Ronkonkoma, PMR 516-467-8200
NC Raleigh, Cartwright-Bean 919-876-4130
OH Medina, Hofstetter Co. 216-241-4880
OR Beaverton, Eclipse Mktg. 503-642-1661
TX Dallas, Comptech 817-265-6007
WA Redmond, Eclipse Mktg. 206-885-6991

INDUSTRIAL FABRICATING CO., 481 Shelton Ave., Hamden, CT 06517, Tel: 203-787-9111; Empl.: 30; *Sls. Mgr.:* Ray Peterson

INDUSTRIAL INDEXING SYSTEMS, INC., 626 Fishers Run, Victor, NY 14564, Tel: 716-924-9181; Empl.: 30; *Sls. Mgr.:* Raymond F. Coller

Local Sales Offices & Reps

IL	Clearview, Microcon, Inc.	312-390-0290
MA	Southborough, Motion Engrg.	617-485-2144
NY	East Rochester, A & D Dvcs.	716-385-2778
PA	Media, Homersmith, Inc.	215-543-2434

Local Distributors

MI	Grand Rapids, Ackerman Elec.	616-459-8327
OH	Cincinnati, Tapco Prods., Inc.	513-683-4481
WI	Oneida, MCL Inds., Inc.	414-434-1500

INDUSTRIAL MIDWEC CAPACITOR CORP., 4902 Tollview Dr., Rolling Meadows, IL 60008, Tel: 312-577-0120, TWX: 910-687-3375, FAX: 312-398-0318; Empl.: 100; *Sls. Mgr.:* Dale Rasmussen

Powertron

FAX: 516-883-7155

INDUSTRIAL TEST EQUIPMENT, 21 Yennicock Ave., Port Washington, NY 11050, Tel: 516-883-1700; FSC No.: 99074; *Sls. Mgr.:* Jay Monroe ..... **D•2120-2124**

INDUSTRIAL TIMER CO., 1500 Meriden Rd., P.O. Box 3329, Waterbury, CT 06705, Tel: 203-753-2487

INERTIAL MOTORS, 280 N. Broad St., Doylestown, PA 18901, Tel: 215-345-1010, TELEX: 83-1633; Empl.: 17; *Sls. Mgr.:* Joanne Dorr

INFICON LEYBOLD-HERAEUS, INC., See Leybold Inficon, Inc.

INFINETICS INC., Friskem Div., 201 Vandever Ave., Wilmington, DE 19802, Tel: 302-658-2471, TWX: 510-666-2332; *Sls. Mgr.:* M. Schwartz

INFODEX, INC., 10 Venus Dr., Wolcott, CT 06716, Tel: 203-757-9291, FAX: 203-757-9291 (x230); FSC No.: 09087; Empl.: 48; *Sls. Mgr.:* E. H. Ulm

INFO-LITE CORP., See Dio-Rey and Crosspoint

INFORMATION CONTROL, Dept. EM7 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 55; *Sls. Mgr.:* Carol J. Smith

INFORMATION CONTROL CORP., Abacus Div. Dept. EM7, 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 50

INFORMATION CONTROL CORP., 9610 Bellanca Ave., Los Angeles, CA 90045, Tel: 213-641-8520, TWX: 910-328-7234; Empl.: 30; *Sls. Mgr.:* J. M. Boyle

INFORMATION TECHNOLGOY A.D.S.C., P.O. Box 470, College Park, MD 20740, Tel: 301-779-5110

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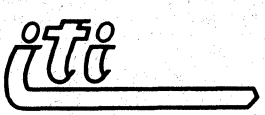

FAX: 716-657-7432

INFORMATION TRANSFER INDL. INC., Box 357, Holcomb, NY 14469, Tel: 716-657-7074; FSC No.: 55137; Empl.: 70; *Sls. Mgr.:* John Dillman ..... **D•1167-1169, 1276-1277**

Local Sales Offices & Reps

AZ	Scottsdale, Luscombe Engrg.	602-949-9333
CA	Pasadena, Luscombe Engrg.	213-684-2000
CA	San Diego, Luscombe Engrg.	619-272-6600
CO	Littleton, Pond Assocs., Inc.	303-798-2904
CT	Marion, Polytek Assocs.	203-621-4542
FL	Port Charlotte, John E. Wiseman Co.	813-625-5740
IL	Schaumburg, Kenneth W. Meyers Co.	312-882-4808
IN	Indianapolis, Kenneth W. Meyers Co.	317-783-1030
IA	Cedar Rapids, Kenneth W. Meyers Co.	319-363-8987
MA	Ashland, Polytek Assocs.	617-881-4741
MN	Minneapolis, Kenneth W. Meyers Co.	612-920-7080
NJ	Oxford, Malin Assocs.	201-689-7398
OR	Portland, Tasco	503-245-8168
PA	Melrose Park, Robert Meyers Assocs.	215-224-1663
TX	Houston, Sci. Sls. Co.	713-460-9170
TX	Richardson, Sci. Sls. Co.	214-231-6541
WA	Bellevue, Tasco	206-453-1414
WI	Brookfield, Kenneth W. Meyers Co.	414-784-3790

INFRARED INDUSTRIES, INC., 12151 Research Parkway, Orlando, FL 32826, Tel: 305-282-7700, TELEX: 568908, FAX: 305-273-9046; Empl.: 80; *Sls. Mgr.:* Thomas Chisholm

INJECTORALL ELECTRONICS (WOMAN OWNED), 110 Keyland Court, Bohemia, NY 11716, Tel: 516-563-3388 ..... **C•1123**

Local Sales Offices & Reps

AL	Birmingham, John F. Russell Co.	205-822-2196

Local Distributors

AL	Birmingham, ACK Radio Supp.	205-322-0588
AZ	Tucson, Electronic City	602-622-1173
CA	San Luis Obispo, Midstate Elctrns. Supp.	805-543-2770
CA	San Rafael, Elctrns. Plus	415-457-0466
CA	Sunnyvale, Halted Specialties	408-732-1573
FL	Jacksonville, Mitchell Elctrns.	904-356-8426
GA	Atlanta, Delta	404-458-4690
IL	Lombard, Tron Elctrns.	312-691-8900
IN	Evansville, Tri-State Supp. Co.	812-423-4257
IA	Cedar Rapids, Iowa Radio Supp. Co.	800-332-5296
KY	Louisville, P.I. Burkes	502-589-3960
MD	Rockville, Capitol Radio Whlsrs.	301-881-2270
MA	Needham, Y.D.I.	617-449-1005
MI	Canton, The Elctrn. Connection	313-595-6655
NY	Endicott, Rogan Elctrns.	607-754-3590
NY	Lindenhurst, RNJ Elctrns.	516-226-2700
NY	Long Island City, Typeco	718-706-6666
NY	Richmond Hill, Anchor	212-846-2420
NC	Charlotte, Slayton Elctrns.	704-375-6600
OK	Oklahoma City, Radio Supp., Inc.	405-332-6127
OR	Beaverton, Norvac	503-644-1025
PA	Philadelphia, H & R Elctrns.	215-426-1700
SC	Charleston, Wholesale Indl. Elctrns.	803-722-2634
TX	Fort Worth, Sweico	817-335-6521
VA	Roanoke, H. C. Baker	703-344-9209

INLAND MOTOR
KOLLMORGEN CORPORATION

FAX: 602-458-2161

INLAND MOTOR, 4020 E. Inland Rd., Sierra Vista, AZ 85635, Tel: 602-459-1150, TELEX: 62858, TWX: 910-973-9869; *Sls. Mgr.:* David Richards ..... **B•1214-1217**

INLAND MOTOR, Kollmorgen Corp., 501 First St., Radford, VA 24141, Tel: 703-639-9045, TWX: 710-875-3740; FSC No.: 11384; Empl.: 500

INMARK CORP., 147 West Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, TELEX: 99-6419, FAX: 203-866-0918; *Sls. Mgr.:* Theo Notaras

INMOS CORP., P.O. Box 16000, Colorado Springs, CO 80935, Tel: 303-630-4000 Ext. 4454, TWX: 910-920-4904; Empl.: 300; *Sls. Mgr.:* Don Carrigan; *Dist. Mgr.:* Jackson Cole

INNOVATEK MICROSYSTEMS, INC., Smithfield Rd., R1 Box 104, Millerton, NY 12546-9720, Tel: 914-373-9003, TELEX: Easylink 62264170; Empl.: 8; *Sls. Mgr.:* Paul F. Fitts

INNOVATIVE ELECTRONICS, INC., Dynatech Corporation, 10110 USA Today Way, Miramar, FL 33025, Tel: 305-432-0300, FAX: 305-432-0705; Empl.: 32; *Sls. Mgr.:* Marshall Roper

INRECO, See Ransco Industries

INRESCO, INC., 654 Ocean Road, Pt. Pleasant, NJ 08742, Tel: 201-892-5881; Empl.: 16; *Sls. Mgr.:* G. L. Martin

INSTRON CORP., 100 Royall St., Canton, MA 02021, Tel: 617-828-2500, TELEX: 924434; Empl.: 1000; *Sls. Mgr.:* Lawrence Frost; *Dist. Mgr.:* Patrick Heck

INSTRULAB, P.O. B. 98, Dayton, OH 45404, Tel: 513-223-2241; Empl.: 22; *Sls. Mgr.:* Philip C. Alderton

ICS inc.

FAX: 312-543-6244

INSTRUMENTATION & CONTROL SYS., 520 Interstate Rd, Addison, IL 60101, Tel: 312-543-6200, TELEX: 271503 ICS UR, TWX: 910-991-5945; Empl.: 50; *Sls. Mgr.:* Donald G. Baltzer; *Dist. Mgr.:* Sue Earnest ..... **B•1499; D•2125**

Local Distributors

NC	Raleigh, Allied Elctrns.	800-638-1381

Local Sales Offices & Reps

Industrial Control Component Reps.

FL	Orlando, Werndli Assocs.	305-851-1923
IL	Elmhurst, F.F./Hill-Gray Inc.	312-832-4101
IN	Indianapolis, E.M.C.I.	317-253-1668
MA	Randolph, Elctrl. Agencies	617-961-4330
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	Plainview, R. Smith Assocs.	516-681-3155
PA	Willogrove, Delta Tech.	215-657-7250
Can	Downsview, Ont., EPT Instrs.	416-665-3772

Power Conditioning Reps.

AL	Birmingham, C. S. Phillips Co.	205-870-0640
MA	Randolph, Elctrl. Agencies	617-961-4330
FL	Orlando, Werndli Assocs.	305-851-1923
IN	Indianapolis, E.M.C.I.	317-253-1668
NJ	Spring Lake, CPN Assocs.	201-774-5224
NY	Brentwood, CPN Assocs.	516-273-8348
NY	Hyde Pk., CPN Assocs.	914-229-7395
NC	Charlotte, Fred Lekson Assocs.	704-536-1868
PA	Willow Grove, Delta Tech.	215-657-7250
TX	Houston, Gettys-Eads-Adair	713-827-7155
Can	Downsview, Ont., EPT Inds.	416-665-3773
AL	Huntsville, Allied Elctrns.	800-241-7122
CA	Canoga Park, C & A Elctrns.	818-340-6022
CA	Hayward, Allied Elctrns.	415-487-5250
CA	Tustin, Allied Elctrns.	213-860-0090
MA	Wilmington, Allied Elctrns.	617-942-0150
FL	Pompano Bch., Allied Elctrns.	305-486-0500
GA	Norcross, Allied Elctrns.	404-377-3555
GA	Norcross, Automatic Controls Co.	404-447-5644
IL	Berwyn, B-B & W, Inc.	312-749-1710
IL	Elgin, Allied Elctrns.	312-697-8200
IL	Rosemont, Advent Elctrns.	312-297-6200
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Indianapolis, Advent Elctrns.	317-872-4910
MD	Marlow Hgts., Allied Elctrns.	301-423-0161
MI	Farmington Hills, Advent Elctrns.	313-447-1650
MN	St. Paul, Powermation	612-645-0781
NY	Hauppauge, N & L Instrs.	516-234-9797
NY	Mineola, Allied Elctrns.	516-248-2360
OH	Chagrin Falls, Comm-Omni	216-543-1328
OH	Warren, REM Elctrn. Supp. Co., Inc.	216-373-1300
TX	Brownsville, Garden Indl. Grp.	512-546-1612
TX	Ft. Worth, Allied Elctrns.	817-336-5401, 214-265-9341
TX	Ft. Worth, Allied Export Svcs.	817-336-5401

TX Garland, Powertronics 214-272-4640
WA Seattle, Allied Elctrns. 206-767-2827
WI Fond du Lac, Fedco Elctrns. 414-922-6490
WI Waukesha, Powermation 414-542-2868

INSTRUMENTATION MEAS. LAB., See Lockheed Electronics Co., Inc.

INSTRUMENTATION PRODS., 3M Co., 300 S. Lewis Rd., Camarillo, CA 93010, Tel: 805-482-1911, TWX: 910-336-1676; Empl.: 500

INSTRUMENTATION SERVICES, INC., 957 Winnetka Ave. N., Minneapolis, MN 55427, Tel: 612-544-8916, FAX: 612-544-4887; Empl.: 30; *Sls. Mgr.:* G. Ryan

INSTRUMENT ENCLOSURES, 9767 Glenoaks Blvd., Sun Valley, CA 91352, Tel: 818-768-4622, TELEX: 70-5097, FAX: 818-767-4988; FSC No.: 62012; Empl.: 28; *Sls. Mgr.:* William B. Taylor

THE INSTRUMENT MART, 295 Community Dr., Great Neck, NY 11021, Tel: 516-487-7430

INSTRUMENT RESEARCH CO., Box 40207, Santa Barbara, CA 93103, Tel: 805-962-8336; Empl.: 6

INSTRUMENT RESISTOR CO., See INRESCO/Instr. Resistor

INSTRUMENTS, INC., 7263 Engineer Rd., Ste. G, San Diego, CA 92111, Tel: 619-571-1111, TELEX: 910-350-7239 INST INC., FAX: 619-571-0188; FSC No.: 34563; Empl.: 28; *Sls. Mgr.:* Ken Kalbfell

INSTRUMENTS & CONTROLS DIV., See Technology Systems Div., KRUG Intl.

INSTRUMENTS FOR INDUSTRY, INC.

FAX: 516-467-8558

INSTRUMENTS FOR INDUSTRY, INC., 731 Union Parkway, Ronkonkoma, NY 11779, Tel: 516-467-8400, TWX: 510-222-0876; Empl.: 25; *Sls. Mgr.:* Ethel Smarz ..... **D•1012**

Local Sales Offices & Reps

AL Eva, Barr Elctrn. Instrs. 205-796-7533
AL Huntsville, Scientific Dvcs. S.E. 205-536-1969
AZ Mesa, DJM Elctrns. 602-820-4030
CA Sunnyvale, DJM Elctrns. 408-749-8936
CA Valencia, DJM Elctrns. 805-255-3291
CO Englewood, R. A. Mayes Co. 303-761-9447
CA San Diego, DJM Elctrns. 619-726-1266
FL Orlando, Scientific Dvcs. S.E. 305-841-8180
IA Cedar Rapids, EIR Co. 319-395-7500
MD Laurel, CSDS, Inc. 301-490-3800
MN Minneapolis, Deerland Distrs. 612-331-6433
MO Kansas City, EIR Co. 816-452-7030
MO Leasburg, EIR Co. 314-895-4100
NH Hudson, EMC Sls., Inc. 603-889-5751
NJ N. Plainfield, Brady Co. 201-755-7900
NM Albuquerque, R. A. Mayes Co. Southwest 505-292-2330
NC Winston-Salem, Scientific Dvcs. S.E. .. 919-765-5776
OH Cincinnati, Bill Teplitz Assocs. 513-481-1648
OH Cleveland, Bill Teplitz Assocs. 216-439-3265
PA Sewickley, Bill Teplitz Assocs. 412-741-3628
TX Austin, Scientific Dvcs. 512-388-3982
TX Houston, Scientific Dvcs. 713-376-8666
TX Richardson, Scientific Dvcs. 214-231-8016
WI Milwaukee, Deerland Distrs. 414-784-1414

INSTRUMENT SPECIALTIES CO., P.O. Box A, Delaware Water Gap, PA 18327, Tel: 717-424-8510, TWX: 510-671-4526, FAX: 717-424-6213; Empl.: 300; *Sls. Mgr.:* Thys Rienstra ..... **C•1748-1749**

Local Sales Offices & Reps

AZ Phoenix, O'Donnell Assocs. 602-944-9542
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NM Albuquerque, O'Donnell Assocs. S.W. 505-883-1030
OR Hillsboro, Temco Northwest 503-649-8375
TX Dallas, J. M. Spell 214-620-0040
WA Bothell, Temco Northwest 206-821-5434
Can Pickering, Ont., A. C. Simmonds & Sons, Ltd. 416-839-8041

INSULCAST, Permagile, 101 Commercial St., Plainview, NY 11803, Tel: 516-349-1100, TELEX: 221720 PERM UR, FAX: 516-349-1156; *Sls. Mgr.:* William P. Flaim, Natl. Sls. Mgr.

INTECH, Instruments Div., 282 Brokaw Rd., Santa Clara, CA 95050, Tel: 408-727-0500, TWX: 910-338-0254; Empl.: 120; *Sls. Mgr.:* Howard Randall; *Dist. Mgr.:* Howard Randall

INTEGRA, INC., 2368 Walsh Ave., Santa Clara, CA 95051, Tel: 408-727-9601, TWX: 910-338-0585; FSC No.: 51162; Empl.: 14; *Sls. Mgr.:* Len Johnson

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FAX: 206-882-1990

INTEGRATED CIRCUITS, INC., 10301 Willows Roads, P.O. Box 97005, Redmond, WA 98073-9705, Tel: 206-882-3100; FSC No.: 50821; Empl.: 290; *Sls. Mgr.:* D. T. Baughman ..... **A•1740-1741; D•1754-1761**

Local Sales Offices & Reps

AL Huntsville, Novus Grp. 205-534-0044
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CA El Toro, Martronix 714-858-0632
TX Irving, Kite Elctrn. Sls. 214-674-1330
CA San Diego, Martronix 619-728-0384
CO Parker, Tech. Mktg. Assocs. 303-841-3435
FL Deerfield Bch., Krutek & Assocs. 305-427-4202
GA Lilburn, Novus Grp. 404-381-1015
IL Elgin, Gassner & Clark Co. 312-698-9540
IA Des Moines, Beams Co. 515-255-1148
KS Shawnee Mission, Beams Co. 913-631-0300
MD Owings Mills, Neal Deoul Assocs. 301-363-4311
MA Wakefield, Howard C. Jappe Co. 617-245-9359
MN Eden Prarie, Electromark 612-944-5850
MO St. Louis, Beams Co. 314-569-1060
MO St. Louis, Beams Co. 314-934-8448
NJ Flanders, K & R Engrg. Sls. 201-584-5235
NY N. Syracuse, Advanced Comps. Corp. 315-699-2671
NC Raleigh, Novus Grp. 919-872-3966
OH Cleveland, Arthur H. Baier Co. 216-461-6161
PA Newtown, Yax Assocs. 215-860-2540
TX Irving, Kite Electrn. Sls. 416-674-1330
Can Ontario/Scarborough, Bestec Elctrns., Ltd. 416-674-1330

INTEGRATED COMPUTER SYSTEMS, 5800 Hannum Ave., Culver City, CA 90230, Tel: 213-417-8888, TELEX: 4995168 ICS LA; Empl.: 100; *Sls. Mgr.:* John Valenti

INTEGRATED DEVICE TECHNOLOGY, INC., 3236 Scott Blvd., Santa Clara, CA 95054-3090, Tel: 408-727-6116, TWX: 910-338-2070; FSC No.: 61772; Empl.: 1200; *Sls. Mgr.:* Joe Zabkar (VP); *Dist. Mgr.:* Rick Keeling

INTEGRATED DIGITAL PRODUCTS, 1470 N. Hundley St., Anaheim, CA 92806, Tel: 714-666-1133; Empl.: 15; *Sls. Mgr.:* Vince Imani; *Dist. Mgr.:* Meda Tharlson

INTEGRATED MICROWAVE, 3422 Tripp Ct., San Diego, CA 92121, Tel: 619-259-2600, TWX: 910-335-2037; FSC No.: 60656; Empl.: 75; *Sls. Mgr.:* Randy D. Mouber

INTEGRITY TECHNOLOGY, 105 Serra Way, Ste. 230, Milpitas, CA 95035, Tel: 408-262-8640, TELEX: 697-2396, ESYLNK: MCI Mail:209837; Empl.: 12

INTELCO, 8 Craig Road, Acton, MA 01720, Tel: 617-264-4485, TELEX: 62923380; Empl.: 25

Intelligence Power Technology

FAX: 805-987-0271

INTELLIGENCE POWER TECHNOLOGY, 829 Flynn Rd., Camarillo, CA 93010, Tel: 805-484-4441, TWX: 910-591-1893; Empl.: 35; *Sls. Mgr.:* Sharon Ellis .... **D•1763**

Local Sales Offices & Reps

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CA Los Angeles, Mil Com Sls. 714-840-2424
CA San Diego, Mesa Engrg. 619-278-8021
MA Chelmsford, Encotronics 617-256-4207
KY Ft. Mitchell, G. W. Thelen 606-341-8181
PA Horsham, Jacobsen Assocs. 215-674-2937
OH Medina, G. W. Thelen 216-723-1293
WA Bellevue, Underwood-Hanify 206-643-1793
WA Vancouver, Underwood-Hanify 206-695-2311
WI Greenfield, Olympic 414-281-9294

INTEPRO SYSTEMS INC., 450 Bedford St., Lexington, MA 02173, Tel: 617-863-9500, FAX: 617-861-1957; Empl.: 50; *Sls. Mgr.:* Mike O'Connor; *Dist. Mgr.:* Mike O'Connor

INTERACTION SYSTEMS INC., 130 Lincoln St., Brighton, MA 02135, Tel: 617-789-5900, TELEX: 753582 ..... **D•1092**

INTERACTIVE COMPUTER PRODUCTS, INC., 23482 Peralta, unit C, Laguna Hills, CA 92653, Tel: 714-770-5332; Empl.: 20; *Sls. Mgr.:* Jim Bearden

Distributor

Interconnect Specialties Inc. Tel: 800-752-4777, 714-773-0411, FAX: 714-447-3976; Telex: 910 321 0310..... 614, 615, 617, 721, 730, 781, 809, 820

FAX: 913-342-7043

INTERCONNECT DEVICES, INC., 5101 Richland Ave., Kansas City, KS 66106, Tel: 913-342-5544, TELEX: 286767 IDIKC UR; *Sls. Mgr.:* Greg Tafel

INTERCONNECT TECHNOLOGIES, INC., 75 Heathridge Rd., Hamden, CT 19355, Tel: 203-288-8428, FAX: 203-288-6783; *Sls. Mgr.:* Jennifer Lavelle; *Dist. Mgr.:* Melinda Lavelle

INTERDYNE CO., 157 Topaz St., Milpitas, CA 95035, Tel: 408-943-9133; FSC No.: 31598; Empl.: 30

INTERELECTRONICS CORP., Interelectronics Park, 550 U.S. Rte. 303, Congers, NY 10920, Tel: 914-EL8-8000; Empl.: 82; *Sls. Mgr.:* M. H. Pintell; *Dist. Mgr.:* G. Sherwood ..... **D•1765**

INTERFACE, INC., 7401 E. Butherus Dr., Scottsdale, AZ 85260, Tel: 602-948-5555, TELEX: 825-882; FSC No.: 32311

INTERFACE ENGINEERING INC., 275/300 Centre St., Unit 7, Holbrook, MA 02343, Tel: 617-986-2600, TELEX: 249-545; FSC No.: 14352; Empl.: 30; *Sls. Mgr.:* Thomas Scanlon ..... **D•1170-1171**

Local Sales Offices & Reps

NY Great Neck, Industron Assoc. 516-487-2620
VA Arlington, Gans & Pugh 703-527-3262

INTERFACE PRODUCTS, INC., 2185 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-549-4977, TWX: 910-595-2569; FSC No.: 55300; Empl.: 60; *Sls. Mgr.:* Western Sls. Mgr./Larry Green

INTERFACE TECHNOLOGY, Dynatech Corp., 2100 E. Alosta Ave., Glendora, CA 91740, Tel: 818-914-2741, TELEX: 4945489

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FAX: 415-340-1670

INTERFAN, William J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-1203; Empl.: 12; *Sls. Mgr.:* F. L. Nelson ..... **C•1678-1679**

Local Sales Offices & Reps

AZ Phoenix, Mercury Engrg. Sls., Inc. 602-265-0344
AR Mabelvale, Erickson Sls., Inc. 501-455-0618
CA Anaheim, Impact Elctrns., Inc. 714-533-1351,
CA Burlingame, William J. Purdy Co. 415-347-7701
CA San Diego, Miner Assocs., Inc. 619-566-9891,
CO Englewood, William J. Purdy Co., Assocs. 303-790-2211,
FL Maitland, Hutto Hawkins Assocs. 305-831-2474,

FL Pompano Bch., Hutto Hawkins Assocs. 305-979-0330,
FL Tampa, Hutto Hawkins Assocs. 813-251-6443,
GA Atlanta, Millar Elctrns., Inc. 404-634-3350
IL Elmhurst, F.F./Hill-Gray Assocs., Inc. .. 312-832-4101
IN Indianapolis, John Sukup, Inc. 317-253-5501
LA Chalmette, Erickson Sls., Inc. 504-271-1976
MD Lisbon, Samuel K. MacDonald, Inc. 301-442-1590
MI Royal Oak, Hilltronics Inc. 313-435-0920
MN Minneapolis, Boerger & Assocs. 612-560-3435
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Englewood, Sprung/Nussbaum, Inc. .. 201-569-5666
NM Albuquerque, William J. Purdy Co. 505-266-7959
NC Raleigh, Millar Elctrns., Inc. 919-828-8840
OH Cleveland, KT/DEPCO 216-442-6200
OH Columbus, KT/DEPCO 614-447-0106
OR Beaverton, Pacific Mktg. Specialists ... 503-641-9373
PA Pittsburgh, KT/DEPCO 412-367-1011
PA Willow Grove, Samuel K. MacDonald, Inc. 215-659-4414,
TX Austin, Erickson Sls., Inc. 512-244-3068
TX Dallas, Erickson Sls., Inc. 214-739-5833
TX Houston, Erickson Sls., Inc. 713-266-1604
WA Redmond, Pacific Mktg. Specialists ... 206-882-3144
Can Lachine, Que., Bytewide Mktg. 514-636-4121,

INTERGALACTIC CORP., Box 7025, Salt Lake City, UT 84107, Tel: 801-262-0094, TWX: 910-530-0888; *Sls. Mgr.:* Shawn MacGregor

INTERLOK, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-348-5625, TELEX: 677-1439 (Purdy UW); FSC No.: 55951; Empl.: 30; *Sls. Mgr.:* Clarence Bruce

INTER-MARKET, 1946 Lehigh Ave., Glenview, IL 60025, Tel: 312-729-5330, TWX: 910-651-1997; FSC No.: 34165; Empl.: 10; *Sls. Mgr.:* Phil Gardanier ..... **B•1153, 1728**

Local Sales Offices & Reps

MN St. Paul, Kenco Tronics 612-645-7717
PA Rydal, Espy Sls. 215-576-0780
WA Redmond, Elctrn. Mktg. 206-882-0962
Can Montreal, Que., Braydon Electro 514-332-5650

Local Distributors

CA Chatsworth, Mil-Comm Distr. 818-998-3111
ID Spirit Lake, A-1 Elctrns. 800-635-1545
IL Chicago, Newark Elctrns. 312-638-4411
MN St. Paul, K.D.I., Inc. 612-645-5090
NH Hudson, C & H Elctrns. 603-882-1133
NJ Oakland, Relay Specialties 201-337-1000
Can Montreal, Que., Braydon Electro 514-332-5650

INTERMATIC, Intermatic Plaza, Spring Grove, IL 60081, Tel: 815-675-2321, TELEX: 25-265; Empl.: 1000

INTER METRO INDUSTRIES CORP., North Washington St., Wilkes-Barre, PA 18705, Tel: 717-825-2741, TELEX: 831-833

INTERNATIONAL COMPONENTS CORP., 105 Maxess Rd., Melville, NY 11747, Tel: 516-293-1500, TELEX: 221576, FAX: 516-293-4983; Empl.: 100; *Sls. Mgr.:* Richard Weiner; *Dist. Mgr.:* Richard Weiner ..... **A•1088; D•1030-1031**

Local Sales Offices & Reps

AL Huntsville, Rick Burns Assocs. 205-461-7888
AR Little Rock, Erickson Sls. 501-455-0618
CA Anaheim, Impact Elctrns. 714-533-1351
CA Redwood City, Hickey Inds. 415-368-3849
CO Parker, Parker Webster 303-841-4888
IL Arlington Heights, MJ Petersen & Assoc. 312-577-8200
IA Cedar Rapids, IOWA Tech. Sls. 319-393-8644
LA Chalmette, Erickson Sls. Inc. 501-271-1976
MD Spencerville, Espy Sls. Co. 301-384-3300
NJ Fairfield, T.A.M. 201-575-4130
NY Syracuse, Nycom 315-437-8343
NC Raleigh, Rick Burns Assocs. 919-876-2224
OH Cincinnati, G & H Sls. Co. 513-272-0580
OH Lakewood, G & H Sls. Co. 216-226-6800
OK Broken Arrow, Erickson Sls. Inc. 918-455-4276
PA Rydal, Espy Sls. Co. 215-576-0780
SC Greer, Rick Burns Assocs. 803-297-8486
TX Austin, Erickson Sls. Inc. 512-244-3068
TX Dallas, Erickson Sls. Inc. 214-739-5833
TX Houston, Erickson Sls. Inc. 713-266-1604
UT Murray, Parker Webster 801-266-9939
PR Hato Rey, Casanova Indl. Sls. Corp. ... 809-753-8674

Local Distributors

CA Canoga Park, Myco Vickers 213-340-2025
CA Redwood City, Hi-Cor 415-365-5087
CT East Haven, JV Elctrns. 203-469-2321
FL Ft. Lauderdale, National Resistor Co. 305-772-4500
IA Cedar Rapids, Dee Elctrns. 319-365-7551
MA Burlington, T.L.C. 617-273-0140
MN Eden Prarie, Cassidy Elctrns. 612-944-0100
MN Minneapolis, Cassidy Elctrns. 612-835-7746
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Clifton, Vantage Comps. 201-667-1840
NJ Rockaway, Tonar Inds. 201-586-9000
NY Commack, Vantage Comps. Corp. 516-543-2000
PA Philadelphia, Mur'Tronics 215-632-4330
TX Ft. Worth, C & W Supp. Co. 817-831-0395

INTERNATIONAL CONFIGURATIONS, INC., P. O. Box 3374, Enfield, CT 06082, Tel: 203-749-6380, TELEX: 643 067; FSC No.: 62484; Empl.: 4; *Sls. Mgr.:* Mr. L. Baldwin

INTERNATIONAL CONTROLS & MEASUREMENTS CORP., P.O. Box 2819, Syracuse, NY 13220, Tel: 315-699-5266; FSC No.: 52516; Empl.: 50; *Sls. Mgr.:* Don Plath; *Dist. Mgr.:* Don Plath

INTERNATIONAL CONVERTER CORP., 770-101 Wooten Road, Colorado Springs, CO 80915, Tel: 719-570-6900, FAX: 719-570-6180; Empl.: 7 (U.S.), 1100 (Offshore); *Sls. Mgr.:* Deanna Thompson

INTERNATIONAL CRYSTAL MFG., 701 W. Sheridan, P.O. Box 26330, Oklahoma City, OK 73126, Tel: 405-236-3741, TELEX: 747-147, FAX: 405-235-1904; Empl.: 224; *Sls. Mgr.:* Paul E. Denwalt

INTERNATIONAL DATA SCIENCES, 7 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-6200, TWX: 710-384-1911; Empl.: 125

INTERNATIONAL DATA TECHNOLOGY, INC., 7440 N.W. 13th St., Ft. Lauderdale, FL 33313, Tel: 305-587-6823, TWX: 910-997-4751 (DIGITAL); Empl.: 15

INTERNATIONAL DIGITAL ELECTRONICS, 2045 S. Arlington Hgts. Rd., Ste. 119, Arlington Hgts., IL 60005, Tel: 312-439-8858/8861/8863, FAX: 312-439-8864; Empl.: 6; *Sls. Mgr.:* Masanori Kotani

INTERNATIONAL DIODE, 229 Cleveland Ave., Harrison, NJ 07029, Tel: 201-482-6518; Empl.: 9; *Sls. Mgr.:* Lee Toong

INTERNATIONAL ELECTRO MAGNETICS, INC., 350 N. Eric Dr., Palatine, IL 60067, Tel: 312-358-4622, TELEX: 4932869 IEM UI; Empl.: 15; *Sls. Mgr.:* T. Pretto ..... **D•1032**

Local Distributors

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CA Pleasant Hill, ALC 415-777-5525
NY Morris, Boynton Studio 607-263-5695
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INTERNATIONAL HIGH VOLTAGE ELCTRNS., INC., Finance Drive, Danbury, CT 06810, Tel: 203-792-7820, 800-634-0740, FAX: 203-743-3370; *Sls. Mgr.:* D. Steers ..... **D•1766-1767**

Local Sales Offices & Reps

CA Santa Ana, Power House, Inc. 714-549-9599

INTERNATIONAL INSTRUMENTATION, INC., 2282 Townsgate Rd., Westlake Vlg., CA 91361, Tel: 805-495-7673, FAX: 805-379-0701; Empl.: 32; *Sls. Mgr.:* Ted Rush; *Dist. Mgr.:* Dan Kimberling

FAX: 203-481-8937

INTERNATIONAL INSTRUMENTS, A PRIME TECHNOLOGY CO., Twin Lakes Rd, P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092; Empl.: 150; *Dist. Mgr.:* Bruce Granoff ..... **D•1374-1375**

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KS Olathe, Tech. Sls. Assoc. 913-829-2800
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MO Ferguson, Tech. Sls. Assocs. 314-725-5361
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NY Rochester, H. C. Johnson Agys. 716-586-0777
OH Westlake, Advanced Tech. Assocs. ... 216-835-5050
PA Glenshaw, H. C. Johnson Agys. 412-487-1246
PA Malvern, Stitzer Assocs. 215-644-5500
VA Dumfries, Electra-Tech 703-670-6962

Local Distributors

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CA Los Angeles, Metermaster 213-685-4340
CA Palo Alto, Metermaster 415-968-0313
CA San Diego, Metermaster 619-560-4841
CA Santa Clara, Dynametron 408-727-6531
CA Santa Clara, E.I.L. Instrs., Inc. 408-727-0396
CO Denver, E.I.L. Instrs., Inc. 303-534-4160
CO Denver, Metermaster Instr. Corp. 303-722-5766
CT Middletown, E.I.L. Instrs., Inc. 203-346-6646
FL Palm Bay, E.I.L. Instrs., Inc. 305-735-8300
GA Norcross, Metermaster 404-446-0166
IL Bridgeview, E.I.L. Instrs., Inc. 312-430-2292
IL Itasca, Metermaster 312-250-0605
IN Indianapolis, E.I.L. Instrs., Inc. 317-545-1373
KY Louisville, E.I.L. Instrs., Inc. 502-454-3420
LA New Orleans, Industrial Instr. Works .. 504-733-8355
MD Gaithersburg, Pioneer Instrs. Div. 301-948-2242
MA Burlington, E.I.L. Instrs. 617-272-9450
MI Ferndale, Ram Meter Inc. 313-398-6767
MN Minneapolis, Process Meas. Co. 612-544-4035
NJ Pensauken, E.I.L. Instrs., Inc. 609-488-0474
NY Clarence, Trott Elctrns., Inc. 716-634-8500
NY Hauppauge, E.I.L. Instrs., Inc. 516-231-6333
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OH Cleveland, Pioneer/Instrmn. Div. 216-587-3600
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OR Beaverton, Eicher-Richards 503-641-3300
PA Philadelphia, Sunshine Scientific 215-673-5600
PA Pittsburgh, E.I.L. Instrs. 412-731-5230
TX Dallas, E.I.L. Instrs., Inc. 214-931-1236
TX Garland, Metermaster 214-271-5671
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TX Houston, Meters & Instr. Corp. 713-644-1631
VA Springfield, E.I.L. Instrs., Inc. 703-354-4330
VA Virginia Beach, E.I.L. Instrs., Inc. 804-499-3746
WA Seattle, E.I.L. Instrs., Inc. 206-762-0800
WA Seattle, Eicher Richards 206-523-7888

INTERNATIONAL LASER SYS., 3404 N. Orange Blossom Trail, Orlando, FL 32804, Tel: 305-295-4010, TWX: 810-850-0195; Empl.: 408; *Sls. Mgr.:* W. C. Hudson

INTERNATIONAL LIGHT, Dexter Industrial Green, Newburyport, MA 01950-4092, Tel: 617-465-5923, TELEX: 94-7135, FAX: 617-462-0759; Empl.: 19; *Sls. Mgr.:* Jack Kelley; *Dist. Mgr.:* Jack Kelley

INTERNATIONAL MANUFACTURING SERVICES, 50 Schoolhouse La., Portsmouth, RI 02871-2418, Tel: 401-683-9700, FAX: 401-683-5571; FSC No.: 45177; Empl.: 25; *Sls. Mgr.:* Jay Benson ..... **A•1936**

Local Sales Offices & Reps

MA Attleboro, Antex-Overseas Sls. 617-222-5221
NJ Flanders, K & R Engr. Sls. 800-452-9767

INTERNATIONAL MICROELECTRONIC PRODS., 2830 North First Street, San Jose, CA 95134, Tel: 408-432-9100, TELEX: 499-1041, TWX: 910-338-2274; Empl.: 380; *Sls. Mgr.:* Robert Kromer

INTERNATIONAL MICROSYSTEMS, 461 Valley Way, Milpitas, CA 95035, Tel: 800-237-4734; Empl.: 10; *Sls. Mgr.:* Peter Schade

FAX: 602-790-2808

INTERNATIONAL MICROTRONICS CORP., 4016 E. Tennessee St., Tucson, AZ 85714, Tel: 602-748-7900, TWX: 910-952-1170; Empl.: 30; *Sls. Mgr.:* H. Statler ..... **D•1377-1379**

Local Sales Offices & Reps

CA La Jolla, John Garvin Assocs. 619-454-6274
CA Torrance, Cutlass Elctrns. 805-527-1905
LA Metairie, R. E. Owens, Inc. 504-866-5813
MA Wayland, Daner-Hayes 617-655-0888
OH North Royalton, Techno Instrs. Inc. 216-237-8815
TX Midland, Total Flow Measures 915-697-9621
PR Guaynabo, Escobar, Owen & Assocs. 809-789-9008

Local Distributors

CA Santa Clara, Tech-Ser, Inc. 408-496-1004
CA Torrance, Tech-Ser, Inc. 213-370-7200
GA Atlanta, Process Meas. Co. 404-696-7481
IL Chicago, Data Elctrns. Co., Inc. 312-283-0300
IL Countryside, Pacific Indicator 312-352-3500

IN	Indianapolis, Data Elctrns.	317-359-5368
MA	Waltham, Calibron Instrs.	617-894-6440
MN	Plymouth, Data Elctrns.	612-559-1434
NY	Rochester, Maseline Elctrns., Inc.	716-546-5373
TX	Dallas, Textrol, Inc.	214-484-9961
VA	Richmond, Meter Metrics	804-275-1431
WI	Wauwatosa, Data Elctrns. Co., Inc.	414-259-9088

INTERNATIONAL POLARIZER, INC., 320 Elm Street, Marlborough, MA 01752, Tel: 617-481-7495, ESYLNK: 6016454; Empl.: 6

INTERNATIONAL POWER
DC POWER SUPPLIES

FAX: 805-388-2686

INTERNATIONAL POWER D.C., Power Supplies Inc., 355 N. Lantana, Ste. 710, Camarillo, CA 93010, Tel: 805-987-7900, TWX: 510-600-6944, ESYLNK: 62911592; Empl.: 25; *Sls. Mgr.:* Craig Johnson; *Dist. Mgr.:* Ron Ostlund ..... **D•1768-1772**

Local Sales Offices & Reps

AZ	Phoenix, S.W. Tech. Sls.	602-893-1209
CA	El Cajon, Atronix	619-444-1501
CA	Oceanside, Atronix	619-438-2537
CA	San Jose, Nelson Elctrn. Sls.	408-293-2600
CA	Woodland Hills, Atronix	818-703-7212
CT	Bethel, Livera Polk Assocs.	203-748-4639
FL	Land O Lakes, A.J. Power Source	813-996-2583
GA	Lawrenceville, R. L. Panyik & Assocs.	404-923-3703
IL	Wheeling, Ed Joyner & Co.	312-520-1200
IN	Indianapolis, JFCO, Inc.	317-576-9363
MD	Randallstown, Beacon North, Inc.	703-478-2480
MI	Grand Rapids, JFCO, Inc.	616-245-4621
MI	Lake Orion, JFCO, Inc.	313-693-2053
MN	Richfield, Clay Rep Co.	612-861-2191
NH	Londonderry, Bennetron	603-432-9092
NJ	Madison, Livera-Polk Assocs.	201-377-3220
NY	Glen Head, Livera-Polk Assocs.	516-759-9300
OH	Cleveland, JFCO, Inc.	216-398-6300
OH	Vandalia, JFCO, Inc.	513-890-8322
OR	Beaverton, Luscombe Engrg.	206-223-1541, 206-636-6664
PA	Pittsburgh, JFCO, Inc.	412-823-5400
TX	Austin, Barry Sls., Inc.	512-837-3616
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls., Inc.	214-234-0255
UT	Ogden, Taylor Mktg.	801-546-9570
VA	Sterling, Beacon North, Inc.	703-478-2480
WI	Milwaukee, Ed Joyner & Co.	414-481-0547
Can	St. Laurent, Que., Componetics, Ltd.	514-334-1464
Can	Surrey, B.C., Enerlec Sls., Ltd.	604-888-1667

Local Distributors

CA	Canoga Pk., Sandy's Elctrn. Supp.	818-346-8353
CA	N. Hollywood, Sandy's Elctrn. Supp.	818-765-8585, 818-983-2550
CA	Thousand Oaks, Pace Elctrns.	818-889-1209, 805-497-7515
IL	Champaign, Klaus Radio	217-356-1896
IL	Mt. Prospect, Feed Control	312-253-3898
IL	Villa Pk., Melvin Elctrns.	312-279-5015
IN	Evansville, Evansville Supp. Co.	812-424-7541
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MD	Glen Burnie, Baytronics	301-766-0081, 301-953-7050
MN	Maplewood, Edison Controls	612-770-5122
NH	Hudson, C & H Elctrns.	603-882-1133, 603-273-4450
NH	Londonderry, Orion Inds., Inc.	603-437-4446
NY	Glen Head, Livera Polk Assocs.	516-759-9300
NC	Raleigh, Sager/Svc. Plus Elctrns.	919-850-9550
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	McKean, Advacom, Inc.	814-476-7774
TX	Richardson, All-Power	214-234-0255
VA	Sterling, ICE Comps., Inc.	703-478-2677
WI	Cedarburg, A-A Elec.	414-377-7500
Can	St. Laurent, Que., Componetics, Ltd.	514-334-1460
Can	Surrey, B.C., Enerlec Sls.	604-888-1667

IPD

FAX: 617-782-7416

INTERNATIONAL POWER DEVICES, 155 N. Beacon St., Brighton, MA 02135, Tel: 617-782-3331, ESYLNK: 989-752; Empl.: 65; *Sls. Mgr.:* Aileen Liu, G/M ..... **D•1774-1778**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg.	205-883-9630
AZ	Mesa, Elec-Com Assocs.	602-844-0566
CA	Los Angeles, Power Partners	213-215-0800
CA	San Diego, Power Partners	619-560-0099
CA	San Ramon, Tech. Consits.	415-830-0829
FL	Clearwater, Electrocraft, Inc.	813-578-2233
FL	Coral Springs, Electrocraft, Inc.	305-753-8566
GA	Norcross, Macro Mktg.	404-441-1081
IL	Lincolnwood, Electro-Tech Mktg. Assocs., Inc.	312-676-3151
MI	Ann Arbor, Augnat Assocs.	313-668-3134
MN	Bloomington, Smiley/Scott Inc.	612-888-5551
MO	Maryland Hgts., Ensco-Rep, Inc.	314-423-3935
NH	Londonderry, Bennetron	603-432-9092
NJ	Englewood, Tecnimat	201-569-4200
NJ	Haddonfield, Sunday O'Brien	609-429-4013
NY	Buffalo, Ed Westgren Assocs.	716-632-0011
NC	Raleigh, Micro Sls., Inc.	919-881-0007
OH	Akron, Augnat Assocs.	216-273-1211
OH	Dayton, Augnat Assocs.	513-298-1507
OR	Portland, Power Sources, Unltd.	503-292-0820
TX	Dallas, Seaton Corp.	214-380-0414
TX	Houston, Seaton Corp.	713-731-2649
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Lynnwood, Power Sources, Unltd.	206-743-6641
WI	Brookfield, Electro-Tech Mktg., Inc.	414-785-9554

INTERNATIONAL POWER MACHINES, 2975 Miller Park North, Garland, TX 75042, Tel: 800-527-1208, TELEX: 794078 IPM POWER, FAX: 214-494-2690; *Sls. Mgr.:* Wayne Harper

INTERNATIONAL POWER SOURCES, INC., 10 Cochituate St., Natick, MA 01760, Tel: 617-651-1818, TWX: 510-100-3635, FAX: 617-655-7984

International
IOR Rectifier

FAX: 213-640-6515

INTERNATIONAL RECTIFIER CORP., Semiconductor Div., 233 Kansas St., El Segundo, CA 90245, Tel: 213-772-2000, TELEX: 472-0403, TWX: 910-348-6291; Empl.: 1900; *Sls. Mgr.:* Don Prescott; *Dist. Mgr.:* Shawn Fogarty ..... **B•1501**

Local Sales Offices & Reps

AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
AZ	Phoenix, Sun State Tech. Sls.	602-220-0595
CA	Chatsworth, First Rep	818-718-6155
CA	Mtn. View, Brooks Tech. Grp.	415-960-3880
CA	San Diego, Harvey King, Inc.	619-587-9300
CA	Tarzana, Power Comp. Sls.	818-881-9111
CO	Wheat Ridge, Waugaman Assocs., Inc.	303-423-1020
CT	Fairfield, N.R.G. Ltd., Inc.	203-384-1112
FL	Boca Raton, Lawrence Assocs., Inc.	305-368-7373
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Hoffman Estates, Micro-Tex, Inc.	312-382-3001
IL	Palatine, International Rectifier	312-397-0002
IN	Carmel, Technlg. Mktg. Corp.	317-844-8462
IA	Cedar Rapids, Hitec Cen., Inc.	319-396-3228
KY	Louisville, Technlg. Mktg. Corp.	502-893-1377
MD	Columbia, L. D. Lowery, Inc.	301-381-0225
MA	Burlington, AD/Nova Sls., Inc.	617-270-9600
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Eden Prairie, Elctrn. Innovators	612-941-0830
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	Florissant, Hitec Control, Inc.	314-831-9377
NJ	Pallisades Park, International Rectifier	201-943-4554
NJ	Wyckoff, Northeast Comps.	201-848-1100
NM	Albuquerque, Reptronix Ltd.	505-292-1718
NY	E. Syracuse, Nycom, Inc.	315-437-8343
NY	Melville, Parallax	516-351-1000
NC	Raleigh, Montgomery Mktg., Inc.	919-851-0010
OH	Cincinnati, Luebbe Sls. Co.	513-530-0600
OH	Cleveland, Luebbe Sls. Co.	216-333-0425
OH	Columbus, Luebbe Sls. Co.	614-431-0474
OH	Dayton, Luebbe Sls. Co.	513-294-0426
OH	Independence, International Rectifier	216-447-9717
OK	Tulsa, BP Sls.	918-744-9964
OR	Portland, N.W. Mktg. Assocs.	503-620-0441
PA	Broomal, L. D. Lowery, Inc.	215-356-5300
TX	Austin, BP Sls.	512-346-9186
TX	Houston, BP Sls.	713-782-4144
TX	Richardson, BP Sls.	214-234-8438
UT	Salt Lake City, BP Mktg.	801-595-0631
WA	Bellevue, N.W. Mktg. Assocs.	206-455-5846
WI	Elm Grove, International Rectifier	414-784-2480
WI	Waukesha, Micro-Tex, Inc.	414-542-5352

IRC
A Member of the Crystalate Group

FAX: 704-264-8865

INTERNATIONAL RESISTIVE COMPANY, P.O. Box 1860, Boone, NC 28607, Tel: 704-264-8861, TELEX: 46-9902; Empl.: 1700; *Sls. Mgr.:* Larry J. Johnston; *Dist. Mgr.:* Hugh Bolen ..... **A•1739, 1937-1940; B•1011**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5110
AZ	Scottsdale, SW Sls. Inc.	602-391-3180
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	Sacramento, ETS	916-962-3030
CA	San Jose, ETS	408-433-9366
CO	Westminster, Straube Assocs.	303-426-0890
CT	E. Norwalk, Tech. Sls. Assocs.	203-853-4466
FL	Orlando, S. Atlantic Comp. Sls.	305-857-3650
GA	Norcross, S. Atlantic Comp. Sls.	404-447-6154
IL	Itasca, Circuit Sls. Inc.	312-773-0200
IN	Ft. Wayne, R. O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R. O. Whitesell & Assocs.	317-359-9283
IA	Cedar Rapids, C. H. Horn & Assocs.	319-393-8703
KS	Lenexa, Midtec Assocs.	913-541-0505
KY	Pewee Valley, R. O. Whitesell & Assocs.	502-241-1441
MD	Columbia, L. D. Lowery Inc.	301-381-0225
MA	Needham Hgts., Coakey, Boyd, & Abbett	617-444-5470
MI	Grand Blanc, R. O. Whitesell & Assocs.	313-695-0770
MI	Grand Rapids, R. O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell & Assocs.	313-559-5454
MN	Minneapolis, Tecteam Sls., Inc.	612-854-6616
MO	St. Louis, Jack Macke Co.	314-432-2830
NY	Rochester, Electra Sls.	716-427-7860
NC	Greensboro, S. Atlantic Comp. Sls.	919-852-4676
OH	Cincinnati, R. O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R. O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R. O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R. O. Whitesell & Assocs.	513-298-9546
OK	Tulsa, Ion Assocs.	918-664-0186
OR	Portland, RTS	503-632-3925
PA	Broomall, L. D. Lowery Inc.	215-356-5300
PA	Pittsburgh, R. O. Whitesell & Assocs.	412-963-6161
TN	Nashville, R. O. Whitesell & Assocs.	615-352-4760
TX	Austin, Ion Assocs.	512-331-7251
TX	El Paso, S. W. Sales	915-594-8259
TX	Grand Prairie, Ion Assocs.	214-647-8225
UT	Salt Lake City, Straube Assocs.	801-263-2640
VA	Earlysville, L. D. Lowery Inc.	804-973-6672
WA	Vashon, RTS	503-632-3925
WA	Vashon, RTS	206-265-1363
WI	Brookfield, Circuit Sls., Inc.	414-784-7773
Can	Toronto, Renmark	416-494-5445

Local Distributors

AZ	Tempe, Hamilton/Avnet	602-231-5100
CA	Campton, Harper S.I.D.	213-979-5090
CA	Chatsworth, Hamilton Electro Sls.	818-700-6500
CA	Culver City, Hamilton Electro Sls.	213-558-2121
CA	Gardena, Bell Inds.	213-515-1800
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Sunnyvlae, Harper S.I.D.	408-988-6041
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Schaumburg, Arrow Elctrns.	312-397-3440
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco	319-365-7551
MD	Columbia, Hamilton/Avnet	301-995-3500
MA	Woburn, Jaco Elctrns.	617-933-7760
MN	Edina, Arrow Elctrns.	612-830-1800
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Marlton, Arrow Elctrns.	609-596-8000
NY	Hauppauge, Hamilton/Avnet	516-231-9800
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NC	Raleigh, Arrow Elctrns.	919-876-3132
NC	Raleigh, Resco/Raleigh	919-781-5700
OH	Columbus, Electronic Mktg.	614-299-4161
OH	Dayton, Hamilton/Avnet	513-439-6700
PA	Philadelphia, Philadelphia Elctrns.	215-568-7400
TX	El Paso, Intl. Elctrns.	915-778-9761
TX	Irving, Hamilton/Avnet	214-659-4100
TX	Richardson, Jaco Elctrns.	214-235-9575
WA	Bellevue, Hamilton/Avnet	206-643-3950
WA	Bellevue, Priebe Elctrns.	206-821-4695

INTERNATIONAL RESOURCE SVCS., 7792 N.W. 72nd Ave., Miami, FL 33166, Tel: 305-884-2924, TELEX: 529076 SUN MIA UD; Empl.: 5; *Sls. Mgr.:* Richard L. Winn ..... **B•1729**

FAX: 402-694-6180

INTERNATIONAL SENSOR SYSTEMS, INC., Aurora Industrial Pk., Box 345, Aurora, NE 68818, Tel: 402-694-6111, ESYLNK: 62942952; Empl.: 45; *Sls. Mgr.:* Wayne Roblee ..... **A•1742-1743**

Local Sales Offices & Reps

CA	Mission Viejo, EAB Assocs. Inc	714-859-7701
CA	Palo Alto, Tri-Rep	415-965-1822
CO	Ft. Collins, Rep Sls. Inc.	303-226-1504
CT	Roxbury, Kimble Assocs.	203-354-1954
KS	Wichita, DLE Elctrns.	316-744-1229
MD	Baldwin, Quarterback Sls. Inc.	301-764-9400
MO	Jefferson City, Williams Assocs. Co.	314-893-2459
NE	Omaha, IONEB	402-895-4431
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NY	Liverpool, Syronics, Inc.	315-451-0968
OH	Cincinnati, Applied Data Mgt.	513-579-8108
PA	Southampton, Campbell Assocs.	215-322-6630
TN	McMinnville, B & D Mktg.	615-473-7155
TX	El Paso, Nokomis of El Paso, Inc.	915-778-2801
TX	Lewisville, Elctrn. Prod. Reps.	214-436-4772
WA	Bellevue, Advanced Power Comps.	206-747-9127

INTERNATIONAL TRANSDUCER CORP., Channel Technologies, Inc., 869 Ward Dr., Santa Barbara, CA 93111, Tel: 805-683-2575, TELEX: 658 495; FSC No.: ID 532; Empl.: 65; *Sls. Mgr.:* Christine M. Bashforth

INTERNATIONAL WIRE PRODUCTS CO., 500 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-5800, TELEX: 642580; Empl.: 700; *Sls. Mgr.:* C. D. Abbott

INTEROPTICS

FAX: 415-340-1670

INTEROPTICS, Purdy Group, 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-7727, TELEX: 677-1439 (PURDY UW); Empl.: 35; *Sls. Mgr.:* Thomas B. Kinney ..... **B•1169**

Local Sales Offices & Reps

AZ	Phoenix, Laser Tech. Intl.	602-978-5756
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Denver, William J. Purdy Co.	303-753-6800
FL	Melbourne, Panterra Sls., Inc.	305-452-4454
GA	Decatur, Panterra Sls., Inc.	404-325-0165
IL	Des Plaines, Flaherty-Haines, Inc.	312-298-2710
MN	Bloomington, Heil's Termatech Elctrn. Mktg.	612-854-2001
MO	St. Louis, Midtec Assocs., Inc.	314-275-8666
NH	Nashua, Bell Controls, Inc.	603-882-6984
NJ	Passaic, Lightcomm Sls. Assocs.	201-778-6540
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NY	New York, Lightcomm Sls. Assocs.	212-807-8924
NY	Utica, Fiber Instrs. Sls.	315-735-1691
NC	High Pt., EME, Inc.	919-869-3335
OK	Park Hill, Scientific Dvcs.	918-457-4888
OR	Beaverton, William J. Purdy Co.	503-641-9373
TN	Fayetteville, Panterra Sls., Inc.	615-759-4155
TX	Richardson, Scientific Dvcs.	214-231-8106
TX	Roundrock, Scientific Dvcs.	512-388-3982
TX	Spring, Scientific Dvcs.	713-376-8666
VA	Williamsburg, EME IV, Inc.	804-253-0171
WA	Redmond, William J. Purdy Co.	206-882-3144

Local Distributors

CA	Anaheim, Fibertron	714-634-3449
Can	Burnaby, BC, C.D. Nova, Ltd.	604-430-5612

INTERSIL, 2450 Walsh Ave., Santa Clara, CA 95051, Tel: 408-996-5000, TWX: 910-338-0583; FSC No.: 32293; Empl.: 4102; *Dist. Mgr.:* Bruce Mattern

INTERSTATE ELECTRONICS CORP., Box 3117, 1001 E. Ball Rd., Anaheim, CA 92803, Tel: 714-635-7210, TELEX: 655443, TWX: 910-591-1197; FSC No.: 6625, 5985; Empl.: 1500; *Sls. Mgr.:* Darryl Watanabe; *Dist. Mgr.:* R. Sorenson

INTERSTATE WIRE CO., INC., 10820 Sanden Dr., Dallas, TX 75238, Tel: 214-553-1311, TWX: 910-860-5084, FAX: 214-348-7106; *Sls. Mgr.:* Chris B. Brandon

INTERSWITCH

FAX: 415-340-1670

INTERSWITCH, Wm. J. Purdy Co., 770 Airport Blvd., Burlingame, CA 94010, Tel: 415-347-8217, TELEX: 677-1439; FSC No.: (Purdy UW); Empl.: 30; *Sls. Mgr.:* Clarence Bruce ..... **B•1823**

Local Sales Offices & Reps

CA	Burlingame, Interswitch	415-347-8217
CA	Anaheim, Impact	714-533-1351
CA	Burlingame, William J. Purdy Co.	415-347-7701
CO	Denver, William J. Purdy Co.	303-790-2211
CT	Meriden, Advanced Comp. Sls.	203-238-6891
IL	Elmhurst, F.F./Hill-Gray	312-832-4101
IN	Indianapolis, John Sukup Inc.	317-253-5501
MD	Lisbon, S. K. MacDonald	301-982-1088
MI	Royal Oak, Hilltronics, Inc.	313-435-0920
MA	Farmingham, Gallagher	617-626-2346
NM	Albuquerque, William J. Purdy Co.	505-266-7959
NY	Rochester, Net Sls.	716-223-1030
OH	Cleveland, Marlow	216-991-6500
OH	Dayton, Marlow	513-274-9666
OR	Beaverton, Pacific Mktg.	503-641-9373
PA	Philadelphia, S. K. MacDonald, Inc.	215-545-1205
TX	Dallas, Elcom Mktg.	214-241-2166
TX	Houston, Elcom Mktg.	713-350-8064
WA	Redmond, Pacific Mktg.	206-882-3144

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
AZ	Tempe, Waltronic Sls.	602-967-1020
CA	Burbank, Merit Comp. Supp.	818-842-8162
CA	Canoga Pk., Panel Parts Co.	818-884-8898
CA	Costa Mesa, Powell	714-754-1717
CA	San Jose, Powell	408-943-9020
CA	Santa Clara, Waltronic Sls.	408-727-1200
FL	Ft. Lauderdale, Powell	305-973-4141
MD	Columbia, Powell	301-621-8080
MA	Lynn, Land Elctrn. Co.	617-592-2220
MN	Minneapolis, Bergquist	612-835-2322
NJ	Englewood, Powell Elctrns.	201-894-0800
NM	Albuquerque, Walker Elctrn. Supp.	505-883-2992
NY	Buffalo, Summit Distrs.	716-884-3450
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
PA	Philadelphia, Powell	215-365-1900
PA	Philadelphia, Resco Elctrns.	215-659-4575
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Irving, Powell	214-550-0547
WI	Mequon, Taylor Elec. Co.	414-241-4321
Can	Don Mills, Ont., Saynor Varah	416-445-0723
Can	Willowdale, Ont., Electrosonic	416-494-1666

The Inter-Technical Group Inc. WIMA Division

FAX: 914-591-7336

INTER-TECHNICAL GROUP INC., WIMA Div., One Bridge Street, Irvington, NY 10533, Tel: 914-591-8822, TWX: 710-564-0802; Empl.: 17; *Sls. Mgr.:* Gary M. Fey; *Dist. Mgr.:* Andrew E. Dvorscak ..... **A•1089**

Local Sales Offices & Reps

AL	Huntsville, J. R. Assocs.	205-830-2130
CA	Campbell, Shur Sls.	408-374-5577
CO	Englewood, B C & Assocs.	303-694-3999
FL	Altamonte Springs, 'C' Assocs., Inc.	305-831-1717
GA	Conyers, J.R. Assocs.	404-922-1231
IL	Westchester, W. G. Brouilette & Assocs.	312-345-6500
KS	Overland Pk., EPI West	913-642-9118
MA	Newton, Normell Assocs.	617-969-5478
MI	Grand Rapids, JFCO, Inc.	616-949-1020
MI	Lake Orion, JFCO, Inc.	313-693-2053
MN	Minneapolis, Intl. Sls. Co.	612-831-8423
MO	St. Louis, EPI, Inc.	314-962-1411
NJ	Upper Montclair, McCarron Entprs., Inc.	201-783-3112
NY	Rochester, BKT Assocs., Inc.	716-461-9880
NY	Smithtown, T & K Sls.	516-724-3456
NC	Lewisville, J.R. Assocs.	919-945-9574
OH	Cleveland, JFCO, Inc.	216-398-6300
OH	Dayton, JFCO, Inc.	513-890-8322
OR	Portland, Harry Levinson Co.	503-245-1902
PA	Pittsburgh, JFCO, Inc.	412-823-5400
TN	Chattanooga, J. R. Assocs.	615-892-7630
TN	Chattanooga, J.R. Assocs.	615-892-7630
TX	Houston, Barry Sls., Inc.	713-784-5860
TX	Richardson, Barry Sls, Inc.	214-234-0255
UT	Murray, Butterworth Mktg.	801-268-2244
VA	Richmond, Glasscock Assocs.	804-740-0063
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

CA	San Jose, Shelly-Ragon, Inc.	408-432-0600
CA	Sunnyvale, Capsco Sls., Inc.	408-734-3020
FL	Melbourne, T.C. Pridmore Co.	305-727-2491
GA	Norcross, Spectrum Elctrns., Inc.	404-448-1516
IL	Rosemont, Advent Elctrns., Inc.	312-297-6200
IN	Indianapolis, Advent Elctrns., Inc.	317-872-4910
IA	Cedar Rapids, Advent Elctrns., Inc.	319-363-0221
MA	Ashland, March Elctrns.	617-881-6715
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MN	New Brighton, Chris Elctrns. Distr.	612-631-2647
NY	Bohemia, March Elctrns.	516-563-6000
NY	Port Chester, MKM Elctrn. Comps., Inc.	914-939-3940
OH	Englewood, Argent Inds., Inc.	513-836-8633
PA	Exton, VSH Elctrns.	215-363-2250
PA	Zelienople, Argent Electra Div.	412-776-4330
TX	McKinney, Prime Distrbg. Co.	214-231-0170
WA	Seattle, Kam Elctrns. Div.	206-382-1300

INTRA-COMPUTER, 101 W. 31st St., New York, NY 10001, Tel: 212-947-5533, TELEX: 64-5067; Empl.: 9; *Sls. Mgr.:* Art Yaglian

FAX: 617-527-3310

INTRONICS, INC., 57 Chapel St., Newton, MA 02158, Tel: 617-964-4000, TELEX: 200095, TWX: 710-335-6835; Empl.: 75; *Sls. Mgr.:* William Dudjoc ..... **D•1779**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
CA	Campbell, Situr Sls.	408-374-5577
CA	Los Alamitos, Power Specialists	213-594-9418
IL	Arlington Hgts., Coombs Assocs.	312-439-9810
IA	Cedar Rapids, Technical Elctrns.	319-366-5443
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	Albuquerque, Trembly Assocs.	505-266-8616
NY	Utica, Fiber Instr. Sls.	315-735-1691
OH	Dayton, Del Steffen & Assocs.	513-293-3145
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, Trembly Assocs., Inc.	801-295-4703
VA	Reston, Stinson Assocs.	703-478-2252
Can	Lachine, Que., Electro Design	514-636-4838
Can	Surry, BC, Enerlec Sls., Ltd.	604-888-1667

ION PHYSICS CO., 323 Andover St., Wilmington, MA 01887, Tel: 617-658-6030, TWX: 510-600-6134

IOTECH, INC., 23400 Aurora Road, Cleveland, OH 44146, Tel: 216-439-4091, TELEX: WUI 6502820864

IPAC GRP., 3047 Indl. Blvd., Bethel Pk., PA 15102, Tel: 412-831-9200, TWX: 510-697-3935; Empl.: 50; *Sls. Mgr.:* D. T. Cusack

Local Sales Offices & Reps

AL	Huntsville, Jim Springer, Inc.	205-883-4163
AZ	Paradise Valley, Lee Assocs.	602-947-9003
CA	Walnut Creek, Briggs Process Instrs.	415-932-5772
MA	Norwell, BESCO	617-659-4915
NC	Smithfield, HESCO	919-934-5115
PA	Bethlehem, Carl Anderson Agy.	215-868-7275
TX	Houston, CPI Sys.	713-580-9411

IPM, INC., Elnik Systems, 3 Edison Place, Fairfield, NJ 07006, Tel: 201-882-8033, TELEX: 13-0567, FAX: 201-882-8037; Empl.: 8; *Sls. Mgr.:* Claus J. Joens

IRONICS INCORPORATED, 798 Cascadilla St., Ithaca, NY 14850, Tel: 607-277-4060, TELEX: 705-742; *Sls. Mgr.:* R. Chris Martens

IR SCIENTIFIC, Box 110, Carlisle, MA 01741, Tel: 617-667-7110; Empl.: 10; *Sls. Mgr.:* S. J. Sommer

ISC CARDION ELECTRONICS, INC., Long Island Expwy., Woodbury, NY 11797, Tel: 516-921-7300, TELEX: 221683 CARD, TWX: 510-221-2179; FSC No.: 12909; Empl.: 450; *Sls. Mgr.:* F. J. Gareffa

ISC DATACOM, ISC Defense & Space, 1288 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-747-0300, FAX: 408-747-1873; FSC No.: 74444; Empl.: 30; *Sls. Mgr.:* C. Frank

ISC MAGNETICS DIV., See Aeroflex Labs., Inc., Magnetic Prods. Div.

ISKRA ELECTRONICS, INC., 222 Sherwood Ave., Farmingdale, NY 11735, Tel: 516-753-0400, 800-862-2101, TELEX: 221527, FAX: 516 753-0658; *Sls. Mgr.:* Debbie Gremito

Local Sales Offices & Reps

CA	San Diego, C. K. Assocs.	619-279-0420
FL	Largo, Burke Assocs.	813-536-4335,
IL	Elmhurst, Utronix Sls.	312-834-1100
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MN	Minneapolis, R.K. Sls. Assocs. Inc.	612-571-1001
NJ	Glasboro, R. P. Luce & Co.	609-881-2877,
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
OH	Mentor, Sales Plus	216-255-6917,
SC	Easley, R A Sls.	803-859-1859
TN	Rutherford, R.A. Sls.	901-665-6301,
TX	Dallas, J. Clay Co.	214-458-8833
TX	El Paso, EPEC Elctrns. Inc.	915-593-8481
UT	South Jordan, MAC III	801-569-1095

FAX: 516-937-3840

ISL PRODUCTS INT'L, LTD., 235 P Robbins Lane, Syosset, NY 11791-6093, Tel: 516-937-3475, TELEX: 503242; Empl.: 25,000; *Sls. Mgr.:* Ken Kawaller ..... **A•1094, 2241; C•1401, 1856; D•2167**

Local Sales Offices & Reps

IL	Chicago, Trans World Products	312-486-5474
IN	Indianapolis, C.C. Electro Sales	317-255-1508
MD	Pikesville, Muncy-Semless Assoc.	301-484-6376
MN	St. Paul, Countryman Assoc.	612-645-9151
NJ	West Berlin, Muncy-Semless Assoc.	609-346-4402

ISOLATION PRODUCTS, INC., 157 San Lazaro Ave., Sunnyvale, CA 94086, Tel: 408-730-4672; Empl.: 5

ISOREG CORP., 410 Great Rd., P.O. Box 486, Littleton, MA 01460, Tel: 617-486-9483, FAX: 617-486-3539; Empl.: 75; *Sls. Mgr.:* Paul Foss; *Dist. Mgr.:* Paul Foss

FAX: 804-977-1849

ISOTEMP RESEARCH, INC., 1750 Broadway St., P.O. Box 3389, Charlottesville, VA 22901, Tel: 804-295-3101; FSC No.: 031785; Empl.: 30 ..... **A•1402-1403**

Local Sales Offices & Reps

AZ	Scottsdale, Faser Technical Sls.	602-948-4404
CA	Fremont, Wm. Parks & Assocs.	415-796-0875
CA	Irvine, EBA Microwave	714-857-6079
CA	San Diego, Qualtronics	619-695-0118
IL	Woodridge, Trend-Tronics	312-985-0626
IN	Fort Wayne, Given Corp.	219-432-5585
NC	Raleigh, Godwin Assocs.	919-847-3006

ISOTRONICS, Augat, Industrial Park, New Bedford, MA 02745, Tel: 617-998-2000, TWX: 710-344-1961; *Sls. Mgr.:* Max Treptow

ITC SYSTEMS, INC., 813 Anapamu St. 2C, Santa Barbara, CA 93103, Tel: 805-965-8900, TELEX: 295-298 INTERTEL SNC; *Sls. Mgr.:* W. Schutz

ITEK ENCODER, 27 Christina St., Newton, MA 02164-1515, Tel: 617-969-7300, TWX: 710-335-6783, FAX: 617-964-3705; Empl.: 100 ..... **B•1892-1893**

Local Sales Offices & Reps

CA	Long Bch., Itek Encoder	213-598-8575
CA	Woodland Hills, Clifton Precision	818-347-0603
FL	Orlando, K. S. Chaney	305-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MI	Grand Rapids, Midwest & Meridian Corp.	616-698-7391
MN	Minneapolis, Marsland Assocs.	612-545-4481
MO	St. Louis, Midwest & Meridian Corp.	314-878-4441
NJ	Metuchen, Itek Encoder	201-548-1500
TX	Garland, Carey, McMahill & Assocs., Inc.	214-494-1212

Local Distributors

FL	Orlando, Kenneth S. Chaney	305-293-5656
IL	Des Plaines, Marsland Assocs.	312-298-2620
IN	Indianapolis, Marsland Assocs.	317-293-5437
MN	Minneapolis, Marsland Assocs.	612-545-4481

ITHACO, INC., Meas. & Control Instrs. Div., 735 W. Clinton St., P.O. Box 6437, Ithaca, NY 14851-6437, Tel: 607-272-7640, TWX: 510-255-9307, FAX: 607-272-4550; Empl.: 120; *Sls. Mgr.:* E. W. Seymour

ITL CIRCUITS, 90 Don Park Road, Markham, Ontario, Canada L3R 1C4, Tel: 416-475-6658, 416-492-9307, FAX: 416-475-5097; *Sls. Mgr.:* Derk Wissink

ITT CANNON, 666 E. Dyer Road, Santa Ana, CA 92705-5684, Tel: 714-557-4700, TELEX: 75-3917, TWX: 910-997-0523; FSC No.: 71468;Multiple; Empl.: 2500; *Sls. Mgr.:* Richard Torson; *Dist. Mgr.:* Richard Torson

FAX: 714-727-2109

ITT COMPONENTS, ITT Corporation, 5 Jenner .st., Ste. 100, Irvine, CA 92718, Tel: 714-727-3001, TELEX: 681-389, TWX: 910-595-1744; FSC No.: 61725; Empl.: 29; *Dist. Mgr.:* K. Rider ..... **A•1092-1093, 1404-1405; B•1502-1509**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs. Inc.	602-994-3813
CO	Englewood, Romulus Elctrns.	303-770-4888
CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Pompano Bch., Bolton Assocs.	305-781-8887
IL	Rolling Meadows, Heartland Tech. Sls.	312-577-9222
IN	Ft. Wayne, M/S Sls.	219-436-3023
KS	Wichita, Thunderbird Tech. Sls.	316-684-3941
MA	Sudbury, KSA of New England	617-443-5881
MI	Brighton, Elctrn. Sources Inc.	313-227-3598
MN	Minnetonka, J.P. & Assocs.	612-935-7930
MO	Maryland Hgts., Thunderbird Tech. Sls.	314-298-8940
NM	Albuquerque, Syntech	505-266-7951
NY	Fairport, Net Sls. Co.	716-223-1030
NY	Manhasset, Win Cor Elctrns.	516-627-9474
NC	Pineville, JWL & Assocs.	704-541-5750
OH	Centerville, Omega Sls.	513-434-5507
OH	Shaker Hgts., Omega Sls.	216-751-9600
PA	Prospect Pk., Elf Sls.	215-534-3340
TX	Richardson, Milco Mktg.	214-783-2716
VA	Front Royal, Eltron Sls.	703-635-7201
WA	Redmond, EMG	206-882-0962

Local Distributors

AZ	Tempe, Richey Western Elctrns.	602-894-9251
CA	Chatsworth, Shelley Ragon	818-998-3333
CA	Garden Grove, Richey Western Elctrns.	714-895-0060
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Irvine, ITT Multi Comps.	714-727-4001
CA	Sacramento, Integrated Elctrns.	916-424-5297
CA	San Diego, Richey Western Elctrns.	619-271-4511
CA	San Diego, Shelley Ragon	619-453-7133
CA	San Jose, Integrated Elctrns.	408-263-1100
CA	San Jose, ITT Multicomps.	408-279-0685
CA	San Jose, Shelley Ragon	408-942-9111
CA	Santa Clara, Richey Western Elctrns.	408-727-7411
CA	Santa Monica, Distr. Specialties	213-452-3445
CA	Santa Monica, Master Distrs.	213-452-1229
CA	Sunnyvale, Capsco Sls.	408-734-3020
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, NEP Elctrns.	303-799-9898
CT	East Haven, J.V. Elctrns.	203-469-2321
CT	New Haven, Greene Shaw Co.	203-397-0710
FL	Davie, ARCO Distrs.	305-473-2550
FL	Ft. Lauderdale, NRC	305-772-4500
IL	Chicago, Leeds Electro Comps.	312-825-3800
IL	Chicago, NEP Elctrns.	312-625-8400
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
IN	Indianapolis, Mar Elctrns.	317-633-6699
MD	Beltsville, RESCO-Washington	301-937-9100
MD	Jessup, TREEKO Sls.	301-792-0112
MD	White Marsh, Resco	301-529-0500
MA	Canton, Impact Sls.	617-821-1500
MA	Newton, Greene-Shaw Co.	617-969-8900
MI	Livonia, Key Elctrns.	313-261-5972
MN	Minneapolis, Industrial Comps.	612-831-2666
NV	Las Vegas, Kiesub Elctrns.	702-733-3888
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Rockaway, Tonar Inds.	201-586-9000
NM	Albuquerque, Betatron Elctrns.	505-344-2381
OH	Middleburg Hgts., Prehler Elctrns.	216-243-5510
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Integrated Elctrns.	503-641-1690
OR	Wilsonville, Shelley Ragon	503-641-1691
PA	Essington, Tri-Com	215-521-3080
TX	El Paso, ERA Elctrns.	915-855-3600
TX	El Paso, International Elctrns.	915-598-3406
WA	Bellevue, Integrated Elctrns.	206-455-2727
WA	Seattle, Richey Western Elctrns.	206-575-1910
WA	Seattle, Shelley Ragon	206-241-1980
WI	New Berlin, NEP Elctrns.	414-785-9100

ITT ELECTRON TUBE, ITT Corp., Box 100, Easton, PA 18042, Tel: 215-252-7331, TELEX: 847494; FSC No.: 20948; Empl.: 350

ITT ELECTRO-OPTICAL PRODS., ITT Corporation, 7635 Plantation Rd., Roanoke, VA 24019, Tel: 703-563-0371, TELEX: 829458; Empl.: 1000; *Sls. Mgr.:* R. Bruce; *Dist. Mgr.:* P. Williams

ITT GENERAL CONTROLS DIV., Intl. Telephone & Telegraph Corp., 801 Allen Ave., Glendale, CA 91201, Tel: 213-842-6131, TELEX: 673147, TWX: 910-498-2225; Empl.: 1545; *Sls. Mgr.:* Phillip Vaughn

ITT GILFILLAN, ITT Corp., 7821 Orion Ave., P.O. Box 7713, Van Nuys, CA 91409, Tel: 818-988-2600, TELEX: 651421, TWX: 910-495-1787; FSC No.: 24930; Empl.: 1800; *Sls. Mgr.:* Hollis White

ITT-HIGBIE MFG., Wagner Rd., Rochester, MI 48063, Tel: 313-651-5300, FAX: 313-651-2365; Empl.: 1500; *Sls. Mgr.:* C. J. Clemens

ITT POWERSYSTEMS CORP., Box 688, Galion, OH 44833-0688, Tel: 419-468-5200, TELEX: 4972923, FAX: 419-468-3235; Empl.: 750; *Sls. Mgr.:* S. L. Benedict

FAX: 612-934-9121

ITT SCHADOW, 8081 Wallace Rd., Eden Prairie, MN 55344, Tel: 612-934-4400, TELEX: 29-0556, TWX: 910-576-2469; Empl.: 150; *Sls. Mgr.:* Darrell Wilk; *Dist. Mgr.:* Scott Mork ..... **B•1730-1733**

Local Sales Offices & Reps

AL	Huntsville, Brandel-Stephens	205-883-0445
AZ	Phoenix, Shefler-Kahn	602-257-9015
CA	Los Angeles, Landa & Assocs.	213-879-0770
CA	Santa Ana, Landa & Assocs.	714-543-7805
CA	Santa Clara, C-Com	408-727-2266
CO	Boulder, Component Prod. Sls.	303-530-2800
CT	Guilford, Richard Purinton Inc.	203-453-4505
FL	Deerfield Beach, Brandel-Stephens	305-427-8558
FL	Orlando, Brandel-Stephens	305-425-3202
GA	Atlanta, Brandel-Stephens	404-261-7579
IL	Elk Grove, Control Sls.	312-595-2110
IN	Indianapolis, EMCI (Elec. Mktg. Consltn., Inc.)	317-253-1668
IA	Marion, W. Saunders Assoc.	319-377-5244
MA	Andover, Richard Purinton, Inc.	617-475-7055
MA	Canton, Richey/Impact Sls. Co.	617-821-1500
MI	Brighton, A.P. Assocs.	313-229-6550
MN	Edina, Hanna/Lind	612-925-5700
MO	St. Louis, W. Saunders Assocs., Inc.	314-576-4650
NJ	W. Caldwell, Grimm, Siegal Assocs.	201-575-9300
NY	East Rochester, L-Mar, Inc.	716-381-9100
NC	Greensboro, Brandel-Stephens	919-274-6952
OH	Dayton, K. W. Elctrns.	513-890-2150
OH	Shaker Heights, K.W. Elctrns.	216-491-9177
OR	Beaverton, James J. Backer Co.	503-627-0775
PA	Allison Pk., K.W. Elctrn. Sls., Inc.	412-487-4300
PA	Trevose, P.S.A., Inc.	215-245-0513
TX	Austin, Fralia & Assocs.	512-835-7911
TX	Euless, Fralia & Assocs.	817-267-3577
TX	Houston, Fralia & Assocs.	713-772-1572
TX	Stafford, Southwest Elctrns/	713-240-4000
WA	Seattle, Jas. J. Backer Co.	206-285-1300

WI	Milwaukee, Indl. Reps., Inc.	414-259-0965
Can	Ontario, Whitby, ITT Cannon-Canada	416-668-8881

Local Distributors

AZ	Tempe, Time Elctrn.	602-967-2000
CA	Gardena, Cal-Switch	213-538-9830
CA	Los Angeles, Richey Western	213-820-3777
CA	Riverside, Electronic Supply	714-787-9220
CA	Sunnyvale, Time Elctrns.	408-734-9888
CO	Denver, Integrated Elctrns.	303-292-6121
FL	Fort Lauderdale, Time Elctrn.	305-974-4800
FL	Miami, Hallmark	305-971-9280
FL	Orlando, Hallmark	305-855-4020
IL	Bensenville, Hallmark	312-860-3800
IL	Crystal Lake, Sub-Sem	312-782-3954
IL	Wheeling, Hawk Elctrns.	312-459-4030
KS	Wichita, R.S.C. Elctrns.	316-267-5213
MD	Beltsville, Treeko Sls.	301-470-3300
MA	Canton, Richey /Impact Sls. Co.	617-821-1500
MA	Hingham, Sager Elec.	617-749-6700
MI	Kentwood, R.M. Elctrns.	616-531-9300
MI	St. Clair Shores, Specialties Mfg.	313-771-2700
MN	Minneapolis, Berquist Co.	612-835-2322
MO	Maryland Heights, Hallmark	314-291-5350
NJ	Oakland, Relay Specialties	201-337-1000
NY	Buffalo, Summit Distr.	716-884-3450
NY	Hauppauge, Sager Elctrn.	516-348-1300
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, SIMCONA	716-328-3230
NC	Raleigh, Hallmark	919-872-0712
OH	Cincinnati, Schuster Elec.	313-489-1400
OH	Twinsburg, Schuster/Cleveland	216-425-8134
PA	Philadelphia, Phila. Elctrns.	215-568-7400
TX	Austin, Hallmark	512-258-8848
TX	Dallas, Hall-Mark	214-343-5000
TX	Stafford, Southwest Elctr.	713-240-4000
WA	Bellevue, Almac Elctrns	206-643-9992
WA	Bellevue, Integrated Elctrn.	206-455-2727
WI	New Berlin, Hallmark	414-797-7844

ITT SEMICONDUCTORS, ITT Corp., 55 Merrimack St., So. Lawrence, MA 01843, Tel: 617-688-1881, TELEX: 947413, FAX: 617-975-7109; Empl.: 2300; *Sls. Mgr.:* S. Rastogi; *Dist. Mgr.:* S. Rastogi

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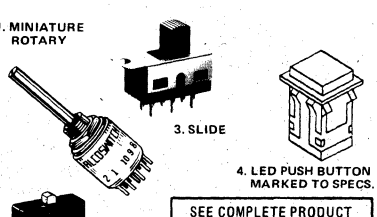

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Local Sales Offices & Reps

AL	Huntsville/Doraville, ACM, Inc.	205-883-9720
CA	Santa Clara, Synelect Mktg.	408-244-9900
CO	Edgewood, High Plains Mktg.	303-792-2020
FL	Orlando/Ft. Lauderdale, Delmac Sls., Inc.	305-898-4688
IL	Elk Grove Vl., Tri-Star Grp. Inc.	312-593-0200
IN	Indianapolis, Central Regional Off.	317-257-3704
IN	Indianapolis, Leslie M. Devoe	317-842-3245
IA	Des Moines, SPS Assocs., Ltd.	515-225-0607
KS	Olathe, SPS Assocs., Ltd.	913-764-4460
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Oak Pk., A. Blumenberg Assocs. Inc.	313-968-3230
MN	Edina, Hanna Lind Ltd.	612-925-5700
MO	Earth City, SPS Assocs., Ltd.	314-291-0520
NE	Panama, SPS Assocs.	913-764-4460
NJ	Haddonfield, ELF Sls.	215-534-3340
NY	Rochester, L-Mar Assocs., Inc.	716-323-1000
NC	Raleigh, C-Tech	919-847-0202
OH	Richfield, Bear Mktg.	216-659-3131
TX	Austin/Fort Smith, Electra Reps, Inc.	713-778-4201
TX	Dallas, Electra Reps, Inc.	214-248-3852
VA	Lynchburg, Paktron Div.	804-239-6941
WA	Bellevue, Caruso & Co.	206-455-8811
WI	Brookfield, TriStar Grp.	414-782-2670
Can	Markham, Ont., Avotronics	416-475-2024
Can	Pointe Claire, Que., Avotronics	514-697-2135

Local Distributors

AZ	Phoenix, Cetec-Future	602-272-7951
AZ	Tempe, Acacia Sls., Inc.	602-882-9054
CA	Chatsworth, Cetec-Future	818-700-0914
CA	Irvine, Acacia Sls., Inc.	714-660-0834
CA	Irvine, Cetec-Future	714-250-4141
CA	San Diego, Acacia Sls., Inc.	619-565-4365
CA	San Diego, Cetec-Future	619-278-5020
CA	San Jose, Cetec-Future	408-434-1114
CA	Sunnyvale, Acacia Sls., Inc.	408-745-7200
CO	Westminster, Future Elctrns., Inc.	303-650-0123
CT	Bethel, Future Elctrns.	203-743-9594
FL	Altamonte Springs, Future Elctrns., Inc.	305-767-8414
FL	Clearwater, Future Elctrns., Inc.	813-578-2770
FL	Clearwater, Hall-Mark Elctrns.	813-530-4543
FL	Melbourne, Rome Elctrns., Inc.	305-242-8152
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
GA	Augusta, Dixie Elctrns., Inc.	404-722-2055
GA	Norcross, Future Elctrns., Inc.	404-441-7676
IL	Elk Grove Village, Bell Inds.	312-640-1910
IL	Rolling Meadows, RM Elctrns. Co., Inc.	312-358-0300
IL	Schaumburg, Future Elctrns., Inc.	312-882-1255
IN	Indianapolis, Advent Elctrns.	317-872-4910
IN	Indianapolis, MAR Elctrns.	317-633-6699
IN	Indianapolis, RM Elctrns. Co., Inc.	317-291-7110
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Columbia, Future Elctrns. Inc.	301-995-1222
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MD	Jessup, Treeko	301-470-3300
MA	Andover, Aved Elctrns., Inc.	617-688-3800
MA	Billerica, A. W. Mayer Co., Inc.	- -
MA	Westboro, Future Elctrns., Inc.	617-366-2400
MI	Grand Rapids, RM Elctrns. Co., Inc.	616-531-9300
MI	Livonia, Future Elctrns., Inc.	313-261-5270
MN	Eden Prairie, Future Elctrns., Inc.	612-944-2200
MN	Eitzen, Capacitor Assocs.	507-495-3130
MN	St. Paul, Gopher Elctrns.	612-483-4450
MO	St. Charles, Finnigan Elctrns., Inc.	314-946-6201
NJ	Bellmaur, Mid Atlantic Elctrns.	609-931-5303
NJ	Fairfield, Future Elctrns.	201-227-4346
NJ	Hanover, State Elctrns.	201-887-2550
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NY	Hauppauge, Future Elctrns. Inc.	516-234-4000
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Simcona Elctrns.	716-328-3230
NY	Rome, Rome Elctrns. Inc.	315-337-5400
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Charlotte, Elctrn. Mktg. Corp.	704-394-6195
NC	Charlotte, Future Elctrns. Inc.	704-529-5500
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Winston-Salem, Dixie Elctrns., Inc.	919-724-5961
OH	Columbus, Elctrn. Mktg. Corp.	614-299-4161
OH	Dayton, Elctrn. Mktg. Corp.	513-439-4711
OH	Highland Heights, Elctrn. Mktg. Corp.	216-442-3441
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Acacia Sls., Inc.	503-646-3377
OR	Beaverton, Future Elctrns. Inc.	503-645-4454
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	McKean, Advacom, Inc.	814-476-7774
SC	Columbia, Dixie Elctrns., Inc.	803-779-5332
SC	Greenville, Dixie Elctrns., Inc.	803-297-1435
SC	N. Charleston, Dixie Elctrns.	803-552-2671
TN	Gray, Dixie Elctrns., Inc.	615-477-3838
TN	Knoxville, Dixie Elctrns., Inc.	615-938-4131
TX	Austin, Altair Co.	512-837-4970
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, Future Elctrns., Inc.	214-437-2437
UT	Salt Lake City, Future Elctrns. Inc.	801-972-8489
WA	Redmond, Future Elctrns., Inc.	206-881-8199
WI	Mequon, Taylor Elec.	414-241-4321
WI	Racine, Badger Elctrns. Co. Inc.	414-637-1256
WI	Waukesha, Bell Inds.	414-547-8879
EXP	Bucks, Eng., C & CD Ltd.	494-882-848
Can	Calgary, Alberta, Future Elctrns., Inc.	403-235-5325
Can	Downsview, Ont., Future Elctrns., Inc.	416-638-4771
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FAX: 312-545-4450

ITW SWITCHES, Illinois Tool Works, 6615 W. Irving Park Rd., Chicago, IL 60634, Tel: 312-282-4040, TELEX: 275226; Empl.: 500; *Sls. Mgr.:* R. Mueller; *Dist. Mgr.:* P. Barthell ..... **B•1734-1745**

Local Sales Offices & Reps

AL	Huntsville, Electro Mech	205-880-0592
AZ	Phoenix, The Knight Co.	602-994-1311
AR	Fort Smith, Electra Reps	501-452-7822
CA	Los Angeles, The Knight Co.	213-670-2833
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, High Plains Mktg.	303-841-6464
CT	North Haven, Kitchen & Kutchin	203-239-0212
FL	Altamonte Springs, Semtronics	305-831-8233
GA	Atlanta, Electro Mech.	404-447-6478
IL	Elk Grove Village, Parcom	312-228-6360
IA	Cedar Rapids, R. F. Welch Co.	319-377-1575
KS	Kansas City, BC Elctrns.	913-342-1211
MD	Baltimore, MicroComp	301-644-5700
MA	Burlington, Kitchen & Kutchin	617-229-2660
MI	Grand Rapids, Urban & Assoc.	616-245-0511
MN	Minneapolis, Comstrand	612-788-9234
MO	St. Louis, BC Elctrns.	314-521-6683
NJ	Florham Pk., Varrelman-Gorman Co.	201-822-9616
NY	Syracuse, Fountain, Young & Co.	315-437-7733
NC	Raleigh, Electro Mech	919-790-9300
OH	Medina, Rockford Controls	216-725-3705
PA	Oreland, Precision Mktg.	215-233-9233
TX	Dallas, Electra Reps.	214-248-3852
WA	Redmond, EMG-Elctrn. Mktg. Grp.	206-882-0962
WI	Mequon, Parcom Inc.	414-241-8544

ITW THIELEX, 201 11th St., Piscataway, NJ 08854, Tel: 201-968-5300, TWX: 710-997-9662, FAX: 201-968-6998; *Sls. Mgr.:* Edward Gayowski

IVEK CORP., 43 School St., N. Springfield, VT 05150, Tel: 802-886-2238, FAX: 802-886-8274; Empl.: 6; *Sls. Mgr.:* Gene Williams

IVERON PACIFIC, 1150 Morena Boulevard, San Diego, CA 92110-3899, Tel: 619-275-1500; Empl.: 16; *Sls. Mgr.:* Lee Kerl

IVO INDUSTRIES, INC., 201 Industrial Way W., Eatontown, NJ 07724, Tel: 201-542-5151, TELEX: 132-414; Empl.: 10; *Sls. Mgr.:* Daniel Vannote ..... **B•1076, 1747, 1894; D•1132-1133**

Local Sales Offices & Reps

CA	Tustin, Sierra-Pacific Engrg.	714-731-3411

Local Distributors

CA	Agoura, Sibbald Instrs.	213-991-3864
CA	Santa Monica, Master Distr.	213-452-1229
FL	Lakeland, A A Electric	813-665-6941
GA	Norcross, A A Electric	404-449-8670
IL	Arlington Heights, Martec Assocs.	312-956-8090
MD	Towson, Kraft Indl.	301-828-5838
MN	St. Paul, Power/Mation Div.	612-645-0781
NJ	E. Rutherford, A A Electric	201-777-5477, 800-223-0119

NY Clarence, Trott Elctrns. 716-634-8500
NC Charlotte, Trott Elctrns. 704-376-2237
NC Huntersville, Scott Equip. 704-875-1611
SC Greenville, Automation Supp. Co. 800-845-5274
TX Dallas, Dallas Meter Tek 214-349-6044
WI Waukesha, Power/Mation Div. 414-542-2868
WI Wausau, Control Specialist 715-359-9122

THE IVYNET COMPANY, One Gale Rd., Brick, NJ 08723, Tel: 201-920-6807; *Sls. Mgr.:* Doug Slocum

IWATSU INSTRUMENTS, INC., 430 Commerce Blvd., Carlstadt, NJ 07072, Tel: 201-935-5220; Empl.: 9; *Sls. Mgr.:* Alex Orloff

IXYS CORP., 2355 Zanker Rd., San Jose, CA 95131-1109, Tel: 408-435-1900, TELEX: 384928 SNJ SU; FSC No.: 408-435-1033; Empl.: 50; *Sls. Mgr.:* Dan Schwob

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FAX: 714-250-8957

JAE ELECTRONICS INC., 1901A E. Carnegie Ave., Santa Ana, CA 92705-5504, Tel: 714-250-8770, TELEX: 681-438 JAE US; Empl.: 3400 (Worldwide); *Sls. Mgr.:* David Shaff; *Dist. Mgr.:* N. Leidig ..... **B•1748-1749; C•1402-1405**

Local Sales Offices & Reps

AL Huntsville, Glen White Assocs. 205-882-6751
AZ Glendale, Camda, Inc. 602-842-2927
CA Canoga Pk., Camda, Inc. 818-703-6132
CA Lawndale, Camda, Inc. 213-219-0320
CA Newport Beach, Camda, Inc. 714-852-9228
CA San Diego, Camda, Inc. 619-571-4818
CA Santa Clara, Pinnacle Sls. 408-249-7400
CO Littleton, Con-Tek Mktg. 303-973-8490
CT Southington, Cycle Sls. 203-755-2888
FL Clearwater, Glen White Assocs. 813-726-0577
FL Ft. Lauderdale, Glen White Assocs. ... 305-977-5885
FL Ft. Lauderdale, JAE Elctrns. 305-563-3484, 800-248-0737
FL Satellite Bch., Glen White Assocs. 305-773-4832
GA Norcross, Glen White Assocs. 404-441-1447
IL Arlington Hgts., Berndt Assocs. Inc. ... 312-632-0900
IN Ft. Wayne, Frank J. Campisano Co. ... 219-486-6443
IN Indianapolis/Ft. Wayne, Campisano Co. 317-253-7651
MD Baltimore, Glen White Assocs. 301-321-7235
MA Harvard, Cycle Sls. 617-456-6868
MN Minneapolis, Berndt Assocs., Inc. 612-546-2021
MS Jackson, Glen White Assocs. 601-856-5411
NJ Mountainside, Henry R. Richter Co. ... 201-233-4615
NY Fayetteville, Henry G. Richter Co. 315-637-6713
NC Greensboro, Caravan Sls. 919-294-1500
NC Raleigh, Glen White Assocs. 919-848-1931
OH Cincinnati, Campisano Co. 513-574-7111
OH Cincinnati, Frank J. Campisano Co. ... 513-574-7111
OH Columbus, Campisano Co. 614-876-5405
OH Medina, Frank J. Campisano Co. 216-722-5550
OH Mentor, Frank J. Campisano 513-575-7111
OH Mentor, Frank J. Campisano Co. 216-257-2961
OR Hillsboro, Rhodes Sls. Corp. 503-640-6666
PA Coraopolis, Campisano Co. 412-264-5151
PA Paoli, Stitzer Assoc. 215-644-5500
PA Phoenixville, Henry G. Richter Co. 215-495-6176
PA Phoenixville, Henry Richter, Inc. 215-495-6176
SC Greenville, Ellenburg Sls. 803-233-9942
TN Gray, Glen White Assocs. 615-477-8850
TX El Paso, Ran & Assocs. 915-598-6801
TX Ft. Worth, Ran Assocs. 817-429-4834
TX The Woodlands, Ran & Assocs. 713-367-7427, 713-525-1118
VA Annandale, Glen White Assocs. 703-354-3889
VA Lynchburg, Glen White Assocs. 804-385-6110
WA Bellevue, Electronic Sources 206-451-3500
WI Milwaukee, Berndt Assocs., Inc. 414-545-8400

Local Distributors

AZ Scottsdale, Cypress Elctrns. 602-949-0802
CA Buena Pk., Cypress Elctrns. 213-744-0355, 714-521-5230
CA San Diego, Cypress Elctrns. 619-535-0011
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
MA Middleboro, Glynn Elctrns. 617-947-4262
NH Manchester, Glynn Elctrns. 603-622-8131
NY Deer Pk., Ramtronix Inc. 516-242-4700
OH Akron, Aesco Elctrns. 216-762-8818
OH Columbus, Aesco Elctrns. 614-882-6762
OR Beaverton, Cypress Elctrns. 503-641-2233
TX Dallas, Cypress Elctrns. 214-869-1435
WA Bothell, Cypress Elctrns. 206-483-1144

JAICO PRODUCTS, Jaidinger Mfg. Co., Inc., 1921 W. Hubbard St., Chicago, IL 60622, Tel: 312-421-1090, FAX: 312-421-1165; Empl.: 35; *Sls. Mgr.:* John S. Jaidinger

JAMESBURY CORP., Div. of Combustion Engineering, Inc., 640 Lincoln St., Worcester, MA 01605, Tel: 617-852-0200, TELEX: 92-0448, TWX: 710-240-1268; Empl.: 900; *Sls. Mgr.:* C. A. Richardson

JAMES ELECTRONICS, 4050 N. Rockwell, Chicago, IL 60618, Tel: 312-463-6500, TWX: 910-221-5034; Empl.: 220; *Sls. Mgr.:* Vincent Kennedy

JAM POWER SYSTEMS, INC., P. O. Box 710, Bronxville, NY 10708-0710, Tel: 914-793-3344; Empl.: 53; *Sls. Mgr.:* Michael Scott; *Dist. Mgr.:* Michael Scott

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JANCO CORP., Box 3038-Glenoaks Sta., Burbank, CA 91504, Tel: 818-846-1800, TWX: 910-498-2701; FSC No.: 91812; Empl.: 185; *Sls. Mgr.:* Sam Kay, Jr. ..... **B•1750-1751**

Local Sales Offices & Reps

AZ Tempe, Piper Sls. 602-949-0048
AR Dallas, Kruvand Assocs. 214-437-3355
CA Cupertino, Codella 408-257-2561
CA San Diego, WES-K San Diego 619-695-2040
CO Longmont, Piper Sls. 303-651-2378
FL Orlando, MacKay, Smith & Assocs. ... 305-423-4353
GA Atlanta, MacKay, Smith & Assocs. 404-449-7444
IL Addison, Vikeland Sls. 312-832-8425
IN Ft. Wayne, Aktron Corp. 219-747-3650
KS Wichita, T-Bird Tech. Sls. & Svc. 316-684-3941
MD Silver Spring, H. R. Sieber co. 301-681-3770
MA Swansea, Eastrep Co. 617-672-0788
MN St. Paul, Cahill, Schmitz & Cahill 612-646-7217
MO Maryland Heights, T-Bird Sls. & Svc. .. 314-298-8940
NJ Cherry Hill, Quality Comps. 609-428-6266
NY Fairport, TAC Sls. Inc. 716-377-2250
NC Charlotte, MacKay, Smith & Assocs. .. 704-372-1188
OH Columbus, Tom Mulligan Company ... 614-457-2242
TX Dallas, Kruvand Assocs. 214-437-3355
WA Seattle, Norwest 206-827-9562

Local Distributors

CA Burbank, Merit Comp. Supp. 818-842-7607
CA Westlake Village, Tech-Cable Prods. .. 818-991-4697

JAN HARDWARE MFG. CO., 47-27 36th St., Long Island City, NY 11101, Tel: 718-361-0800; FSC No.: 99813; Empl.: 60; *Sls. Mgr.:* Irwin E. Wasserman ..... **C•1602, 1607-1632**

Local Sales Offices & Reps

CA Hillsboro, Long Assocs. 415-342-6544
CA San Diego, James E. Fitch & Assocs. 213-945-2624
CA Santa Fe Springs, James E. Fitch & Assoc. 213-945-2624
IN Huntingdon, Ellet Sls. 219-356-1866
IA W. Des Moines, Nevco Inc. 515-225-9866
MD Gaithersburg, Naudain Assocs. South. 301-258-5040
MA Brookline, Harman Assoc., Inc. 617-232-6687
MA Lee, Harman Assoc., Inc. 413-243-1158
MN Golden Valley, A.I.M. 612-542-8437
MO Crestwood, Nevco, Inc. 314-343-7406
NJ Englewood, Harold Gray Assoc. 201-894-0894
NJ Marlton, Naudain Assoc. 609-983-5300
OH Kettering, F. L. Ohmer & Assoc. 513-434-1454
OR Beaverton, Cascade Sls. Co. 503-626-7978
TX Richardson, AGM Sls. Co. 214-644-1475
Can Scarborough, Ont., Banke Elctrns., Ltd. 416-292-5152

JAPANESE PRODUCTS CORP., 7 Westchester Plaza, Elmsford, NY 10523, Tel: 914-592-8880, TELEX: 516929 ANS BACK ENFD, FAX: 914-592-7001; Empl.: 8; *Sls. Mgr.:* Don Cassalia

JARO COMPONENTS, INC., 5549 Powerline Rd., Ft. Lauderdale, FL 33309-2883, Tel: 305-771-7000, TELEX: 159007, FAX: 305-772-8899; Empl.: 30; *Sls. Mgr.:* Floyd Burwell; *Dist. Mgr.:* Floyd Burwell

JAY CONTROL CO., 21 Sequin Dr., Glastonbury, CT 06033, Tel: 203-633-5294; Empl.: 40; *Sls. Mgr.:* Mike Colomonico

JAYCO

FAX: 714-998-4954

JAYCO PLASTICS OF CALIFORNIA, INC., 507 W. Blueridge Ave., Orange, CA 92665, Tel: 714-974-1701, TELEX: 67840; Empl.: 26; *Sls. Mgr.:* Hemant Mistry ..... **B•1824-1825**

Local Sales Offices & Reps

AZ Scottsdale, Advent Comps. Corp. 602-481-0044
CA San Diego, Coastal Elctrn. Sls. 619-459-4148
CO Boulder, Stratford Grp. 303-530-3194
IL Palatine, Somers-Reagan 312-991-1108
NY New York, Breen Assocs. 201-696-8633
OH West Carrollton, Scientific Sys. 513-253-3141

JAYCOR, P.O. Box 85154, San Diego, CA 92138, Tel: 619-453-6580, TWX: 910-322-1064; Empl.: 500; *Sls. Mgr.:* Steven Lutjens

JAY-EL PRODS., Sub. Ducommun Inc., 1859 W. 169th St., Gardena, CA 90247, Tel: 213-323-7130, TWX: 910-346-7633; FSC No.: 08719;Multiple; Empl.: 480

JB ELECTRONIC TRANSFORMERS, 2300 W. Armitage Ave., Chicago, IL 60647, Tel: 312-342-0080; FSC No.: 11700; Empl.: 150

JBM ELECTRONICS, INC., 531 Front St., Manchester, NH 03102, Tel: 603-623-0222, TELEX: 953134, TWX: 710-220-8978, FAX: 603-623-0446; FSC No.: 62694; Empl.: Approx. 100

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Local Sales Offices & Reps

MN	Minneapolis, Hei-Lite Sls.	612-861-6051
TX	Dallas/Houston, Elcom Mktg., Inc.	214-241-2166
Can	Thornhill, Ont., R. C. Kahnert Sls., Ltd.	416-221-7755
Can	Winnipeg, Vancouver, Smith-Paterson & Assocs.	604-681-0743

Local Distributors

AL	Montgomery, Southern Controls	205-277-5030
CA	Los Angeles, CMI/Metermaster	213-685-4340
CA	Sacramento, Sacramento Elctrns.	916-441-4821
CA	Wilmington, Wilmington Instrs.	213-834-1133
CO	Denver, E.I.L. Instrs.	303-534-4160
CO	Denver, Ward/Brownell	303-333-3541
CT	New Haven, Hatry Elctrns.	203-787-5921
FL	Miami, Florida Precision	305-324-1731
GA	Augusta, Speciality Distributing	404-873-2521
IL	Bridgeview, E.I.L. Instrs.	312-430-2292
IL	Elk Grove Village, CMI/Metermaster	312-593-8650
LA	Lafayette, Ralph's Elctrns.	318-234-4507
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MI	Grand Rapids, S-F Electra, Inc.	616-459-0216
MN	Minneapolis, Instrument Controls	612-871-2514
MS	Jackson, Ellington Elctrn. Supp.	601-355-0561
NJ	Belleville, Miscorp	201-751-8680
NJ	Newfoundland, Hosica Labs	201-697-6111
NY	Long Island City, Metermod	718-726-4850
NY	Lynbrook, Peerless Radio	516-593-2121
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Scott-Friedman	513-298-5555
TN	Nashville, Electra Distributing	615-329-3971
TX	Ft. Worth, Swieco	817-335-6521
TX	Garland, CMI/Metermaster	214-271-5671
TX	Houston, Harrison Equip.	713-879-2600
WA	Seattle, Eicher-Richards	206-523-7888
WV	St. Albans, Preiser Scientific	304-727-2902
Can	Willowdale, Ont., Electrosonic	416-494-1666

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JDK CONTROLS, INC., 2630 Lavery Ct, Suite F, Newbury Park, CA 91320-1593, Tel: 805-499-7779, FAX: 805-499-0990; Empl.: 25; *Sls. Mgr.:* Reece Kendall ..... **A•2075**

JEFFERS ELECTRONICS, Grand Plaza, 945 Grand Ave., Nogales, AZ 85621, Tel: 602-287-5851, TELEX: 165036; FSC No.: 59474; Empl.: 400; *Sls. Mgr.:* Ken Shobert; *Dist. Mgr.:* Steve Morris

JEFFERSON ELEC., MagneTek, Inc., 1400 Center Circle Drive, Downers Grove, IL 60515-1021, Tel: 312-691-2400, TELEX: 72-8408; Empl.: 1200; *Sls. Mgr.:* Tom Hull; *Dist. Mgr.:* Frank Michalik

JENSEN TOOLS, INC., Axia, Inc., 7815 S. 46th St., Phoenix, AZ 85044, Tel: 602-968-6241, TWX: 910-950-0115; Empl.: 200; *Sls. Mgr.:* Herb Oberman

JEROME INDUSTRIES CORPORATION
FAX: 201-353-1021

JEROME INDUSTRIES CORP., 730 E. Division St., Elizabeth, NJ 07201, Tel: 201-353-5700; Empl.: 150; *Sls. Mgr.:* Anthony Di Girolamo ..... **A•2242; D•1780-1783**

JERSEY SPECIALTY CO., See JSC Wire & Cable

JETA POWER SYSTEMS, INC
FAX: 213-426-2417

JETA POWER SYSTEMS, INC., 2675 Junipero, Signal Hill, CA 90806, Tel: 213-427-0095, TWX: 510-101-1804; Empl.: 100; *Sls. Mgr.:* Derek Steel ..... **D•1785-1787**

Local Sales Offices & Reps

AL	Huntsville, R. O. Whitesell & Assocs.	205-883-5150
CA	Anaheim, Alpha Sls.	213-215-0249
CA	Mission Viejo, The Powerhouse, Inc.	714-770-9009
CA	San Diego, Miner Assocs.	619-566-9891
CA	Santa Clara, Basic Sys. Corp.	408-727-1800
CT	Vernon, George Urban & Assocs.	203-647-3991
FL	Altamonte Springs, Semtronic Assocs., Inc.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, R. O. Whitesell & Assocs.	404-449-9190
GA	Norcross, R.O. Whitesell & Assocs.	404-449-9190
IL	St. Charles, XYZ Mktg.	312-584-3001
IN	Indianapolis, R. O. Whitesell	317-359-9283
MD	Wheaton, Brimberg Sls.	301-946-2670
MA	Dover, George Urban & Assocs.	617-329-4068
MI	Farmington Hills, Comstrand	612-788-9234
MN	Minneapolis, Comstrand Co.	612-788-9234
NY	Fairport, Hi-Tec Sls.	716-223-5922
NY	Yonkers, Sonkin Assocs.	914-968-8282
NC	Greensboro, R.O. Whitesell & Assocs.	919-273-1945
OH	Cincinnati, R. O. Whitesell	513-521-2290
OH	Cleveland, R. O. Whitesell	216-447-9020
OH	Columbus, R. O. Whitesell	614-888-9396
OH	Dayton, R. O. Whitesell	513-298-9546
OR	Portland, J. J. Backer Co.	503-297-8744
OR	Salem, Jas. J. Backer Co.	503-362-0717
PA	Huntingdon Valley, Lynbar Grp., Inc.	215-947-3554
PA	Pittsburgh, R. O. Whitesell	412-963-6161
TN	Knoxville, R.O. Whitesell & Assocs.	205-883-5150
TX	Dallas, S. W. Tech. Sls.	214-243-0180
WA	Seattle, Jas J. Backer Co.	206-285-1300
WI	Milwaukee, XYZ Mktg.	312-584-3601
Can	Montreal, Empro Sls.	514-341-6420

JETTRON PRODUCTS, P.O. Box 337, E. Hanover, NJ 07936, Tel: 201-887-0571, FAX: 201-887-4182; FSC No.: 04435; Empl.: 30; *Sls. Mgr.:* J. M. Schill ... **C•1406-1407**

Local Sales Offices & Reps

CA	El Cajon, A-Tronics	619-444-1501
CA	Woodland Hills, A-Tronics	818-703-7212
NY	New York, Eltron Export Co.	212-944-7635

JEWELL ELECTRICAL INSTRUMENTS, Grenier Industrial Air Park, 850 Perimeter Rd., Manchester, NH 03108-4038, Tel: 603-669-6400, TELEX: 943435 JEWELL MAN, FAX: 603-669-5962; Empl.: 250; *Sls. Mgr.:* George Molleur; *Dist. Mgr.:* Bill Bolia

JFD ELCTRNS., See Murata Erie No. Amer., Inc.

JF MICROSYSTEMS, 3641 Frontier Road, Pasco, WA 99301, Tel: 509-297-4294, 800-JF-CARDS; Empl.: 2; *Sls. Mgr.:* Jim Follansbee

JFW INDUSTRIES, INC., 5134 Commerce Sq. Dr., Indianapolis, IN 46237, Tel: 317-887-1340, FAX: 317-881-6790; FSC No.: 61162; Empl.: 70; *Sls. Mgr.:* Jackie Buescher

JKL COMPONENTS CORPORATION

FAX: 818-897-3056

JKL COMPONENTS CORPORATION, 13343 Paxton St., Pacoima, CA 91331, Tel: 818-896-0019; FSC No.: 55335; Empl.: 19; *Sls. Mgr.:* Bob Brandt ..... **B•1135**

Local Sales Offices & Reps

AL	Huntsville, Southern Sls. & Mktg.	205-830-9322
AZ	Tempe, Elec-Com	602-967-8644
CA	San Diego, Lawsco	619-755-0200
IL	Park Ridge, Bob Burns & Assocs.	312-823-9360
IN	Carmel, APEX TEC, Inc.	317-846-3333
MI	Farmington Hills, Clark Sls.	313-553-0610
OH	Chagrin Falls, Clark Sls. Co.	216-247-7848
PA	Philadelphia, Check Assoc.	215-487-3007
TX	Irving, Kite Elec. Sls.	214-986-0321

Local Distributors

AL	Huntsville, Powell Elec.	205-539-2731
AL	Mobile, Specialty Distr. Co.	205-344-0450
AZ	Phoenix, Capital Elctrns.	602-252-5899
CA	Garden Grove, Richey Western	714-895-0060
CA	Gardena, Cal. Switch & Signal	213-770-2330
CA	San Jose, Powell Elec.	408-943-9020
CA	Santa Clara, Richey/Western Elec.	408-727-7411
CA	Sunnyvale, Target Elec.	415-961-1170
CT	Cheshire, Time Elec.	203-271-3200
FL	Clearwater, Elec. Precepts of Florida	813-530-9781
FL	Tampa, Specialty Distr. Co.	813-870-3315
GA	Atlanta, Specialty Distrbg. Co.	404-873-2521
IN	Indianapolis, Meunier Elctrns.	317-635-3511
IA	Cedar Rapids, Advnet Elec.	319-363-0221
KY	Louisville, Peerless Elec.	502-637-7674
MD	Columbia, Powell Elec.	301-621-8080
MD	Kensington, Marine Air Supp.	301-949-1353
MD	Rockville, M S Elctrns.	301-340-6400
MA	Avon, Controller Svcs.	617-584-9010
MA	Needham, Cronin	617-449-5000
MA	Westborough, Powell Elec.	617-366-6100
MN	Hopkins, The Joel Co.	612-935-6202
MN	St. Paul, Gopher Elec.	612-483-4450
MO	Richland, ATR Ent.	314-765-5219
NV	Sparks, Capital Lighting	702-356-6162
NH	Hudson, C & H Elec.	603-882-1133
NJ	Clifton, Vantage Comps.	201-777-4100
NJ	Englewood, Powell Elec.	201-894-0800
NJ	Pomton Lakes, Pan American Elec.	201-839-0077
NM	Albuquerque, Walker Elec. Supply	505-883-2992
NY	E. Syracuse, Modutex	716-924-4400
NY	Hauppauge, Genelco	516-231-1144
NC	Cary, Powell Elec.	919-467-1212
NC	Greensboro, Hammond	919-275-6391
OH	Cincinnati, Schuster Elec.	216-425-8134
OK	Oklahoma City, Radio Supp. Inc.	405-232-6127
PA	Philadelphia, Powell Elec.	215-365-1900
PA	Wayne, Peak Elec.	215-293-9000
TN	Chattanooga, Specialty Distr. Co.	615-624-1040
TN	Chattanooga, Techni-Tronics	615-875-5449
TX	Dallas, Norvell Comp. Sls.	214-233-0020
TX	Dallas, Off-the-Shelf Comps.	214-247-0052
TX	Las Colinas, Powell Elec.	214-550-0547
WA	Greenacres, Mica Co.	509-928-1720
WA	Seattle, Radar Elec.	206-282-2511
WI	Milwaukee, Elctrn. Expeditors	414-228-8100
WI	Oshkosh, Electronic Inds.	414-235-8930

JMJ TECHNICAL PRODS., 50 Wheeler Point Rd., Newark, NJ 07105, Tel: 201-589-4257; Empl.: 8; *Sls. Mgr.:* Kevin Kolenut ..... **C•1633**

JMK

JMK, INC., 15 Caldwell Dr., Amherst, NH 03031, Tel: , , , 603-886-4115, TELEX: 955329; Empl.: 200; *Sls. Mgr.:* J. Kennedy ..... **A•1663-1665**

Local Sales Offices & Reps

CA	Santa Clara, Cummings & Assocs.	408-247-8656
IL	Chicago, Momak Sls.	312-963-6400
MD	Silver Springs, Mid-Atlantic Sls. Co.	301-593-7749
MA	Framingham, Sullivan Tech. Sls.	617-620-0195
MN	St. Paul, Arkco Sls.	612-777-7454
NJ	Princeton, Murtronics Assocs.	609-394-3737
NY	Syracuse, Nycom Inc.	315-437-8343
OR	Hillsboro, Temco N.W.	503-649-8375
WA	Bothell, Temco N.W.	206-821-5434
Can	Montreal, Que., A. R. Gray	514-694-6378

JMR ELECTRONICS, 1525 Blondell Ave., Bronx, NY 10461, Tel: 212-597-6050, FAX: 212-597-6137; Empl.: 50; *Sls. Mgr.:* Joel Howard

JM TRANSFORMER CO., INC., 112 Florida St., Farmingdale, NY 11735, Tel: 516-293-0475; Empl.: 13; *Sls. Mgr.:* J. Millman ..... **A•2243-2247**

JOBMASTER CORP., 9008 Liberty Rd., Randallstown, MD 21133, Tel: 301-655-1400, 800-642-1400, FAX: 301-521-5461; Empl.: 22; *Sls. Mgr.:* Wendy Goldman ..... **A•1320**

JOHANSON DIELECTRICS, 2220 Screenland Dr., Burbank, CA 91505, Tel: 818-848-4465, TWX: 910-498-2735, FAX: 818-841-7261; Empl.: 300; *Sls. Mgr.:* Fred Luhrs ..... **A•1098**

Local Sales Offices & Reps

AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Glendale, Mission Mktg.	818-247-9110
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assocs.	303-426-0890
FL	Boca Raton, Lawrence Assocs	305-368-7373
FL	Clearwater, Lawrence Assocs.	305-339-3855
IL	Lisle, WG Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-452-4057
KS	Shawnee Mission, Florence & Meyer	913-722-5210
CT	Wethersfield, Compac Sls.	203-563-4784
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
NY	Huntington, Compar New York Inc.	516-423-5660
NY	Syracuse, Pitroncis	315-455-7346
NC	Winston-Salem, Murcota	919-722-9445
OH	Westlake, Baehr Greenleaf Assocs.	216-892-1770
PA	Trevose, PSA Co.	215-245-0513
TX	Dallas, C & J Assocs.	214-539-0140
WA	Seattle, Northmar Inc.	206-524-5170
Can	Hamilton, Ont., Cartwright/Southhall	416-528-0294

Local Distributors

CA	Los Alamitos, SEMI DICE	213-594-4631
CA	Santa Clara, SEMI DICE	408-980-9777
CA	Sunnyvale, Bell Inds.	408-734-8570
FL	Orlando, Chip Supp.	305-298-7100
IL	Chicago, Newark	312-638-4411
MA	Canton, Semi Dice	617-821-0070
NJ	Fairfield, CHPS Inc.	201-882-0997

JOHANSON MANUFACTURING CORPORATION, 400 Rockaway Valley Rd., Boonton, NJ 07005, Tel: 201-334-2676, TWX: 710-987-8367, FAX: 201-334-2954; FSC No.: 91293; Empl.: 200 ..... **A•1099**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Compass Mktg. & Sls.	602-996-0635
AZ	Tucson, Compass Mktg. & Sls.	602-293-1220
CA	Escondido, Knight Co.	619-743-5136
CA	Los Angeles, Knight Co.	213-670-2833
CA	Mountain View, Straube Assocs.	415-969-6060
CO	Westminster, Straube Assoc., Mt. States	303-426-0890
CT	Wetherfield, Compak, Inc.	203-563-4784
FL	Boca Raton, Perrott Assocs.	305-482-6909
FL	Clear Water Bch., Perrott Assocs.	813-443-5214
FL	Orlando, Perrott Assocs.	305-298-7748
IL	Lisle, W.G. Controls	312-963-5954
IN	Kokomo, Schillinger Assocs.	317-455-2708
IA	Hiawatha, ARD Sales Co.	319-393-6392
MA	Hudson, Compak, Inc.	617-568-0331
MN	Bloomington, Bill Deming & Assoc.	612-888-5000
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Boonton, Johanson Mfg. Corp.	201-334-2676
NY	Mount Vernon, Friedman-Smith Elctrn. Sls.	914-664-4866
NY	Pittsford, NHA, Inc.	716-586-9002
NC	Winston-Salem, Murcota Corp.	919-722-9445
OH	Columbus, Baehr, Greenleaf & Assocs.	614-847-0220
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assoc.	216-842-1770
PA	Evans City, Baehr, Greenleaf & Assocs.	412-776-2151
PA	Trevose, P.S.A.	215-245-0513
TX	Austin, W. Pat Fralia & Assocs.	512-835-7911
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia & Assocs.	713-772-1572
UT	Salt Lake City, Straube Assocs., Mt. States	801-263-2640
VA	Oakton, PSA South	703-281-1806
WA	Seattle, Northmar	206-524-5170

Local Distributors

AZ	Tempe, Bell Inds.	602-966-7800
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	San Diego, Bell Inds.	619-268-1277
CA	San Jose, All American Semiconductor	408-287-0190
CA	San Pedro, ASAP Elctrns./West	213-519-8377
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	213-826-6778
CA	Van Nuys, CW Swift & Assocs.	818-989-1133
CA	Westlake VL, Distel, Inc.	805-495-9998
CO	Wheatridge, Bell Inds.	303-424-1985
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Orlando, Pelcor Co.	305-299-1541
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Elk Grove VL, Bell Inds.	312-640-1910
IN	Indianapolis, Bell Inds.	317-634-8202
MD	Baltimore, Radio Elec. Svc.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MA	Seekonk, M-Squared	617-761-5490
MA	Wilmington, RC/Jaco Elctrns.	617-273-1860
NM	Albuquerque, Bell Inds.	505-292-2700
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Mt. Vernon, ASAP Elctrns.	914-699-2727
NY	Syracuse, Newark Elctrns.	315-437-6611
OH	Dayton, Bell Inds.	513-435-8660
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Philadelphia, PEI-Genesis	215-673-0400
TX	Ft. Worth, PATCO Supplies	817-429-8596
TX	Irving, Newark Elctrns.	817-534-3696
UT	Salt Lake City, Bell Inds.	801-972-6969
WA	Bellevue, Bell Inds.	206-747-1515

JOHNSON, E. F., CO., 11095 Viking Dr., Eden Prairie, MN 55344, Tel: 612-942-1000, TELEX: 290470; Empl.: 1400; *Sls. Mgr.:* Charles Ard

JOHNSON CONTROLS, Battery Grp.-Indl. Prods. Div., Janet A. Korol, Milwaukee, WI 53212, Tel: 414-961-6500, FAX: 414-961-6506; Empl.: 20,000; *Sls. Mgr.:* James M. Szollar

JOLO

FAX: 714-554-0303

JOLO INDUSTRIES, 13921 Nautilus Dr., Garden Grove, CA 92643, Tel: 714-554-6840, TWX: 910-595-1138; FSC No.: 30035; Empl.: 20; *Sls. Mgr.:* J.S. Giampiccolo, Jr. ..... **C•1408-1410**

Local Sales Offices & Reps

CA	Mountain View, Leddy Assocs.	415-969-6313
CA	Santa Ana, Bee Jay Enterprises	714-836-7870
FL	Longwood, Mathias Assocs., Inc.	305-682-1700
IL	Chicago, Jack Elsley & Assocs.	312-827-6360
MA	Reading, Lincoln Tech. Sls.	617-944-9594
NJ	Berkeley Heights, Cambridge-Allen & Assocs.	201-464-0203
NY	Corbettsville, SHR	717-967-2607
OH	Cleveland, Geotronix Mktg. Assocs.	216-659-6100
WA	Seattle, Evergreen Mktg. Grp. Inc.	206-633-3160
Can	Nepean, Ont., Intrade(Canada)	613-727-1272

Local Distributors

CA	San Ramon, Xstor	415-820-2048
FL	Miami, Electronic Equip.	305-871-3500
NJ	Berkeley Heights, Rockwood Sls. Co.	201-464-0203
OH	Richfield, Alpha Distr. Corp.	216-659-6100

JONARD INDUSTRIES CORP., 134 Marbledale Rd, Tuckahoe, NY 10707, Tel: 914-793-0700, TELEX: 996570, TWX: 710-562-0107; Empl.: 65; *Sls. Mgr.:* R. Fersen

JONATHAN MANUFACTURING CORP., 1101 So. Acacia Ave., Fullerton, CA 92631, Tel: 714-526-4651, TWX: 910-592-1241, FAX: 714-773-5582, 714-879-1212; Empl.: 375; *Sls. Mgr.:* Todd Leverich; *Dist. Mgr.:* Wm. Valitus

JONES, HIRAM, ELCTRNS. INC., See Hiram Jones Elctrns. Inc.

JORI RESOURCES, 2128 Knoll Dr., Ventura, CA 93003, Tel: 805-642-2266; Empl.: 4

JOSLYN ELECTRONIC SYSTEMS, P.O. Box 817, Goleta, CA 93116, Tel: 805-968-3551, TWX: 910-334-3464; FSC No.: 23663; Empl.: 210; *Sls. Mgr.:* M. Melcher

JRW INDUSTRIES, INC., 2312 N Second St., Harrisburg, PA 17110, Tel: 717-236-1418; Empl.: 4; *Sls. Mgr.:* Bryan J. Williams, Sls. Mgr.

JSC WIRE & CABLE, Box 248, Burgess Pl., Wayne, NJ 07474, Tel: 201-694-6200; Empl.: 40; *Sls. Mgr.:* Richard Wojtovitz

JTM SYSTEMS & CONSULTING, INC., Terrace Hill, Ithaca, NY 14850, Tel: 607-272-0808; Empl.: 12

JUDCO MFG. INC., P.O. Box 487-E84, 24030 Frampton Ave., Harbor City, CA 90710, Tel: 213-534-0959

JUDD WIRE, High Voltage Engrg., 57 Turnpike Rd., Turners Falls, MA 01376, Tel: 413-863-4357, TWX: 510-290-2147; FSC No.: 3357; Empl.: 148; *Sls. Mgr.:* Steve Fritz ..... **B•1012; C•1857**

Local Sales Offices & Reps

AL	Huntsville, R & G Assocs.	205-536-6300
CA	Laguna Hills, English/Damco	714-837-3801
CA	Los Altos, Ewing Foley	415-941-4525
CO	Denver, Elcom	303-337-2300
FL	Coral Springs, HAI Elctrns.	305-752-7520
GA	Gainsville, R & G Assocs.	404-532-3850
IL	Arlington Heights, Rozner Sls. Co.	312-577-0067
KS	Overland Pk., Spectrum Sls.	913-648-6811
MD	Baltimore, R. A. Wafer Assocs.	301-744-1133
MA	Marlborough, O.K. Engrg.	617-481-6400
MN	Brooklyn Center, Willman Assocs.	612-566-5010
MO	Florissant, Spectrum Sls.	314-731-5151
NJ	Haddonfield, Mesa Tech. Assocs.	609-429-9531
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Attica, B. H. Tollefson Assocs.	716-591-1219
NY	Auburn, B. H. Tollefson Assocs.	315-253-4109
NY	Rochester, B. H. Tollefson Assocs.	716-271-4141
NC	Resch. Triangle Pk., Naylor Assocs.	919-544-6630
OH	Worthington, Simcox Assocs.	614-885-8995
OR	Portland, Jas. J. Backer Co.	503-297-8744
TX	Denton, Stevens Sls. Co.	817-382-4735
UT	Salt Lake City, Elcom	801-486-4233
WA	Seattle, Jas. J. Backer Co.	206-285-1300

Local Distributors

AL	Madison, Sea Wire & Cable	205-772-9616
CA	Anaheim, Innovative Sys.	714-968-6383
CA	Concord, Control Master	415-939-3600
CA	Irvine, Republic Elctrns.	714-855-2222
CA	San Leandro, Anixter	415-352-3100
CA	Torrance, Blake Wire & Cable	213-533-8141
CA	Valencia, Wirenetics Co.	805-257-2400
CO	Colorado Springs, Colorado Mfg. Technlg.	303-598-6888
CT	East Hartford, E. J. Stephens Co.	203-282-9400
CT	Manchester, I.M.S.	203-649-4415
FL	Altamonte Springs, Royce Elctrns.	305-869-4700
FL	Ft. Lauderdale, Anixter	305-485-4455
FL	Ft. Lauderdale, Pacer Elctrns.	305-462-0902
IL	Brookfield, Conductors Unltd.	312-485-7855
MA	Woburn, Pacer Elctrns.	617-935-8330
MN	Bloomington, K. L. Tannehill	612-881-6700
NH	Amherst, North Country Wire & Cable	603-889-0063
NJ	Atlantic Highlands, Freedom Elctrns.	201-872-2300
NJ	Dover, Electro Spec.	201-361-6300
NM	Albuquerque, Southwest Wire	505-888-3400
NY	Farmingdale, Weico Elctrns.	516-293-0050
NY	Johnson City, HELP Elctrns.	607-729-3528
NY	Rochester, Pacer Elctrns.	716-288-6750
NY	Rochester, Simcona Elctrn.	716-328-3230
NY	Ronkonkoma, Zenith Wire	516-585-1444
OH	Dayton, Astro Inds.	513-429-5900
PA	Montgomeryville, Pyttronic Ind.	215-242-6700
TX	Dallas, Interstate Wire	214-553-1311
WA	Woodinville, Storm Prods.	206-488-7400
WI	New Berlin, Indl. Elec. Wire & Cable	414-782-2323

JUDD WIRE, High Voltage Engrg., 870 Los Vallecitos Blvd., San Marcos, CA 92069, Tel: 619-744-7720, TWX: 910-322-1149, FAX: 619-744-6089; FSC No.: 3357

Refer to Judd Wire, Turners Falls, MA for sales office and distributor information.

JULIE RESEARCH

FAX: 212-757-0904

JULIE RESEARCH LABS., 211 West 61st St., New York, NY 10023, Tel: 212-245-2727, TWX: 710-581-5138; FSC No.: 07062; Empl.: 45; *Sls. Mgr.:* Pamela Spencer; *Dist. Mgr.:* Pamela Spencer ..... **A•1961; D•1278-1282**

Local Sales Offices & Reps

Resistors

CA	Northridge, Craig Assocs.	213-993-4060

JUMO PROCESS CONTROL, INC., 410 Garibaldi Ave., Lodi, NJ 07644, Tel: 201-779-7744, FAX: 201-779-1928; *Sls. Mgr.:* Bert Robinson

Local Sales Offices & Reps

IL	Algonquin, Marshall Wolf, Assoc.	312-658-8130,

JUPITER SYSTEMS, 1100 Marina Village Parkway, Alameda, CA 94501, Tel: 415-523-9000, TELEX: 6713004, FAX: 415-523-9151; FSC No.: 63872; *Sls. Mgr.:* Glenn Meyer

KAHGAN ELECTRONICS CORP., 605 Peninsula Blvd., Hempstead, NY 11550, Tel: 516-538-2300, TELEX: 261097 KAHG UR; Empl.: 31; *Sls. Mgr.:* Fred Strauss; *Dist. Mgr.:* Bernard Stapler

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CA San Jose, TTI, Inc. 408-946-5577
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CT Stratford, Electro Comp. 203-375-1400
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GA Norcross 404-441-7701
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MA Stoneham 617-279-0400
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NC Raleigh 919-872-2877
OH Columbus 614-885-3330
OK Tulsa 918-664-8592
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SC Greenville 803-242-5789
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WA Kirkland 206-828-4853

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ME	Bangor, Holmes Distrs.	207-942-7357
ME	Portland, Holmes Distrs.	207-774-5901
MD	Sparks, E.I.L. Instrs.	301-771-4800
MA	Burlington, E.I.L. Instrs.	617-272-9450
MA	W. Springfield, Control Engrg.	413-781-1330
MA	Wilmington, Stan. Elec. Supp.	617-658-5050
MI	Ann Arbor, Madison Elec.	313-665-6131
MI	Ann Arbor, McNaughton & McKay	313-995-9515
MI	Jackson, Madsion Elec.	517-783-2735
MI	Kalamazoo, Madison Elec.	616-342-1965
MI	Madison Hgts., McNaughton & McKay	313-399-7500
MO	Maryland Hgts., French Gerleman Elec.	314-569-3122
NH	Manchester, Holmes Distrs.	603-669-5060
NJ	Green Brook, Apparatus Elctrl. Supp.	201-752-8400
NY	Clarence, Trott Elctrns.	716-634-8500
NY	Elmira, Brady Supp.	607-733-6591
NY	Pittsford, Trott Elctrns.	716-586-8251
NC	Charlotte, Trott Elctrns.	704-376-2237
OH	Cleveland, Pioneer Stan.	216-587-3600
OH	Dayton, Pioneer Dayton	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
TN	Nashville, A A Elec.	615-832-6632
WI	Oconomowoc, Atlas Instrs.	414-367-8759

KESTER

FAX: 312-390-9338

KESTER SOLDER DIV., Litton Sys., Inc., 515 E. Touhy Ave, Des Plaines, IL 60018, Tel: 312-297-1600, TWX: 910-221-2100; Empl.: 350; *Sls. Mgr.:* Mack J. Haraburd; *Dist. Mgr.:* Carl Voelkel ..... **C•1758**

Local Sales Offices & Reps

CA	Anaheim	714-871-0280
NJ	Newark	201-589-0246

KEVLIN MICROWAVE CORP., 26 Conn St., Woburn, MA 01801, Tel: 617-935-4800, TWX: 710-393-1239; FSC No.: 25634; Empl.: 120; *Sls. Mgr.:* James E. Riley

Keystone CARBON COMPANY

FAX: 814-781-7648

KEYSTONE CARBON, Thermistor Div., 1935 State Street, St. Marys, PA 15857, Tel: 814-781-1591, TELEX: 91-4517; FSC No.: 75-263; Empl.: 1200; *Sls. Mgr.:* John A. Brock; *Dist. Mgr.:* John A. Brock ..... **B•1847-1849**

Local Sales Offices & Reps

CA	Orange, El Dorado Sls.	714-538-7252
CA	Redwood City, Hickey Inds. Sls.	415-594-9978
CA	San Diego, El Dorado Sls.	619-549-2202
CT	Wethersfield, L.J. Labant	203-529-0048
GA	Marietta, J.J. Arnold	404-427-1062
IL	West Dundee, W. S. Heffron	312-426-6472
IN	Fort Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
KS	Shawnee, Benson Engrg.	913-491-4446
MI	Farmington Hills, J.L. Montgomery Assocs.	313-489-0099
MN	Minneapolis, Dave Marrone	612-566-6573
MO	St. Louis, Frank H. Ring	314-863-2511
NY	Rochester, Foster & Wager	716-385-7744
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
NC	Cary, J. E. Shea	919-481-2475
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
TX	Dallas, Benson Engrg.	214-352-7541
TX	Houston, Benson Engrg.	713-672-2194
EXP	NY, Inwood, Minthorne Int'l.	516-239-0767
Can	Burlington, Ont., Donald J. Hyslop	416-333-3520

Local Distributors

AZ	Scottsdale, Allied Elctrns.	602-990-9549
CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Inglewood, Newark Elctrns.	213-671-7066
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
FL	Ft. Lauderdale, Allied Elctrns.	305-486-0500
GA	Atlanta, Allied Elctrns.	404-237-3366
IL	Elgin, Allied Elctrns.	312-697-8200
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Westland, Allied Elctrns.	313-595-6565
MN	Minneapolis, Allied Elctrns.	612-559-9545
MO	St. Louis, Allied Elctrns.	314-878-1229
NJ	Springfield, Newark Elctrns.	201-376-9500
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Cary, Allied Elctrns.	919-467-0720
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-667-6940
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-445-7123
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772
WI	Milwaukee, Allied Elctrns.	414-463-2662

KEYSTONE ELECTRONICS CORP., 31-07 20th Rd., Astoria, NY 11105-2017, Tel: 718-956-8900, TELEX: 35-3700, FAX: 718-956-9040; FSC No.: 91833; Empl.: 80; *Sls. Mgr.:* Charles Gold; *Dist. Mgr.:* Len Lenzen .... **C•1705**

KEYTEK INSTRUMENT CORP., 260 Fordham Rd., Wilmington, MA 01887, Tel: 617-658-0880, TELEX: 951389 KEYTEK BURL; *Sls. Mgr.:* Michael Hopkinbs

KEYTEK KEYBOARDS CANADA INC., 16 Mary St., Units 3 & 4, Aurora, Ontario, Canada L4G 3W8, Tel: 416-727-9491; Empl.: 20

KEY TRONIC, P.O. Box 14687, Spokane, WA 99214, Tel: 509-928-8000, TWX: 510-773-1885; FSC No.: 52833; Empl.: 1350

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FAX: 818-798-1466

KGS ELECTRONICS, INC., 2029 N. Lincoln Ave., Pasadena, CA 91103, Tel: 818-798-0786; Empl.: 50 ..... **D•2126-2127**

Local Sales Offices & Reps

TX Hurst, McGarrah & Assocs. 817-268-3557

WALTER KIDDE, Div. of Kidde, Inc., Fire Sys. Operations, P.O. Box 1147, Wake Forest, NC 27587, Tel: 919-556-6811, TELEX: 802569 WALTKIDDE; Empl.: 250; *Sls. Mgr.:* Andy Halasz

K.I. INDUSTRIES INC., P. O. Box 166, Elmhurst, IL 60126, Tel: 312-449-1990, TELEX: 721498; Empl.: 30; *Sls. Mgr.:* Henry W. Faller

KIK®

FAX: 213-542-4943

KIKUSUI INTERNATIONAL CORP., 19601 Mariner Ave., Torrance, CA 90503, Tel: 213-371-4662, 800-545-8784, TWX: 910-346-7648 .. **D•1414-1415, 1824-1825**

Local Sales Offices & Reps

AL Huntsville, Morard & Co.(MOCO) 205-881-5968
AZ Chandler, Vic Myers Assocs. 602-241-9324
CA Carson, Amasco South 213-516-8561
CA Sunnyvale, Amasco North 408-733-8690
CO Aurora, R & R Instrmn. 303-340-8728
CT Madison, Eastronix, Inc. 203-421-4514
FL Melbourne, EMS, Inc. 305-724-1027
FL Plantation, EMS, Inc. 305-587-7146
FL Sarasota, EMS, Inc. 813-923-2804
HI Honolulu, Honolulu Elctrns. 808-949-5564
IL Elmhurst, Sector Engrg. Sls. 312-530-7850
IN Indianapolis, Sector Engrg. Sls. 317-842-1120
KS DeSoto, Midtec Assocs. 913-441-6565
MD Wheaton, Brimberg Sls. (Power Supp.) 301-946-2670
MA Bedford, Eastronix 617-275-5775
MI Plymouth, EQS Sys., Inc. 313-455-7920
MN Minneapolis, Sector Engrg. Sls. 612-593-1809
MO St. Louis, Midtech Assocs. 314-275-8666
NJ Teaneck, Scientific Dvcs. East 201-837-1035
NM Albuquerque, Vic Myers Assocs., Inc. 505-884-6878
NY Rochester, EIC Elctrns. 716-544-4392
OH Chesterland, EQS Sys., Inc. 216-729-2222
OH Dayton, EQS Sys., Inc. 513-236-7676
OK Parkhill, Scientific Dvcs.-S.W. 918-457-4888
OR Portland, Syntek, Inc. 503-636-6793
PA Pittsburgh, EQS Sys., Inc. 412-261-2604
PA Springhouse, Scientific Dvcs. East 215-643-3335
TX Austin, Scientific Dvcs. SW 512-442-6215
TX Houston, Scientific Dvcs. SW 713-864-1711
TX Richardson, Scientific Dvcs. SW 214-231-8106
UT Salt Lake City, Intermountain Instrs. ... 801-487-3151
VT Shelburne, Eastronix 802-985-3743
WA Kirkland, Syntek, Inc. 206-488-0394
WI Milwaukee, Sector Engrg. Sls. 414-352-8280
PR San Juan, David S. Ternent 809-762-2688
Can Burnaby, BC, Interfax Sys., Inc. 604-430-1410
Can Mississauga, Ont., Interfax Sys., Inc. ... 416-671-3920
Can Nepean, Ont., Interfax Sys., Inc. 613-726-8888
Can St. Laurent, Que., Interfax Sys., Inc. 514-336-0392

KILO INTERNATIONAL

FAX: 714-596-0681

KILO INTERNATIONAL, 2118 D Street, La Verne, CA 91750, Tel: 714-593-4626; FSC No.: 05129; Empl.: 50; *Sls. Mgr.:* James T. Davis; *Dist. Mgr.:* James T. Davis ..... **A•2076**

Kilovac Corporation

FAX: 805-684-9679

KILOVAC CORP., Box 4422, Santa Barbara, CA 93140, Tel: 805-684-4560, TWX: 910-336-1141; FSC No.: 18741; Empl.: 85; *Sls. Mgr.:* Patrick McPherson, VP Sls. & Mktg. ..... **B•1510-1515**

Local Sales Offices & Reps

CA Campbell, Kottmeier Assocs. 408-371-8700
CA Tarzana, High Voltage Sls. 818-881-9194
FL St. Petersburg, K-Square 813-381-1893
GA Atlanta, Electro Tech 404-262-1522
IL Elgin, Gassner & Clark, Inc. 312-695-9540
IA Cedar Rapids, H. R. Brown Sls. Co. ... 319-366-0635
KS Olathe, M. E. Bettis Co. 913-764-0621
KS Wichita, M. E. Bettis Co. 316-265-8250
MD Columbia, Tyler Griffin Co. 301-995-1215
MN Osseo, Gaffney Sls. 612-425-5484
MO St. Louis, Abrams & Assocs. 314-569-0447
NM Albuquerque, Cleveland Entprs., Inc. .. 505-265-7893
NY Great Neck, Trionic Assocs. 516-466-2300
NY Rochester, Lamb Comp., Inc. 716-323-1250
NY Syracuse, Lamb Comps., Inc. 315-455-2469
NC Winston-Salem, DGW, Inc. 919-768-7166
OH Cleveland, Electronic Components, Inc. 216-331-5330
OH Columbus, Electronic Comp., Inc. 614-231-2318
OH Miamisburgh, Electronic Comps., Inc. 513-866-3340
OR Tigard, Components West, Inc. 503-684-1671
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Dallas, Edward F. Aymond Co. 214-826-7620
WA Redmond, Components West, Inc. 206-885-5880
Can Brit. Columbia, Macom Agencies, Ltd. 604-271-2661
Can Etobicoke, Ont., Dynasty Comps. 416-674-8060
Can Nepean, Ont., Dynasty Comps. 613-723-0725
Can Quebec, Dynasty Comps. 514-694-0275

KINEMETRICS/SYSTEMS, Kinemetrics, Inc., 222 Vista Ave., Pasadena, CA 91107, Tel: 818-795-2220, TELEX: 67-5402; Empl.: 65; *Sls. Mgr.:* A. M. Sereci

KINEMETRICS/TRUETIME, 3243 Santa Rose Ave, Santa Rosa, CA 95407, Tel: 707-528-1230, TELEX: 176687 (TRUETIME SARO), FAX: 707-527-6640; Empl.: 38; *Sls. Mgr.:* R. J. Dielman

KINETIC SYSTEMS, 11 Maryknoll Dr., Lockport, IL 60441, Tel: 815-838-0005, TWX: 910-638-2831, FAX: 815-838-4424; Empl.: 170; *Sls. Mgr.:* R. H. Brislan

KINGS ELECTRONICS CO., INC., 40 Marbledale Rd, Tuckahoe, NY 10707, Tel: 914-793-5000

KING WIRE & CABLE CORP., 179-45 110 Ave., Jamaica, NY 11433, Tel: 718-657-4422, TELEX: 96-8858; FSC No.: 06145; *Sls. Mgr.:* David Berger

KIPP & ZONEN, Enraf-Nonius, 390 Central Ave., Bohemia, NY 11716, Tel: 516-589-2885, 800-645-1025, TELEX: 0960250, FAX: 516-589-2068; Empl.: 25; *Sls. Mgr.:* Wm. Novack; *Dist. Mgr.:* Wm. Novack

KISTLER-MORSE, 10201 Willows Rd. N.E., P.O. Box 3009, Redmond, WA 98073, Tel: 206-881-8000, FAX: 206-883-4893; *Sls. Mgr.:* Stan Isenhath

KLC/KARL LAMBRECHT CORP., 4204 N. Lincoln Ave., Chicago, IL 60618, Tel: 312-472-5442, TELEX: 759819, FAX: 312-472-2724; Empl.: 29; *Sls. Mgr.:* Raymond Lambrecht

KLM ELECTRONICS, 16890 Church St., P.O. Box 816, Morgan Hill, CA 95037, Tel: 408-779-7363, TWX: 910-590-4468; Empl.: 250; *Sls. Mgr.:* Chuck McKinney

KLOCKNER MOELLER, 4 Strathmore Rd., Natick, MA 01760, Tel: 617-655-1910, TELEX: 94-8434; Empl.: 250

KMC SYSTEMS, INC., 140 Greenwood Ave. (Bldg. 3), Midland Pk., NJ 07432, Tel: 201-447-0007; Empl.: 120; *Sls. Mgr.:* E. Verder

Local Sales Offices & Reps

UT Bountiful, Lectrol, Inc. 801-292-7674
Can Downsview, Ont., Displayco, Ltd 416-663-6405

KNOWLEDGEWARE, INC., 3340 Peachtree Rd., N.E., Ste. 1100, Atlanta, GA 30026, Tel: 404-231-8575, TELEX: 544080; FSC No.: 7030-0003; Empl.: 1250; *Sls. Mgr.:* Donald P. Addington

KNOWLES ELECTRONICS, INC., 3100 N. Mannheim Rd., Franklin Park, IL 60131, Tel: 312-455-3600, TWX: 433-0330, FAX: 1-312-455-9203; *Sls. Mgr.:* Reginald G. Garratt, VP-Mktg.

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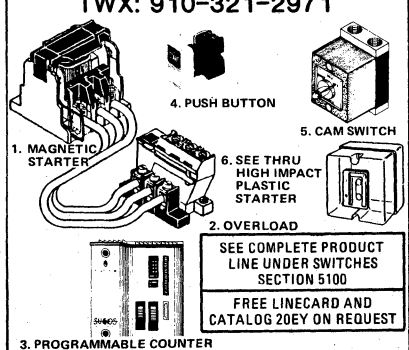

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Local Sales Offices & Reps

AL	Huntsville, Cartwright & Bean	205-830-1540
AZ	Phoenix, Howe & Howe Sls.	602-264-7971
CA	Garden Grove, ELSCO Elctrns.	714-891-4621
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Caltron Comps.	408-980-0181
CO	Boulder, R. G. Entprs.	303-447-9211
CT	Middletown, Gerber Sls.	203-347-3000
FL	Altamonte Springs, APM Assocs.	305-869-6831
FL	Ft. Lauderdale, APM Assocs.	305-978-9941
FL	Tampa, APM Assocs.	813-886-2457
GA	Norcross, Cartwright & Bean	404-368-0160
IL	Arlington Hgts., C. L. Greenslade Sls.	312-593-3450
IN	Fort Wayne, John F. Kilfoil	219-436-7233
KS	Overland Pk., Spectrum Sls.	913-648-6811
LA	Covington, Cartwright & Bean	504-892-1780
MA	Waltham, Gerber Sls.	617-890-3334
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Edina, Grayden & Flemmer	612-941-1120
MS	Jackson, Cartwright & Bean	601-981-1170
MO	Hazelwood, Spectrum Sls.	314-731-5151
NM	Albuquerque, SynTech	505-266-7951
NY	East Rochester, Tri-Tech Elctrns.	716-385-6500
NY	Endwell, Tri-Tech Elctrns.	607-754-1094
NY	Fayetteville, Tri-Tech Elctrns.	315-446-2881
NY	Fishkill, Tri-Tech Elctrns.	914-897-5611
NY	Great Neck, MOS Assocs.	516-487-3966
NC	Charlotte, Cartwright & Bean	704-536-0303
NC	Raleigh, Cartwright & Bean	919-876-4130
OH	Cincinnati, John F. Kilfoil	513-791-6150
OR	Beaverton, Earl & Brown Co.	503-643-5500
PA	Wynnewood, Metz-Benham Assocs.	215-896-7300
TN	Knoxville, Cartwright & Bean	615-693-7450
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Lewisville, Jim Hughes	214-221-1536
WA	Redmond, Earl & Brown Co.	206-885-5064
PR	San German, Digit-Tech Sls.	809-892-4260
Can	Ontario, Cantronics Ltd.	416-297-8668

Local Distributors

AZ	Ftn. Hill, RCD Inds.	602-483-6412
AZ	Phoenix, Camco Elctrn. Comps.	602-269-6201
AZ	Phoenix, Sterling Elctrns.	602-268-2121
AZ	Tempe, T.T.I.	602-431-1191
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Campbell, Lartronics	408-379-6454
CA	Chatsworth, MIL-Comm Distrs.	818-998-3111
CA	Chatsworth, T.T.I.	818-709-1010
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Fountain Valley, Comps. Ctr.	714-979-0433
CA	Garden Grove, Natl. Elctrns.	800-854-2451
CA	Irvine, KELEX	714-863-1230
CA	Milpitas, T.T.I.	408-946-5577
CA	Orange, Ryno Elctrns.	714-637-0200
CA	San Diego, Ryno Elctrns.	619-453-8430
CA	San Diego, T.T.I.	619-587-4888
CA	San Jose, Eric Elctrns.	408-432-1111
CA	Santa Clara, Components Ctr.	408-988-3751
CA	Sunnyvale, SAI	408-745-0800
CO	Boulder, R. G. Entprs.	303-447-9211
CO	Denver, T.T.I.	303-429-6806
CO	Englewood, Shelly-Ragon Elec. Parts	303-744-3601
CT	Stratford, T.T.I.	203-375-1400
CT	Stratford, Utronics	203-378-4201
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Orlando, TTI	305-859-1000
FL	Tampa, Reptron Elec.	813-855-4656
FL	W. Palm Beach, Nurmi Elctrn. Supp.	305-684-0320
GA	Atlanta, Prehler Elctrns.	404-447-5540
GA	Norcross, T.T.I.	404-662-0911
IL	Elk Grove Village, GBL/Goold Elctrns.	312-593-3220
IL	Elk Grove VL, Prehler Elctrns.	312-364-6070
IL	Rosemont, Advent Elctrns.	312-298-4210
IN	Indianapolis, Advent Elctrns.	317-872-4910
IA	Cedar Rapids, Advent Elctrns.	319-363-0221
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
MD	Baltimore, Radio Elec. Svc. Co.	301-529-0500
MD	Beltsville, Radio Elec. Svc.	301-937-9100
MD	Columbia, Jaco Comps.	301-995-6620
MD	Columbia, T.T.I.	301-995-1331
MA	Billerica, Baldwin Comp. Ctr.	617-667-6710
MA	Hingham, Sager Elec. Supp.	617-749-6700
MA	Norwood, Gerber Elctrns.	617-769-6000
MA	Wilmington, J.V. Elctrns.	617-657-6523
MA	Wilmington, T.T.I.	617-658-4700
MA	Woburn, Sterling Elec.	617-938-6200
MI	Ann Arbor, Wedemeyer	313-665-8611
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Farmington Hills, Prehler Elctrns.	313-476-7084
MI	Livonia, Reptron Elctrns.	313-525-2700
MI	St. Clair Shores, SPEMCO	313-771-2700
MN	Eden Prairie, T.T.I.	612-944-5080
MN	Hibbing, Minn Tech Elctrns.	218-262-5228
MN	St. Paul, Shelley-Ragon Elctrns.	612-642-2828
MO	Independence, Shelley-Ragon Elctrns.	816-254-3410
MO	St. Louis, Franklin Elctrns.	314-993-5333
NE	Lincoln, Scott Elctrns.	402-466-8221
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Mountainside, Enox Resistor Co.	201-654-7600
NJ	Parsippany, Fabe Electro Sls.	201-299-1123
NY	Amherst, Standard Elctrns.	716-691-3801
NY	Buffalo, Summit Distrs.	716-887-2845
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Hauppauge, Fairmont Elctrn. Sls.	516-231-3313
NY	Hauppauge, Jaco	516-273-5500
NY	Melville, S.A.I.	516-293-2710
NY	Rochester, Summit Distrs.	716-334-8110
NY	Ronkonkoma, Baldwin Comp. Ctr.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
NY	Ronkonkoma, T.T.I.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
NC	Greensboro, Golden Elctrns.	919-294-4653
NC	Raleigh, Resco	919-781-5700
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Cleveland, Roberts Elect. Corp.	216-238-1711
OH	Columbus, T.T.I.	614-848-5770
OH	Worthington, Reptron	614-436-6675
OK	Tulsa, Altair Co.	918-252-5781
OR	Beaverton, Murphy Elctrns.	503-642-2001
PA	Drexel Hill, Kass Elctrns. Dist.	215-449-2300
PA	Erie, Rem Elctrns.	814-453-5626
PA	Harrisburg, Cumberland Elctrns.	717-233-5883
PA	Philadelphia, PEI/Genesis	215-673-0400
PA	Philadelphia, Shap	215-969-3300
RI	Pawtucket, Major Edwards	401-725-7400
TN	Knoxville, Bondurant Bros.	615-573-9151
TN	Memphis, Bluff City Elctrns.	901-345-9500
TN	Nashville, Bluff City Elctrns.	615-242-8000
TX	Dallas, Shelley-Ragon	214-349-2424
TX	Ft. Worth, T.T.I.	817-831-8300
TX	Ft. Worth, T.T.I. Inc.	817-831-0441
TX	Houston, Altair Co.	713-462-3029
TX	Richardson, Altair Co.	214-231-5166
TX	Richardson, CCI	214-644-3444
TX	Richardson, Jaco	214-235-9575
WA	Redmond, Murphy Elctrns.	206-881-1234
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, T.T.I.	206-882-0291
WI	Oconomowoc, G W Elctrns.	414-567-9445
Can	Mississauga, Ont., Prelco	416-678-0401
Can	Montreal, Que., Prelco	514-389-8051

KODE, Odetics, 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0400, TWX: 910-595-2680; FSC No.: 62767; Empl.: 40; *Sls. Mgr.:* Dick Miller

KOEP PRECISION STANDARDS, INC., IC Coan Place, Metuchen, NJ 08840, Tel: 201-549-9280/9282, TWX: 710-998-0503; FSC No.: 57114; Empl.: 9; *Sls. Mgr.:* Cynthia Keep; *Dist. Mgr.:* Cynthia Keep ..... **D•1283**

Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CA	Torrance, Cutlas Elctrns.	213-324-7360
CO	Commerce City, Williams Assocs.	303-289-5647
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Binghamton, Tae-Rep	607-722-9265
NY	Rochester, Tae-Rep	716-586-8710
UT	Salt Lake City, Williams Assocs.	801-532-7701

KOLIN INDS., Box 300, Pound Ridge, NY 10576, Tel: 914-764-5775, FAX: 914-764-5386; Empl.: 30; *Sls. Mgr.:* J. Kolinsky

KOLLSMAN INSTR., 220 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-889-2500, TELEX: 94-3537, TWX: 710-366-6883; Empl.: 2200

KONTES, Kimble Div. of Owens/IL, 1001 Spruce St., Vineland, NJ 08360, Tel: 609-692-8500, TWX: 510-687-8967

KONTRON ELCTRNS., 630 Clyde Avenue, Mountain View, CA 94039-7230, Tel: 415-965-7020, TWX: 910-378-5207, FAX: 415-965-3505; Empl.: 60; *Sls. Mgr.:* Bob Woyciehowsky

KOOLTRONIC, INC., Hamilton Ave., Hopewell, NJ 08525, Tel: 609-466-3400, TELEX: 843345, FAX: 609-466-1114; Empl.: 180

KOOLTRONIC, INC., 1700 Morse Avenue, Ventura, CA 93003, Tel: 805-642-8521, FAX: 805-658-2901

KORRY ELECTRONICS CO., Criton Technologies, 901 Dexter Ave. N., Seattle, WA 98109, Tel: 206-281-1300, TWX: 910-444-2295; Empl.: 410; *Sls. Mgr.:* Bob Simpson

KRAFT DYNATRONIX, INC., 105 Power St., Amery, WI 54001, Tel: 715-268-8118, 800-826-7172, TWX: 297861 DYTX UR, FAX: 715-268-8183; Empl.: 25; *Sls. Mgr.:* R. W. Kappler; *Dist. Mgr.:* R. W. Kappler, Natl. Sls. Mgr.

KRECKMAN, HERB, CO., Cresco, PA 18326, Tel: 717-595-2212; Empl.: 4

KR ELECTRONICS, INC., 91 Avenel St., Avenel, NJ 07001, Tel: 201-636-1900; FSC No.: 55259; Empl.: 15; *Sls. Mgr.:* Frank Senkewicz ..... **A•1666-1668**

Local Sales Offices & Reps

CO	Englewood, Tech. Mktg. Co.	303-770-8994
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
OH	Kettering, Frank Bold & Assocs.	513-298-6145
TX	Dallas, Kay Todd Assocs.	214-458-8833

FAX: 603-624-0634

KRL/BANTRY COMPONENTS, INC., 160 Bouchard St., Manchester, NH 03103, Tel: 603-668-3210; FSC No.: 18235; Empl.: 75; *Sls. Mgr.:* Bert A. Spiller ..... **A•1951-1953**

Local Sales Offices & Reps

AZ	Tempe, Toribre Entprs., Inc.	602-820-5866
CA	Fountain Valley, Francisco/SMC Sls.	714-240-8309
CA	Mtn. View, Francisco & Assocs.	415-962-1717
CA	San Diego, Francisco/SMC Sls.	619-224-0013
FL	Boca Raton, Sls. Specialists	813-754-1329
IN	Indianapolis, CC Electro Sls.	800-423-7799
MN	Minneapolis, PSI, Inc.	612-944-8545
NH	Amherst, D. A. Crowley & Assocs.	603-673-7050
NY	Port Washington, Ashtec	516-767-0336
NY	Rochester, H. C. Johnson Agencies	716-586-0777
OH	Akron, Augnat Assocs.	216-273-1211
OK	Tulsa, Milco Mktg.	918-664-2277
PA	Wyndmoor, Precision Mktg. Grp.	215-233-9233
TX	Houston, Milco Mktg.	713-723-5003
TX	Richardson, Milco Mktg.	214-738-2716
UT	Salt Lake City, Sage Assocs.	801-467-5451
WA	Seattle, The Harry Levinson Co.	206-382-1300

Local Distributors

MA	Billerica, Baldwin Comps.	617-667-6710
NJ	Mountainside, ENOX Resistors	201-654-7600
NY	Ronkonkoma, Baldwin Comps. Center	516-588-5700,800-645-5608
PA	Harrisburg, Ad-Tech	717-939-8337

KROHN-HITE CORP., Avon Indl. Pk., Bodwell St., Avon, MA 02322, Tel: 508-580-1660, FAX: 617-583-8989; Empl.: 60; *Sls. Mgr.:* Warren Howard, Sls. Mgr. ..... **A•1669; D•1285**

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AZ	Phoenix, Odyssey 1	602-246-8846
CA	Huntington Bch., Sci-Dev West	714-840-3501
CA	San Jose, MCH Assocs.	408-246-7330
CO	Englewood, Odyssey 1	303-773-8176
FL	Ft. Lauderdale, Gentry Assocs.	305-791-8405
FL	Orlando, Gentry Assocs.	305-859-7450
FL	Tampa, Gentry Assocs.	813-886-0720
GA	Atlanta, Gentry Assocs.	404-998-2828
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
KS	Overland Park, Ramsey Assocs.	913-649-6996
LA	Gretna, Gentry Assocs.	504-367-3975
MD	Baltimore, Sci-Rep	703-385-0600
MI	Detroit, EQS Sys.	313-961-3042
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	St. Louis, Ramsey Assocs.	314-878-5042
NJ	Englewood, Sci. Devices E.	201-871-3916
NM	Albuquerque, Odyssey 1	505-265-6645
NY	Syracuse, Labtronics	315-455-7314

OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
WA Bellevue, Sci. Dvcs., N.W. 206-747-5189
PA Pittsburgh, EQS Sys. 216-729-2222
PA Spring House, Scientific Devices East 215-643-3335
SC Columbia, Gentry Assocs. 803-772-6786
TN Knoxville, Gentry Assocs. 615-584-0281
TX Houston, Barnhill Assocs. 713-444-1733
VA Fairfax, Sci-Rep 703-385-0600
WA Bellevue, Sci. Dvcs. N. W. 206-747-5169
WI Milwaukee, Berndt Assocs. 414-545-8400

KRYSTINEL CORP., 126 Pennsylvania Ave., Paterson, NJ 07509, Tel: 201-345-8900, TWX: 710-988-5931, FAX: 201-345-1172; Empl.: 200; *Sls. Mgr.:* Stuart Gordon, VP Sls./Mktg.

KSI, See Kaiser Systems, Inc.

K-SYSTEMS, INC., 3902 Lilac, Las Cruces, NM 88005, Tel: 505-526-3209, TELEX: WUI 6502763972; Empl.: 5; *Sls. Mgr.:* J. C. Kates

K-TWO INDUSTRIES, 4331 Miranda Ave., Palo Alto, CA 94306, Tel: 408-720-9316; Empl.: 5

H. KUHNKE, INC., 26 W. Highland Ave., Atlantic Highlands, NJ 07716, Tel: 201-291-3334, 800-221-0714, TELEX: 854041; Empl.: 12; *Sls. Mgr.:* John Chapski

KULITE SEMICONDUCTOR PRODS., INC., One Willow Tree Rd., Leonia, NJ 07605, Tel: 201-461-0900, TELEX: 685-3296, FAX: 201-461-0990; Empl.: 300

KULKA (DIALIGHT COMPANY), 1913 Atlantic Ave., Manasquan, NJ 08736, Tel: 201-223-9400 .. **B•1115, 1121-1124, 1692-1693; C•1412-1415, 1553, 1709**

See Dialight Corp. for sales offices & representatives.

KURZ INSTRUMENTS INC., 2411 Garden Rd., Monterey, CA 93940, Tel: 800-424-7356, TELEX: 172275; FSC No.: 94-24-11681; Empl.: 72; *Sls. Mgr.:* Phil Hickerson

KURZ-KASCH, Knob Div., 711 Hunter Dr., Wilmington, OH 45177, Tel: 513-382-0966; Empl.: 250; *Sls. Mgr.:* J. McGeady, M. Krystofik

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 28; *Sls. Mgr.:* Freda Pickard

K-W MANUFACTURING CO., INC., P. O. Box 508, Prague, OK 74864, Tel: 405-567-2285, TELEX: 4932625, FAX: 405-567-4153; Empl.: 28; *Sls. Mgr.:* Freda Pickard

KYOCERA NORTHWEST, Electronic Components Group, P.O. Box 85542, San Diego, CA 92138-5542, Tel: 619-576-2600, TELEX: 472-3062, FAX: 619-268-8540; *Sls. Mgr.:* Koji Kanatani; *Dist. Mgr.:* Mike Drotar

LAAKMANN ELECTRO-OPTICS, INC., 33052 Calle Aviador, San Juan Capistrano, CA 92675, Tel: 714-493-6624, TELEX: 681335; *Sls. Mgr.:* John Wheeler

LAB-LINE INSTRUMENTS, 15th & Bloomingdale, Melrose Park, IL 60160, Tel: 312-450-2600, TELEX: 6871028; Empl.: 225

LABORATORY PRODUCTS, INC., 16 Fairmount Ct., P. O. Box 258, Hyde Pk., MA 02136, Tel: 617-364-6260; FSC No.: 04-2593524; Empl.: 9; *Sls. Mgr.:* R. J. Toronto

LAFRANCE CORP., Entprs & Exec Aves, Philadelphia, PA 19153, Tel: 215-365-8000, TELEX: 506 082; Empl.: 502; *Sls. Mgr.:* Elizabeth Swanson

LAFRANCE CORP., PACTEC DIV., See PacTec Div., LaFrance Corp.

LAKE SHORE CRYOTRONICS, INC., 64 E. Walnut St., Westerville, OH 43081, Tel: 614-891-2243, TELEX: 24-5415, FAX: 614-891-1392; *Sls. Mgr.:* David L. Calvelage

LA MARCHE MFG., 106 Bradrock Dr., Des Plaines, IL 60018, Tel: 312-299-1188, TELEX: 28-2526; FSC No.: ;15736; Empl.: 225

LAMBDA ELECTRONICS, Veeco Instr., Inc., 515 Broad Hollow Rd., Melville, NY 11747, Tel: 516-694-4200, TWX: 510-224-6484; Empl.: 1200; *Sls. Mgr.:* I. Gutman

LAMBDA SEMICONDUCTORS, Veeco Instruments, 121 International Dr., Corpus Christi, TX 78410, Tel: 512-289-0403, 800-255-9606, TWX: 910-876-1404, FAX: 512-289-0472; Empl.: 200

LAMP TECHNOLOGY, INC., 1645 Sycamore Ave., Bohemia, NY 11716, Tel: 516-567-1800, TELEX: 279260; Empl.: 20; *Sls. Mgr.:* Neal Shupak

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MO St. Louis, F. Floyd Smith/Omni 314-355-5072
CA Westlake Vl., CASCO 818-889-7889
WA Lynnwood, The Nichols Co. 206-742-8761
IL Palatine, Golbeck Milota Assocs. 312-705-0602
WI Ripon, Kilgore Assocs. 414-748-7485

LAMTECH ELECTRONICS, 620 Easy Street, Garland, TX 75042, Tel: 214-272-3504, FAX: 214-669-2809; FSC No.: O7R487; Empl.: 100; *Sls. Mgr.:* Phillip Rasor; *Dist. Mgr.:* Phillip Rasor

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LANCE WIRE & CABLE, INC., 1010 Sherman Ave., Hamden, CT 06514, Tel: 203-288-5571, TWX: 510-601-0470, FAX: 203-248-0256; Empl.: 50; *Sls. Mgr.:* Bill Kahler

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L & L SPECIAL FURNACE, 166 Kent Rd., Aston, PA 19014, Tel: 215-459-9216, FAX: 215-459-3689; Empl.: 20; *Sls. Mgr.:* Greg Lewicki; *Dist. Mgr.:* Stephen Lewicki

L & R MFG. CO., 577 Elm St., Kearny, NJ 07032, Tel: 201-991-5330, FAX: 201-991-5870; Empl.: 220; *Sls. Mgr.:* Bruce Bernardo

LANGLEY, P.O. Box 2911, San Diego, CA 92112, Tel: 619-264-3181; FSC No.: 83549; Empl.: 130; *Sls. Mgr.:* A. Kremm

LANSING RESEARCH CORP., 705 Willow Ave., Ithaca, NY 14850, Tel: 607-272-3265, 607-257-7613, 800-847-3535; *Sls. Mgr.:* Fred B. Widding ..... **C•1062**

LARK ELECTRONICS, INC., Box 390, New York, NY 10040, Tel: 212-569-0430; FSC No.: 52682

LARK ENGINEERING CO., Baier & Baier Inc., 26401 Calle Rolando, San Juan Capistrano, CA 92675, Tel: 714-240-1233, FAX: 714-240-7910; FSC No.: 33175; Empl.: 25

LARSON INSTRUMENT, Greenbush Rd., Orangeburg, NY 10962, Tel: 914-359-3800; Empl.: 18; *Sls. Mgr.:* A. D. Stephens

LASER CONCEPTS, Omega Organization Intl., P.O. Box 33623, Seattle, WA 98133, Tel: 206-364-7881; *Sls. Mgr.:* Roberta Forsythe

LASER DIODE, INC., Morgan Crucible, 1130 Somerset St., New Brunswick, NJ 08901, Tel: 201-249-7000, TWX: 710-998-0597, FAX: 201-249-9165; Empl.: 170; *Sls. Mgr.:* Greg Dougherty; *Dist. Mgr.:* Greg Dougherty

LASER PRECISION CORP., 1231 Hart St., Utica, NY 13502, Tel: 315-797-4449, TELEX: 646803; Empl.: 180; *Sls. Mgr.:* David Stehlin

LASER TECHNOLOGY, INC., 10624 Ventura Blvd., N. Hollywood, CA 91604, Tel: 818-763-7091, TELEX: Cable-LASTEC (No. Hollywood); Empl.: 22; *Sls. Mgr.:* H. A. Mangels

LAW, R. E. INSTRUMENT, INC., 7735 W. 112th Pl., Palos Hills, IL 60465, Tel: 312-974-4000; FSC No.: 6685-6695; *Sls. Mgr.:* R. Gene Law; *Dist. Mgr.:* R. Gene Law

LAWRENCE-CROW ELCTRNS. INC., 2100 Stemmons, Dallas, TX 75207, Tel: 214-749-5440, TELEX: 730213; *Sls. Mgr.:* Jesse Hall; *Dist. Mgr.:* Michael T. McAndrews

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L-COM INC., 1755 Osgood St., N. Andover, MA 01845, Tel: 617-682-6936, FAX: 617-689-9484; Empl.: 16; *Sls. Mgr.:* Scott Black

LDJ INCORPORATED, 2200 Stephenson Hwy., P.O. Box 219, Troy, MI 48099-0219, Tel: 313-528-2202, TWX: 810-232-1509 LDJ TRMI, FAX: 313-689-2525; Empl.: 63; *Sls. Mgr.:* Jim Ling

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CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Quorum 3 Sls. Grp.	303-696-8480
FL	Oveido, Conley & Assocs.	305-365-3283
FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
GA	Gainsville, R & G Assocs.	404-532-3850
IL	Elgin, R.H.I. Sls. Corp.	312-888-0099
MD	Hunt Valley, Marktron, Inc.	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Needham, Component Technlg., Inc.	617-449-8490
MI	Southfield, Rathsburg Assoc. Inc.	313-559-9700
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MO	St. Louis, Leach Corp.	314-524-2880
NM	Albuquerque, O'Donnell Assocs.	505-883-1030
NY	Commack, Leach Corp.	516-499-2449
OH	Dayton, SAI Mktg. Corp.	513-434-8151
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Leach Corp.	214-341-0811
UT	Salt Lake City, Quorum 3 Sls. Corp.	801-943-9227
KS	Wichita, BAKA Corp.	316-682-8411
WA	Bellevue, Leach Corp.	206-746-7236
Can	Glouchester, Ont., Robin Aerospace Prods., Ltd.	613-746-7400
Can	Kirkland, Que., Robin Aerospace Prods., Ltd.	514-694-1315
Can	Mississauga, Ont., Robin Aerospace Prods., Ltd.	416-673-1666

Local Distributors

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AZ	Tempe, Time Elctrns.	602-967-2000
CA	Anaheim, Time Elctrns.	714-937-0911
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CA	San Diego, Time Elctrns.	619-586-1331
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns. West	213-320-0880
CO	Englewood, Time Elctrns.	303-799-8851
CT	Cheshire, Time Elctrns.	203-271-3200
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Orlando, Time Elctrns.	305-841-6565
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Time Elctrns.	404-448-4448
IL	Wood Dale, Time Elctrns.	312-350-0610
MD	Columbia, Time Elctrns.	301-964-3090
MA	Peabody, Time Elctrns.	617-532-6200
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MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Pine Brook, Time Elctrns.	201-882-4616
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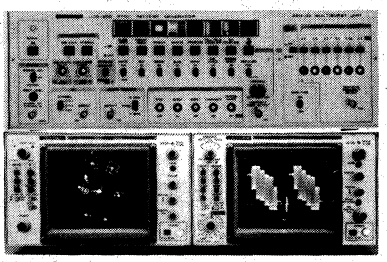

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AL	Huntsville, Montgomery Mktg., Inc.	205-830-0498
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CA	Buena Pk., Leach Corp.	714-739-8151
CA	San Mateo, Halbar Assocs.	415-349-4700
CO	Denver, Quorum 3	303-696-8480
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
IL	Elgin, RHI Sls. Corp.	312-888-0099
KS	Wichita, Baka Corp.	316-682-8411
MD	Hunt Valley, Marktron	301-628-1111
MD	Rockville, Marktron	301-251-8990
MA	Needham, Comp. Techn.	617-449-8490
MI	Southfield, Rathsburg Assocs., Inc.	313-559-9700
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NM	Albuquerque, O'Donnell Assocs. S.W.	505-883-1030
NY	Commack, Leach Corp.	516-499-2449
NC	Cary, Montgomery Mktg., Inc.	919-467-6319
OH	Dayton, Leach Corp.	513-434-8151
PA	Trevose, PSA, Inc.	215-245-0513
TX	Dallas, Leach Corp.	214-341-0811
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WA	Bellevue, Leach Corp.	206-746-7263
Can	Glouchester, Ont., Robin Aerospace Prods.	613-746-7400
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CT	Cheshire, Time Elctrns.	203-271-3200
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
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MD	Columbia, Time Elctrns.	301-964-3090
MA	Peabody, Time Elctrns.	617-532-6200
MN	Edina, Time Elctrns.	612-835-1250
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Pine Brook, Time Elctrns.	201-882-4611
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-273-0100
NC	Charlotte, Time Elctrns.	704-522-7600
OH	Dublin, Time Elctrns.	614-761-1100
OR	Portland, Time Elctrns.	503-684-3780
PA	King of Prussia, Time Elctrns.	215-337-0900
TX	Austin, Time Elctrns.	512-339-3051
TX	Carrollton, Time Elctrns.	214-241-7441
TX	Houston, Time Elctrns.	713-530-0800
UT	Salt Lake City, Time Elctrns.	801-973-8181
WA	Redmond, Time Elctrns.	206-882-1600

LEADER INSTRUMENTS CORP., 380 Oser Ave., Hauppauge, NY 11788-3694, Tel: 516-231-6900, TWX: 510-227-9669; Empl.: 42; *Sls. Mgr.:* R. Sparks, Sls. Mgr.; *Dist. Mgr.:* A. Ambrosio ..... **D•1286-1288**

Local Sales Offices & Reps

CA	Cypress, Leader Instrs. Corp.	714-527-9300

L.E.A. DYNATECH, INC., Dynatech Corporation, 12516 Lakeland Rd., Santa Fe Springs, CA 90670-9990, Tel: 213-944-0916, TWX: 910-586-1381, FAX: 213-944-0781; FSC No.: 57499; Empl.: 35; *Sls. Mgr.:* Roger L. Lewis; *Dist. Mgr.:* Roger L. Lewis

LEAR SIEGLER, INC., 2850 Ocean Park Blvd., P.O. Box 2158, Santa Monica, CA 90406, Tel: 213-452-5444, TWX: 910-343-6463; Empl.: 29,725

FAX: 714-535-4679

LEAR SIEGLER, INC., Telecommunications Div., 714 N. Brookhurst St., Anaheim, CA 92801, Tel: 714-774-1010, TWX: 310-497-9012; Empl.: 256; *Sls. Mgr.:* J. Horgan ..... **C•1416**

Local Sales Offices & Reps

CA	Placentia, Local Sls., Inc.	714-993-1800
CA	San Diego, Qualtronics	619-695-0118
CA	Sunnyvale, Wedemeyer Sls.	408-354-7334
GA	Atlanta, Grady Duckett	404-451-3529
IN	Indianapolis, Elctrn. Sls. & Engrg.	317-849-4260
MA	Brookline, L. K. Harmon & Assocs.	617-232-6687
MA	Haverhill, L.K. Harmon	617-373-1313
MI	Detroit, Hummon Assocs.	313-474-0661
MN	Bloomington, Paul Ericson & Assocs., Inc.	612-884-1969
NJ	Bellmawr, Mid Atlantic Corp.	609-931-5303
NY	Fayettesville, Floring & Assocs.	315-637-4552
NY	Scottsville, Floring & Assocs.	716-889-4614
NY	Williston Park, ABC Elec.	516-747-6610
TX	Austin, Alphatech, Inc.	512-458-9179

Local Distributors

Can	Kingston, Ont., Elec. Packaging Sys.	613-384-1142

LEBOW PRODUCTS, Eaton Corp., 1728 Maplelawn Rd., Troy, MI 48084, Tel: 313-643-0220, FAX: 313-643-0229; Empl.: 97; *Sls. Mgr.:* Michael J. Parker

LECROY CORP., 700 S. Main St., Spring Vly., NY 10977, Tel: 914-425-2000, TWX: 710-577-2832; Empl.: 300; *Sls. Mgr.:* Henry Bickel

LECTROHM DIV. OF CAPCO, INC., Box 1028, Grand Junction, CO 81502, Tel: 303-243-8480, TWX: 910-929-6989; Empl.: 110

LECTRO MAGNETICS, INC., 6056 W. Jefferson Blvd., Los Angeles, CA 90016, Tel: 213-870-9383, (USA):800-325-9814, (CA):800-325-9815; FSC No.: 29098; Empl.: 60; *Sls. Mgr.:* Wm. DeSalle

LECTRONIC RESEARCH LABS., INC., 1423 Ferry Ave., Camden, NJ 08104, Tel: 609-541-4200, TELEX: 6711825; FSC No.: 99228; Empl.: 20; *Sls. Mgr.:* Ken Reid

LECTROTECH, INC., 5810 N. Western Ave., Chicago, IL 60659, Tel: 312-769-6262, TELEX: 4993905 LECTRO; Empl.: 35

LEDCO DIV., 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; FSC No.: 55292; Empl.: 25; *Sls. Mgr.:* Laurie Wilbrecht

FAX: 213-676-0108

LEDTRONICS, INC., 4009 Pacific Coast Hwy., Torrance, CA 90505, Tel: 213-676-7996, TELEX: 4945454; FSC No.: 8Z410; Empl.: 14; *Sls. Mgr.:* A. Claudio .. **B•1079, 1125**

Local Sales Offices & Reps

CT	Ansonia, Pace Assocs.	203-732-8756
CT	S. Glastonbury, Pace Assocs.	203-659-2266
MI	Detroit, Qualitron	313-534-1511
NE	Lincoln, Creative Concepts	402-483-6559
TX	Dallas, Rem-Air	214-234-1069
Can	Markham, Ont.	416-475-2024

Local Distributors

AZ	Phoenix, EKO Sls.	602-437-4646
AR	Fort Smith, Radio, Inc.	501-646-5200
CA	Fremont, Vic-Tal	415-651-6420
CA	Hollywood, Yale Elctrns.	213-465-3186
CA	Industry, Ital Elctrns.	818-968-8515
CA	Irvine, J & J Elctrns.	714-455-0104
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Mission Viejo, Opto Plus	714-380-8654
CA	Sacramento, Zack Elctrns.	916-446-3131
CA	San Francisco, Zack Elctrns.	415-626-1444
CA	Tustin, Added Value Elctrns.	714-258-8259
CA	Van Nuys, Wes-Garde	818-786-3724
CO	Denver, RSI	303-373-1812
CO	Wheatridge, Aved Inc.	303-422-1701
CT	Ansonia, Pace Assocs.	203-654-2266
CT	Hartford, Wes-Garde	203-527-7705
FL	Lakeland, Wes-Garde	813-644-7564
FL	Largo, Elctrns. Precepts	813-544-3636
GA	Norcross, Emsco	404-925-8366
GA	Norcross, Specialty Distributing Co.	404-448-4004
IL	Addison, Belford Elctrns.	312-691-1100
IL	Carol Stream, Wes-Garde	312-653-1460
IL	St. Charles, Norman Lamps	312-377-3004
IN	Ft. Wayne, Kendall Elec.	219-484-0755
IN	Indianapolis, Mar Elctrns.	317-633-6699
KS	Great-Bend, RSC Elctrns.	316-793-3507
KS	Salina, RSC Elctrns.	913-823-6353
KS	Wichita, Radio Inc.	316-264-2798
KS	Wichita, RSC Elctrns.	316-267-5213
LA	Baton Rouge, CED/Cust. Svc. Elec. Supp.	504-295-0069
LA	Lafayette, Ralphs	318-233-0105
MD	Gaithersburg, MS Elctrns.	301-921-0200
MD	Spencerville, U. S. Elctrns.	301-384-3300
MI	Battle Creek, Kendall Elec.	616-963-5585
MI	Livonia, R S Elctrns.	313-525-1155
MN	Brighton, Parts One	612-633-8079
MN	Hibbing, Minntech Elctrns.	218-262-5228
MO	St. Louis, Ric-Tronics	314-576-9816
MO	St. Louis, Wes-Garde	314-567-7776
NE	Lincoln, Creative Concepts	402-483-6559
NH	Nashua, Wes-Garde	603-880-1971
NJ	E. Brunswick, Bros. Elctrns.	201-238-2200
NJ	E. Brunswick, Brother Elctrns.	201-238-2200
NJ	Mt. Laurel, Wes-Garde	609-778-8190
NJ	Teaneck, Comet Elctrns.	201-836-6699
NM	Albuquerque, RSI	505-828-2148
NY	Freeport, KRP Elctrns.	516-623-3346
NY	Henrietta, CAM/RPC	716-334-5600
OH	Cincinnati, Eclipse of Ohio	513-661-7733
OH	Cleveland, CAM/RPC	216-461-4700
OH	Westerville, Wes-Garde	614-885-0319
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Oklahoma City, RSC Elctrns.	405-631-7729
OK	Tulsa, Radio, Inc.	918-587-9123
OR	Portland, O4-Controls	503-231-8058
PA	Drexel Hill, Kass Elctrns.	215-449-2300
PA	Pittsburgh, CAM/RPC	412-782-3770
SC	Charleston, Wholesale Inds.	803-722-2634
SC	Greenville, EMSCO	803-233-4121
TX	Austin, Southwest Elexs.	512-837-8971
TX	Beaumont, Ralphs	409-833-9443
TX	Brownsville, Carden Inds.	512-541-3660
TX	Dallas, Southwest Elctrns.	214-234-3050
TX	Dallas, Wes-Garde	214-357-1768
TX	Dickinson, RSI	713-337-1757
TX	Pflugerville, RSI	512-251-1161
TX	Richardson, RSC Elctrns.	214-644-3444
TX	Stafford, Southwest Elexs	713-240-4000
TX	Texas City, Electronic Supp.	409-945-7757
UT	W. Valley City, Aved Inc.	801-975-9500
VA	Charlottesville, Virginia Elctrns.	804-296-4184
VA	Norfolk, Priest Elctrns.	804-855-0105
WA	Seattle, Westlake Elctrns.	206-622-6600
WI	Milwaukee, Progressive Image	414-321-4722

LEECRAFT MFG., 21-02 44th Rd., Long Island City, NY 11101, Tel: 718-392-8800, TWX: 710-582-2897; Empl.: 250; *Sls. Mgr.:* John Inzerillo

LEE DATA CORPORATION, 7075 Flying Cloud Drive, Minneapolis, MN 55344, Tel: 612-828-0300, TWX: 910-576-1690; Empl.: 1075; *Sls. Mgr.:* James McCormack, VP Commercial Sls.

LEEDS & NORTHRUP, GENERAL SIGNAL, Sumneytown Pike, North Wales, PA 19454, Tel: 215-643-2000

LEEPOXY PLASTICS, 3324 Ferguson Rd., Ft. Wayne, IN 46809, Tel: 219-747-7411; Empl.: 15; *Sls. Mgr.:* Rick Stacy

LEIGH INSTRUMENTS LTD., Components Division, 141 Bond Ave., Don Mills, ON, Canada M3B 1M2, Tel: 416-447-8531, TELEX: 06-966626, FAX: 416-447-8535; FSC No.: 02533; Empl.: 158; *Sls. Mgr.:* R. W. Parkins

LEKTRA SERVICE CORP., 129-07 18th Ave., P.O. Box 222, College Point, NY 11356, Tel: 718-939-7171; Empl.: 10; *Sls. Mgr.:* Ben Eisenberg

LEL CO., 5 Burns Pl., Cresskill, NJ 07626, Tel: 201-569-8641; Empl.: 10

LEMO USA INC. ELECTRONIC CONNECTORS

FAX: 707-578-0869

LEMO U.S.A., INC., P.O. Box 11488, Santa Rosa, CA 95406, Tel: 707-578-8811, TELEX: 340-933; FSC No.: 2P953; Empl.: 17 ..... **C•1417-1429**

Local Sales Offices & Reps

AZ	Tempe, Trembly Assocs.	602-967-2058
CA	Irvine, Balzer-Wolf Assocs.	714-261-6877
CA	San Diego, Balzer-Wolf Assocs.	619-581-6060
CA	San Jose, Ruppert Sls. & Engrg.	408-998-8717
CO	Wheat Ridge, Trembly Assocs.	303-421-8900
FL	Melbourne, Southern Elctrns., Inc.	305-242-9661
GA	Norcross, Hughes Assocs., Inc.	404-662-1587
IL	Northbrook, Raines & Assocs.	312-498-0890
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Rockville, Mechtronics Sls., Inc.	301-340-2130
MA	Lexington, Zieco	617-861-8300
MI	Detroit, Jack M. Thorpe Co.	313-779-6363
MN	Edina, Hanna Lind	612-925-5700
MS	Corinth, Hughes Assocs., Inc.	601-287-2915
MO	St. Louis, Midtec Assocs.	314-275-8666
NV	Las Vegas, Trembly Assocs.	702-739-9770
NJ	Englewood, Sprung/Nussbaum, Inc.	201-569-5666
NM	Albuquerque, Trembly Assocs.	505-266-8616
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
NY	Victor, Canavan-Scanlon Assocs.	716-924-7450
NC	Cary, Hughes Assocs., Inc.	919-467-7029
OH	Cleveland, K/T Depco	216-442-6200
OH	Columbus, K/T Depco	614-262-9151
OR	Portland, Earl & Brown Co.	503-643-5500
PA	Hatboro, Jacobsen Assocs.	215-674-2937
PA	Pittsburgh, K/T Depco	412-367-1011
TN	Jonesboro, Hughes Assocs.	615-753-2719
TX	Lewisville, Jim Hughes Co.	214-221-1536
UT	Salt Lake City, Trembly Assocs.	801-295-4703
WA	Redmond, Earl & Brown Co.	206-885-5064
Can	Markham, Ont., Birde Mktg.	416-477-7722

LENCO ELECTRONICS, INC.

FAX: 815-344-2730

LENCO ELCTRNS., INC., 1330 Belden St., McHenry, IL 60050, Tel: 815-344-2900; Empl.: 155; *Sls. Mgr.:* Lenard J. Duncan ..... **A•2248-2249**

Local Sales Offices & Reps

CA	Northridge, Myco Sls.	818-886-7101
CA	Palo Alto, TriRep	415-965-1822
CO	Aurora, Butler Tech. Sls.	303-343-3787
IL	Bartlett, Lemvig Assocs.	312-830-2241
IL	McHenry, Mesa Inc.	815-344-2820
KS	Mission, McAllister Assocs.	913-262-5500
MA	Framingham, Stone Comps.	617-875-3266
MI	Farmington Hills, Stone Comps. Sls.	313-476-6090
NJ	Oak Ridge, P.G. Assocs.	201-697-0128
NJ	Pensauken, Vantage Sls.	609-663-6660
NC	Fripp Island, NPM Assocs.	803-838-2691
OH	Fairview Pk., Comp. Specialty	216-734-0655
SC	Fripp Island, N.P.M. Assocs.	803-838-2691

LENCO ELECTRONICS, INC., 300 N. Maryland St., Jackson, MO 63755, Tel: 314-243-3147, TWX: 910-760-1382; Empl.: 70; *Sls. Mgr.:* Bob Bergfeld; *Dist. Mgr.:* Mark A. Hill, Intl. Sls. Mgr.

LENOX-FUGLE ELECTRONICS, 100 Sylvania Pl., S. Plainfield, NJ 07080, Tel: 201-756-1164; Empl.: 25; *Sls. Mgr.:* Henry J. Lenox

LENOX INSTRUMENT, 265 Andrews Rd., Trevose, PA 19047, Tel: 215-322-9990, TWX: 710-670-1440; FSC No.: 35733; Empl.: 30; *Sls. Mgr.:* William Lang

LEPCO/LEONARD ELEC. PRODS., 85 Industrial Dr., Brownsville, TX 78521, Tel: 512-546-1625, FAX: 512-546-4112; Empl.: 180; *Sls. Mgr.:* Andrew C. Smith

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MD	Randallstown, Chesapeake Indl. Mktg.	301-922-5997
MA	Burlington, Omni-Rep	617-245-4511
MN	N. Mankato, E. I. Sls.	507-345-5786
NC	Cary, RFS Mktg.	919-469-4150
OH	Cleveland, Engrd. Indl. Sls.	216-371-4350
OK	Tulsa, Advance Tech. Sls.	918-664-0482
PA	Newton, Indl. Sls. Assocs.	215-860-2076
TX	Austin, Advance Tech. Sls.	512-331-9979
TX	Dallas, Advance Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888

LEPEL, 50 Heartland Blvd., Edgewood, NY 11717, Tel: 516-586-3300, TELEX: 12303, FAX: 516-586-3232; Empl.: 150; *Sls. Mgr.:* Richard Sutton

LESTRONICS, INC., 1840 Industrial Circle, Longmont, CO 80501, Tel: 303-651-2011, FAX: 303-678-8360; Empl.: 75; *Sls. Mgr.:* Linda Tholen

LEVITON TELCOM, Leviton Manufacturing, 2222 222nd St., S.E., Bothell, WA 98021-4416, Tel: 206-485-4288, FAX: 206-483-5270; Empl.: 40; *Sls. Mgr.:* Jerry Cooley

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LEYBOLD INFICON, INC., 6500 Fly Rd, E. Syracuse, NY 13057, Tel: 315-437-0377, TWX: 710-541-0594, FAX: 315-437-3803; Empl.: 185; *Sls. Mgr.:* John G. Stratakos

LFE, Instruments Div., 55 Green St., Clinton, MA 01510, Tel: 617-835-1000, TWX: 710-347-1734, FAX: 614-835-1068; FSC No.: 20905; Empl.: 250; *Sls. Mgr.:* D. Snyder, C. Holdever; *Dist. Mgr.:* B. Pugsley (East.)E. Stuart (West.)

LF ENGINEERING COMPANY, 17 Jeffry Road, East Haven, CT 06512, Tel: 203-467-3590

LH

FAX: 714-669-2544

LH RESEARCH, INC., 14402 Franklin Ave., Tustin, CA 92680, Tel: 1-800-547-2537, TWX: 910-595-2540; Empl.: 900; *Sls. Mgr.:* Mr. Dayve Day ..... **D•1826-1831**

Local Sales Offices & Reps

CA	Tustin, LH Resch., Inc.	714-730-0162
CA	Tustin, LH Resch., Inc.	800-824-5429
CA	Tustin, LH Resch., Inc.	800-LHS-ALES

LIBBEY-OWENS-FORD CO., Liberty Mirror Products, 851 Third Ave., Brackenridge, PA 15014, Tel: 412-224-1800; Empl.: 150; *Sls. Mgr.:* Terry W. Garrett

LIBERTY CONTROLS INC.

LIBERTY CONTROLS, 500 Brookforest Ave., Shorewood, IL 60435, Tel: 815-725-2241; Empl.: 60; *Sls. Mgr.:* Gary Davies ..... **B•1626**

Local Sales Offices & Reps

CA	Arcadia, H.M.C. Inc.	818-447-0958
CA	Hayward, Featherstone Sls. Co.	415-785-1926
CO	Arvada, Gemini Elctrns.	303-428-5600
CT	Cheshire, The MacInnis Co.	203-272-3797
IL	Palatine, Goldbeck Milota Assocs. Inc.	312-705-0602
KS	Olathe, Advanced Tech. Sls.	913-782-8702
MA	Norwood, The MacInnis Co.	617-762-8090
MI	Detroit, R. P. Urban & Assocs.	313-535-2355
MI	Grand Rapids, R. P. Urban & Assocs.	616-245-0511
MN	St. Paul, Countryman Assocs.	612-645-9151
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	Englewood Cliffs, Mason-Esco Inc.	201-569-8868
NY	Hauppauge, Mason-Esco Inc.	516-273-3500
NY	Rochester, BRS Sls. Assocs.	716-586-1522
OH	Dayton, J. C. Hoffsteller Co.	513-296-1010
OH	Medina, J. C. Hoffstetter Co.	216-241-4880
OR	Portland, SPS Elctrns., Inc.	503-297-6919
TX	Dallas, Reese & Assocs.	214-351-0703
UT	Slat Lake City, Gemini Elctrns.	801-278-0201
WA	Redmond, SPS Elctrns., Inc.	206-323-4140

LIBERTY ENGINEERING, 9300 Mason Avenue, Chatsworth, CA 91311

LIBERTY INTL. CORP., FIRSTOHM, 2539 237th St., Suite F, Torrance, CA 90505, Tel: 213-539-6452, FAX: 213-539-8450; Empl.: 5; *Sls. Mgr.:* Gary Lee; *Dist. Mgr.:* Maria A. Lauro

Local Sales Offices & Reps

AL	Adamsville, Southrep	205-674-3056
CA	Fremont, William Parks Assocs.	415-796-0875
CO	Parker, The Remington Grp.	303-841-0523
GA	Norcross, Southrep	404-262-6942
MA	Canton, Dave Taggart Assocs.	617-828-6064
MI	St. Clair Shores, D.E.M. Sls., Inc.	313-777-1750
MN	Roseville, TLC Elctrns.	612-483-2226
NJ	Wayne, Howard Kagan Assocs.	201-694-1115
OH	Miamisburg, ECI Distbn. Corp.	513-866-3340
PA	Harrisburg, Beil & Whitaker	717-564-6900
WA	Seattle, Harry Levinson Co.	206-382-1300

Local Distributors

AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Fountain Hills, RCD Inds.	602-483-6412
CA	La Selva, Coast Comps.	408-684-1185
CA	San Diego, Sigma Elctrns.	619-565-6000
CA	San Jose, Compass Components	408-432-7575
CO	Aurora, Jet Elctrn. Supply Co., Inc.	303-364-1000
FL	Melbourne, TC Pridmore Co.	305-727-2491
IL	Chicago, Century Elctrns. Corp.	312-777-9700
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
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MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Livonia, Key Elctrns.	313-261-5391
MN	New Brighton, Chris Elctrns.	612-631-2647
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PA	Harrisburg, Ad-Tech Elctrns., Inc.	717-939-8337
RI	Pawtucket, Major/Edward Elctrns.	401-725-7400
TN	Knoxville, Industrial Elctrns.	615-573-7135
TX	Garland, J & S Elctrns.	214-487-8808
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LIGHTNING PROTECTION CORP., Box 6086, Santa Barbara, CA 93160, Tel: 805-967-5089/4577, FAX: 805-967-4320; FSC No.: 56618; Empl.: 25; *Sls. Mgr.:* Chester J. Kawiecki

LIGHTWAVE COMMUNICATIONS, INC., 650 Danbury Rd., Ridgefield, CT 06877, Tel: 203-438-3591, FAX: 203-431-3001; *Sls. Mgr.:* Greg Pollack

LINCOLN INSTRUMENTS, 456 W. Montana St, Pasadena, CA 91103, Tel: 818-798-0733; Empl.: 11; *Sls. Mgr.:* Barbara J. Burchette

LINCOLN LASER CO., 234 East Mohave, Phoenix, AZ 85004, Tel: 602-257-0407, TELEX: 165-718; FSC No.: 602-257-0728; Empl.: 100; *Sls. Mgr.:* Robert S. Nehrbas, Jr.

LINDGREN RF ENCLOSURES, INC., 1228 Capitol Drive, Addison, IL 60101, Tel: 312-628-9100, TELEX: 297296 LIND UR; FSC No.: 18234; Empl.: 100; *Sls. Mgr.:* Dennis Wallach

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GA Tucker, Control Instr. Device 404-491-3143
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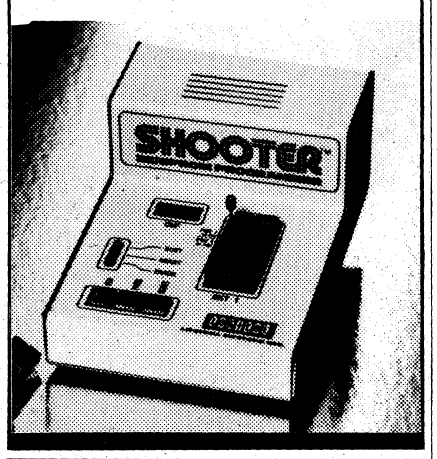

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MI	Union Lake, G. L. Ashby Assoc. Inc.	313-363-1100
MN	Wayzata, White Sls. Co.	612-544-1374
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NY	Ronkonkoma, JL Sls.	516-737-2801
OH	Cleveland, G. L. Ashby Assoc. Inc.	216-461-0826
OH	Dayton, G. L. Ashby Assoc. Inc.	513-252-5627
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PA	Churchville, Dynamic Elctrn. Sls.	215-322-2611
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FL	Pompano Beach, Techn. Mktg. Assocs.	305-977-9006
GA	Atlanta, DHR Mktg., Inc.	404-451-9848
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LVC INDUSTRIES, INC., 23 Hanse Ave., Freeport, NY 11520, Tel: 516-868-1900; FSC No.: 32759; *Sls. Mgr.:* Adam Kiecun

LXD, INC., 24500 Highpoint Road, Beachwood, OH 44122, Tel: 216-292-3300, TELEX: 98-5442 LXD BCWD; FSC No.: 66706; Empl.: 100; *Sls. Mgr.:* Gerald G. Gross; *Dist. Mgr.:* Gerald G. Gross

LYNN ELECTRONICS, 915 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-677-6700, 800-523-6075, TWX: 510-667-1988, FAX: 215-364-2944; FSC No.: 19151; Empl.: 125; *Sls. Mgr.:* H. T. Colas

LYN-TRON, INC., 3150 Damon Way, Burbank, CA 91505, Tel: 213-849-6211, 800-423-2734, TELEX: 662729, FAX: 818-423-2734; FSC No.: 05791; *Sls. Mgr.:* Alfred C. Redlitz; *Dist. Mgr.:* Alfred C. Redlitz

LYON METAL PRODUCTS, 47 Railroad Ave., Aurora, IL 60507, Tel: 312-892-8941, TWX: 910-232-3132; Empl.: 600; *Sls. Mgr.:* R. R. Bodlund

LYTRON INCORPORATED, Dragon Court, Woburn, MA 01801, Tel: 617-933-7300, TELEX: 951-934, FAX: 617-935-4529; Empl.: 75; *Sls. Mgr.:* Edwin Carell

LZR

FAX: 301-670-0436

LZR ELECTRONICS, INC., 8174 Beechcraft Ave., Gaithersburg, MD 20879, Tel: 301-921-9440; Empl.: 25; *Sls. Mgr.:* Ron Riser; *Dist. Mgr.:* Phil Aliff ..... **B•1756-1757; C•1430-1447, 1858-1861; D•1033-1035, 1834-1839**

Local Sales Offices & Reps

CT	Guilford, Data Mark, Inc.	203-453-0575
FL	Melbourne, Kennedy Assocs.	305-676-6875
IL	Arlington Hgts., Gaertner & Assocs.	312-593-2332
MA	Norwood, JMG, Inc.	617-762-5333
NJ	Clifton, ROI Sls.	201-340-1515
NY	Liverpool, M. M. Hare Co.	315-457-6859
OH	Lyndhurst, Technical Sls. Assocs.	216-461-0826
OK	Tulsa, Advance Tech. Sls.	918-664-0462
PA	West Chester, TCA Assocs.	215-692-6853
TX	Austin, Advance Tech. Sls.	512-346-5322
TX	Dallas, Advanced Tech. Sls.	214-340-1300
TX	Houston, Advance Tech. Sls.	713-440-3888
Can	Downsview, Ont., Telbit Elctrns., Inc.	416-633-5050

MABUCHI MOTOR AMERICA CORP., 475 Park Ave. South, New York, NY 10016, Tel: 212-686-3622, TELEX: 23-4374, TWX: MABU; Empl.: 6000 ..... **B•1231**

PANAFAX: 212-532-4263

MACCOR, INC., 3203 W. 41st St., Tulsa, OK 74107, Tel: 918-446-1874; FSC No.: 6625; *Sls. Mgr.:* Andrew D. MacKay

MACHINE COMPONENTS CORP., 70 Newtown Rd., Plainview, NY 11803, Tel: 516-694-7222, FAX: 516-694-7252; FSC No.: 15531; Empl.: 45; *Sls. Mgr.:* D. L. Dubov

MACOM, INC., 43 Second Ave., Bldg. 8, Burlington, MA 01803, Tel: 617-272-3000, TELEX: 94-9464, TWX: 710-332-6789

M/A-COM LASER DIODE, INC., See Laser Diode, Inc., Div. of Morgan Crucible

M/A COM LTD., Humphrey Rd., Dunstable, Bedfordshire, England LU5 4SX, England, Tel: 44(582)471200, TELEX: 82295; Empl.: 500; *Sls. Mgr.:* S. Shopcraft

M/A-COM MICROWAVE COMPONENTS, INC., South Avenue, Burlington, MA 01803, Tel: 617-272-3000, TELEX: 94-9464, TWX: 710-332-6789; Empl.: 500; *Sls. Mgr.:* Tom Rose

M/A-COM MICROWAVE POWER DVCS., 330 Oser Ave., Hauppauge, NY 11788, Tel: 516-231-1400, TWX: 510-227-6239; FSC No.: 34874; Empl.: 385

M/A-COM OMNI SPECTRA, INC., 21 Continental Blvd., Merrimack, NH 03054, Tel: 603-424-4111, TELEX: 6817280, TWX: 710-366-0674; FSC No.: 16179; Empl.: 750

M/A-COM OSW, INC., 2626 S. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, TELEX: 668-332, TWX: 910-950-1296; *Sls. Mgr.:* Bob Blaisdell

M/A-COM PHI, INC., M/A-COM, 1742 Crenshaw Blvd., Torrance, CA 90501, Tel: 213-320-6160, TWX: 910-349-6651; Empl.: 260; *Sls. Mgr.:* Fred McAdara

MAC PANEL

FAX: 919-887-1565

MAC PANEL CO., P. O. Box 7728, 551 W. Fairfield Rd., High Point, NC 27264, Tel: 919-884-8111, TWX: 510-926-1542; FSC No.: 16654; Empl.: 90; *Sls. Mgr.:* T. A. Hayworth ..... **C•1728-1729; D•1427**

Local Sales Offices & Reps

CA	Tustin	714-669-1400

MACROAMP INC., P.O. Box 1512, Ukiah, CA 95482, Tel: 707-462-2222, FAX: 707-462-4103; Empl.: 25; *Sls. Mgr.:* Terry L. Sholin; *Dist. Mgr.:* Terry L. Sholin

MACRODYNE, 1004 Princetown Rd., Schenectady, NY 12301, Tel: 518-356-3500; Empl.: 22; *Sls. Mgr.:* Robert L. Grinnell

MACROLINK, 1500 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-8800, TWX: 910-591-1671; Empl.: 25; *Sls. Mgr.:* Bill Goodale

MACRONETICS, See Veeco Instrs. Inc.

MAG-CON, 1626 Terrace Dr., St. Paul, MN 55113, Tel: 612-633-8820; Empl.: 40; *Sls. Mgr.:* M. Crellin

MAGNAPOWER, 70 Rainor Ave., Ronkonkoma, NY 11779, Tel: 516-737-3800, FAX: 516-737-3062; *Sls. Mgr.:* Hugh Whitsit

MAGNATROL VALVE CORP., 67 Fifth Ave., Hawthorne, NJ 07507, Tel: 201-427-4341, ESYLNK: 130357, FAX: 201-427-7611; *Sls. Mgr.:* R. Kretschmer

Magnecraft ELECTRIC COMPANY

FAX: 312-564-3027

MAGNECRAFT ELECTRIC CO., 1910 Techny Road, Northbrook, IL 60062-5376, Tel: 312-564-8800, TWX: 910-221-0122; FSC No.: 94696; Empl.: 700; *Sls. Mgr.:* Wiley Greenwood; *Dist. Mgr.:* Wiley Greenwood ..... **B•1535**

Local Sales Offices & Reps

AL	Huntsville, Electronic Mktg. Assocs.	205-536-3044
AZ	Scottsdale, Bill Earl Assocs., Inc.	602-994-3813
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Los Angeles, Universal Comp. Corp.	213-641-4255
CO	Parker, Technology Mktg. Assocs.	303-841-3435
CT	Bethel, Ray Perron & Co., Inc.	203-798-0261
CT	Farmington, R. Perron & Co.	203-673-4825
DC	Owings Mills, MD, Walker-Houck Assocs.	301-356-9500
FL	Orlando, Honeyco, Inc.	305-299-1222
GA	Atlanta, Electrn. Mktg. Assocs.	404-448-1215
IL	Northbrook, Magnecraft Elec. Co.	312-564-8800
IN	Ft. Wayne, Scott Elctrns., Inc.	219-489-5690
IN	Indianapolis, Scott Elctrns., Inc.	317-841-0010
IA	Cedar Rapids, R. W. Kunz & Assocs.	319-396-5386
KS	Olathe, R. W. Kunz & Assocs.	913-648-3535
MD	Owings Mills, Walker-Houck Assocs.	301-356-9500
MA	Needham, R. Perron & Co.	617-449-6162
MI	Royal Oak, Hilltronics	313-435-0920
MN	Edina, Hanna Lind Ltd.	612-925-5700
NH	Dover, R. Perron & Co.	603-742-2321
NH	Merrimack, Ray Perron & Co.	603-424-4423
NY	Islandia, Schmitt Ind. Mkt.	516-582-5888
NY	Pittford, Franklin Sls. Corp.	716-248-8251
NC	Raleigh, Electrn. Mktg. Assocs.	919-847-8800
OH	Cincinnati, Scott Elctrns., Inc.	513-791-2513
OH	Cleveland, Scott Elec., Inc.	216-473-5050
OH	Dayton, Scott Elec., Inc.	513-294-0539
OH	Reynoldsburg, Scott Elctrns., Inc.	614-863-1281
PA	Horsham, Jacobsen Assoc.	215-674-2937
SC	Greenville, Elctrn. Mktg. Assoc.	803-233-4637
TX	Dallas, Raven Sls. Inc.	214-490-8230
UT	Salt Lake City, Techn. Mktg. & Assocs.	801-483-1009
WI	Colgate, Rep 1 & Assocs.	414-628-4016

MAGNETEK CORP., 7315 Red Deer Dr., Boulder, CO 80301-4696, Tel: 303-442-6700, FAX: 303-447-1588; FSC No.: 58439; Empl.: 25; *Sls. Mgr.:* Carl A. Forsberg ..... **A•2250-2251**

Local Sales Offices & Reps

CA	San Diego, Mesa Sls. & Engrg.	619-278-8021
KS	Shawnee Mission, Robinson & Assoc.	913-262-1374

MagneTek Triad

FAX: 219-356-3148

MAGNETEK TRIAD, 1124 E. Franklin St., Huntington, IN 46750, Tel: 219-356-6500; Empl.: 850; *Dist. Mgr.:* Pete Amick, Prod. Mgr. ..... **A•2252-2261**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-994-3813
CA	Los Altos, Recht Assocs.	415-964-6321
CA	Upland, Tracy Elctrns. Sls.	714-985-0423
CO	Denver, Lindberg Co.	303-758-9033
FL	Maitland, Hutto-Hawkins Assocs.	305-831-2474
GA	Norcross, Glen White Assocs.	404-441-1447
HI	Honolulu, Hawaii Elctrn. Svc.	808-845-8207
IL	Wilmette, J. Wasserman Assocs.	312-256-3566
KS	Overland Pk., Electri-Rep	913-649-2168
LA	Little Rock, J. Y. Schoonmaker	501-375-2168
MA	Westboro, Bay Colony	617-870-1930
MI	Southfield, Rathsburg Assocs., Inc.	313-559-9700
MN	Minneapolis, Bicon Sls.	612-936-2322
MO	St. Louis, Electri-Rep	314-993-4421
PA	Narberth, Bresson Assocs.	215-664-6460
NY	Islandia, Schmitt Indl. Mktg.	516-582-5888
NY	Rochester, Apex Assocs.	716-254-6050
OH	Cincinnati, F.E. Kahsar Sls.	513-922-3133
TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
WA	Redmond, Earl & Brown Co.	206-885-5064
Can	Inwood, N.Y., Minthorne Int'l.	516-239-0767

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
AZ	Phoenix, Dalis Elctrn. Supp.	602-275-2885
AR	Little Rock, Carlton Bates Co.	501-562-9100
CA	Milpitas, Zack Elctrns.	408-942-5432
CA	Riverside, Electronic Supp.	714-683-7300
CA	Sunnyvale, Abacus Elctrns.	408-732-2000
CO	Denver, Newark Elctrns.	303-757-3351
FL	Ft. Lauderdale, Peerless Radio Corp. of Fla.	305-973-4141
GA	Atlanta, Ack Radio Supp.	404-351-6340
IL	Chicago, Bell Inds.	312-982-9210
IL	Chicago, Newark Elctrns.	312-638-4411
IN	Indianapolis, Graham Elctrns.	317-634-8202
IA	Cedar Rapids, Deeco, Inc.	319-365-7551
KY	Louisville, P. I. Burks Co.	502-589-3960
LA	New Orleans, William B. Allen Co.	504-525-8222
MD	Rockville, Capitol Radio Whls.	301-881-2270
MA	Hingham, Sager Elec.	617-749-6700
MA	Needham, Cronin Elctrns.	617-449-5000
MI	Grand Rapids, S-F Elctrns.	616-459-0216
MI	Livonia, R. S. Elctrns.	313-525-1155
MN	St. Paul, Gopher Elctrns.	612-483-4450
MO	St. Louis, Olive Indl. Elctrn.	314-426-4500
NE	Lincoln, Scott Elctrn. Supp. Corp.	402-466-8221
NH	Hudson, C & H Elctrns.	603-882-1133
NJ	Camden, General Radio Supp.	215-922-7037

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NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Simcona	716-328-3230
NY	Rome, Rome Elctrns.	315-337-5400
NC	Greensboro, Hammond Elctrns.	919-275-6391
OH	Cleveland, Pioneer Std. Elctrns.	216-587-3600
OH	Dayton, Pioneer/Dayton	513-236-9900
OK	Oklahoma City, Radio Supp.	405-232-6127
OR	Portland, United Radio Supp.	503-233-5346
PA	Philadelphia, Almo Elctrns.	215-698-4000
SC	Greenville, Hammond Elctrns.	803-233-4121
TN	Memphis, Bluff City Elctrns.	901-345-9500
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Altair Co.	713-462-3029
UT	Salt Lake City, Standard Supply	801-486-3371
WA	Seattle, Almac	206-643-9992
WI	Milwaukee, Marsh Elctrns.	414-475-6000

MAGNETIC AUDIO/VIDEO PRODUCTS DIV., 3M Co., 3M Center, Bldg. 223-5 South, St. Paul, MN 55101, Tel: 612-733-1110, TWX: 910-563-3712; Empl.: 38,351

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Local Sales Offices & Reps

CA	Santa Clara, R-C Elctrns.	408-988-0701
WA	Bellevue, Advanced Power Comps.	206-747-9127
WA	Seattle, Advanced Power Comps.	206-527-7945

MAGNETIC COILS, INC., See MCI Transformer Corporation

MAGNETIC COMPONENT ENGINEERING, INC., 11379 Playa Street, Culver City, CA 90230, Tel: 213-398-4761; FSC No.: 52634; Empl.: 12; *Sls. Mgr.:* D. V. Cropsey

MAGNETIC DEVICES INC., 5575 Kearny Villa Rd., San Diego, CA 92123, Tel: 619-279-7054; FSC No.: 13786; *Sls. Mgr.:* Dave Loughlin

mi

FAX: 317-549-0502

MAGNETIC INSTRUMENTATION, 8350 E. 48TH ST., Indianapolis, IN 46226, Tel: 317-545-2102, TELEX: 27-2111; Empl.: 35 ..... **D•1289**

Local Sales Offices & Reps

EXP NY, Irvington, Inter Technical Export Corp. 914-591-8822

MAGNETICO INC., 182 Morris Ave., Holtsville, NY 11742, Tel: 516-654-1166, FAX: 516-758-7408; Empl.: 65 ..... **A•2262**

MAGNETICS, Spang & Co., Box 391, Butler, PA 16003-0391, Tel: 412-282-8282, TWX: 710-373-3821, FAX: 412-282-6955; Empl.: 650; *Sls. Mgr.:* J. F. Huth

MAGNETIC SHIELD CORPORATION, Perfection Mica Co., 750 North Thomas Dr., Bensenville, IL 60106, Tel: 312-766-7800, TWX: 910-256-4815; FSC No.: 06682; Empl.: 43 ..... **C•1751-1753**

Local Sales Offices & Reps

CA	Woodland Hills, Cal-Ward Sls. Co.	213-883-2202
FL	Orlando, Ludlum Assoc. Co.	305-894-7761
MD	Baltimore, Bernard White & Co.	301-484-5400
MA	Framingham, Harvard Technlg.	617-899-4568
MI	Farmington, Amtech Reps.	313-474-8300
MN	Minneapolis, Josco-Meluis & Assocs.	612-861-3343
NM	Albuquerque, IMEC	505-883-9010
NJ	Morristown, Kenneth L. Love Assocs.	201-540-0204
NY	Syracuse, Canavan-Scanlon Assocs.	315-437-1271
OH	Cleveland, Bill Teplitz & Co.	216-439-3265
OR	Hillsboro, Temco Northwest	503-648-8171
PA	Media, W. Reeves Assocs.	215-566-6709
TX	Dallas, Talo Prods.	214-644-6010
WA	Kirkland, Temco Northwest	206-488-1254

MAGNETIC SPECS., 10 Albemarle Ave., Trenton, NJ 08638, Tel: 609-883-3150; Empl.: 23

MAGNETIC SYSTEMS, 1021 Pecten Ct., Milpitas, CA 95035, Tel: 408-263-6680; Empl.: 7

MAGNETIC SYSTEMS, 770 Linden Avenue, Rochester, NY 14625, Tel: 716-385-9010, FAX: 716-385-5625; Empl.: 50; *Sls. Mgr.:* Gordon H. McNeil

MAGNETIC TECHNOLOGY, 21001 Kittridge St., Canoga Pk., CA 91303, Tel: 818-887-7700, TWX: 910-494-1217; FSC No.: 15828; Empl.: 150; *Sls. Mgr.:* David Mighdoll

MAGNETOELASTIC DEVICES, Box 625, Pittsfield, MA 01201, Tel: 413-445-5608

MAGNET SALES & MFG. CO. INC., 11250 Playa Court, Culver City, CA 90230-6127, Tel: 213-391-7213, 800-421-6692; FSC No.: 95-2916141; Empl.: 35; *Sls. Mgr.:* Anil Nanji; *Dist. Mgr.:* Anil Nanji

MAGNOS, 6 Old School-House Rd., Harvard, MA 01451, Tel: 617-456-8880, TELEX: 951417 MAGN; Empl.: 5 ..... **D•1290**

MAGNUM MICROWAVE CORP., 4575 Cushing Pkwy., Fremont, CA 94538, Tel: 415-657-9898, TELEX: 4992965; FSC No.: 59277; Empl.: 50; *Sls. Mgr.:* Harry L. Fowler

Local Sales Offices & Reps

AZ	Phoenix, Odyssey 1	602-246-8846
CA	Mtn. View, Pacific Tech. Mktg.	415-969-3010
CA	Signal Hill, Thorson Co.	213-595-0361
FL	Clearwater, Beacon Instrmn.	813-796-2378
GA	Atlanta, Beacon Instrmn.	404-256-9646
IL	Palatine, R-Tek	312-991-4404
IN	Ft. Wayne, R-Tek	219-432-8783
MD	Marriottsville, Neal Deoul Assocs.	301-795-5775
MA	Chelmsford, Matrix Sls. Inc.	617-459-4000
MO	Leasburg, EIR Co.	314-895-4100
NY	Clark Mills, KLM Garner, Inc.	315-853-6126
NY	New Rochelle, Robert Diamond, Inc.	914-632-2828
TX	Garland, Carey, McMahill Assocs.	214-681-1414

MAGNUM OPUS CUSTOM ELCTRN. ENGRG., 284 Kennedy St., Iselin, NJ 08830, Tel: 201-283-4925; *Sls. Mgr.:* R. Galanty ..... **D•1113**

MAG-TEK, 20725 S. Annalee Ave., Carson, CA 90746, Tel: 213-631-8602, TWX: 510-600-0621 MAG TEK CRSN, FAX: 213-631-3956; *Dist. Mgr.:* Shelley Schira

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MAIDA DEVELOPMENT CO., 20 Libby St., Hampton, VA 23663, Tel: 804-723-0785, TELEX: 82-3443; Empl.: 299; *Sls. Mgr.:* Edward T. Maida, Frank Thompson ..... **A•1103-1107, 1954-1955**

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CA	Redwood City, Hickey Indl. Sls.	415-368-3849
CA	Tarzana, High Voltage Sls.	818-881-9194
FL	Vero Bch., John M. Hansen Assocs.	305-562-2328
IL	Arlington Hgts., Russell Elctrns. Sls.	312-394-5560
NH	Milford, D. A. Crowley & Assocs.	603-673-7050
SC	Mauldin, Carl Hart	803-288-2323
VA	Danville, F.B.D. Sls.	804-791-1499
WA	Snohomish, L.D. Elctrns.	206-568-0511
Can	Ontario, D. J. Hyslop & Co.	416-648-0061

MALCO, DIV. OF MICRODOT, INC., See Microdot, Interconnect Sys. Div.

MALCO SYSTEMS, THORN EMI Malco, Inc., 74 Gwynns Mill Court, Owings Mills, MD 21117, Tel: 301-363-1600, TELEX: TRT14005, ESYLNK: 62933125, FAX: 301-363-4336; *Sls. Mgr.:* William Newill

MALLORY BATTERY, See Duracell Intl.

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MALLORY CAPACITOR CO., Emhart Elctrl./Elctrn. Grp., 3029 E. Washington St., Dept. EM, P.O. Box 1284, Indianapolis, IN 46201, Tel: 317-636-5353, TELEX: 687-6027, TWX: 687-6015; FSC No.: 317-261-1581; Empl.: 450; *Sls. Mgr.:* Tom Pilcher, Mktg. Mgr.; *Dist. Mgr.:* Tom Green, Dir. of Fld. Sls. ..... **A•1108-1111; D•1036-1037**

Local Sales Offices & Reps

AL	Huntsville, Jack Harvey & Assocs., Inc.	205-536-4414
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FL	Clearwater, Semtronic Assocs., Inc.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs., Inc.	305-731-2484,305-944-0149
GA	Norcross, Jack Harvey & Assocs., Inc.	404-449-4643
IL	Elk Grove VL, Mallory Capacitor Co.	312-364-5750
IN	Indianapolis, D-M Assocs.	317-842-4424

MD Lisbon, S. K. Macdonald, Inc. 301-982-1088, 301-442-1590
MA Needham Hgts., The Newscott Co., Inc. 617-444-1923
MN Minneapolis, Technical Comps. Grp. ... 612-536-9512, 612-536-9659
MO St. Louis, KKB & Co. 314-647-2400
NM Albuquerque, Summit Sls. 505-345-5003
NY Fairport, LamTec Sls. Corp. 716-377-1210
NY Manlius, LamTec Sls. Corp. 315-637-3738
NY N. Bellmore, Aurora Mktg., Inc. 516-221-0764
NC Raleigh, Mallory Capacitor Co. 919-872-0711
OH Beachwood, Elctrn. Salesmasters, Inc. 216-831-9555
PA Pittsburgh, S. K. Macdonald, Inc. 412-366-0861
PA Willow Grove, S. K. Macdonald, Inc. ... 215-659-4414
TX Hurst, Pro-Comp Sls. Co. 817-589-0336
TX Richardson, Pro-Comp Sls. Co. 214-669-1500
WA Redmond, Quadra Sls. Corp. 206-883-3550, 503-635-3545
Can Pickering, Ont., A. C. Simmonds & Sons 416-839-8041

MALLORY COMPONENTS DIVISION, Emhart Elec./Elctrn. Grp., 222 Dixon Rd, Weston, Ont., Canada M9P 3S5, Tel: 416-244-4239, TELEX: 064-74132; FSC No.: 37942;76055; *Sls. Mgr.:* Peter Balodis; *Dist. Mgr.:* Russ Jones ..... **A•1113, 2077**

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MI Grand Rapids, DEM Elctrn. Sls. 616-361-5414
MI Warren, Dem Elctrn. Sls. 313-575-9444
MN St. Paul, Johnson Co. 612-641-1878
NJ Burlington, VDE Elctrns. Sls. 609-387-9331
NY Rochester, Dasson 716-338-1699
PA Doylestown, Monteiro Assocs. 215-345-5855
TX Ft. Worth, El-Tec Sls. 817-268-2896

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FAX: 317-634-4214

MALLORY TIMERS, Emhart Elec./Elctrn. Grp., 3029 E. Washington St., Indianapolis, IN 46201, Tel: 317-636-5353; Empl.: 2,000; *Sls. Mgr.:* Lewis Jones ..... **A•1113, 2077; B•1536**

MANAGE, INC., Fibre Optics Elctrns. Sys. Grp., P.O. Box 175, 40 Nichols Rd., Chicopee, MA 01014, Tel: 413-592-9123, FAX: 413-594-4891; Empl.: 33; *Sls. Mgr.:* David Menard

MANGER ELECTRIC COMPANY, INC., W. Henry St., Stamford, CT 06902, Tel: 203-348-7761, FAX: 203-324-5447; FSC No.: 20262; Empl.: 100; *Sls. Mgr.:* J. V. Judge

MANHATTAN ELECTRIC CABLE, 225 Passaic St., Passaic, NJ 07055, Tel: 201-779-8900, TELEX: 137-387; Empl.: 125; *Sls. Mgr.:* Ed Harvey; *Dist. Mgr.:* Allan Marconi

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IL Chicago, Bensdorf & Johnson 800-942-1147
MA Boston, Manhattan Elec. Cable Corp. 800-255-1429
NJ Bridgeton, Manhattan Elec. Cable Corp. 800-225-2293,800-257-7071
NJ Harrison, Manhattan Elec. Cable Corp. 201-484-9111,800-826-5171
OH Cleveland, Dynamic Elec. Sls. 216-362-7900
TX Houston, Manhattan Elec. Cable Corp. 800-231-3868,800-392-4948
TX Irving, Huemmer-O.K. Inc. 800-442-7733

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CA Burlingame, TRAC Sls. 415-692-5255
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MI Highland, Nova Elec. Sls. Inc. 313-887-0064
MN Brooklyn Pk., North Central Sls. 800-328-8322
MS Brandon, Service Elec. Sls. 601-992-9122
MO St. Louis, Jones Elec. Entprs. 314-428-5665

MANN, HENRY, INC., 3983 Mann Road, Huntingdon Valley, PA 19006, Tel: 215-355-7200, TELEX: 6851160, FAX: 215-355-5134; Empl.: 52; *Sls. Mgr.:* Dan Martin; *Dist. Mgr.:* Mickey Hoffer

MANTEX CORP., 1800 Metamora Rd., P.O. Box 15E, Oxford, MI 48051, Tel: 313-628-8200, FAX: 313-628-1520; Empl.: 100; *Sls. Mgr.:* John R. Santiago

MANUFACTURERS COMPONENT, INC., 2260 W. 77 St., Hialeah, FL 33016, Tel: 305-556-4481, 800-367-0377, TELEX: 514181, FAX: 305-823-8934; Empl.: 5; *Sls. Mgr.:* Jackie Barker

MARATHON FLITE-TRONICS COMPANY, A Marathon Power Technologies Co., 2525 N. Naomi St., Burbank, CA 91504, Tel: 818-841-3210, TELEX: 69-1487; Empl.: 65

MARATHON POWER TECHNOLOGIES, P.O. Box 8233, Waco, TX 76714-8233, Tel: 817-776-0650, TWX: 910-894-5203 MARATHON WAC

MARATHON SPECIAL PRODS., 13300 Van Camp Rd., Bowling Green, OH 43402, Tel: 419-352-8441, TWX: 810-499-2988, FAX: 419-352-0875; Empl.: 150; *Sls. Mgr.:* J. Campisi

MAR-CHAR CORPORATION, ATR Electronics, Inc., 167 East Fifth Street, Montello, WI 53949, Tel: 608-297-2106; Empl.: 10; *Sls. Mgr.:* Charles G. Nutter

MARCON AMERICA CORP., 310 Era Drive, Northbrook, IL 60062, Tel: 312-564-2820, FAX: 312-564-1150; Empl.: 11; *Sls. Mgr.:* Tony Olita; *Dist. Mgr.:* Helen A. Stubbs

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AL Huntsville, Beacon Elctrns. Assocs. ... 205-881-5031
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GA Atlanta, Beacon Electrns. Assocs. 404-256-9640
IL Chicago, K.W. Meyers 312-882-4808
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MD Burtonsville, Eastern Instrmn. 301-792-7039
MA Chelmsford, ICS Assocs. 617-256-3350
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NJ Elmwood Park, L & M Assocs. 201-797-0441
NM Albuquerque, Scientific Dvcs. 505-883-3668
NY New York City, L & M Assocs. 212-243-6155
NY Whitney Point, Tae-Rep 607-692-3705
NC Raleigh, Beacon Electrns. Assoc. 919-787-0330
OH Chesterland, EQS Systems 216-729-2222
PA Andalusia, L & M 215-245-6658
TX Dallas, EES 214-644-8881
MD Burtonsville, Eastern Instrmn. 301-384-8500
WA Marysville, The Western Rep 206-653-6031

MAREL INSTR. CO., 907 South East 13th Pl., Cape Coral, FL 33990, Tel: 813-574-8788; Empl.: 14; *Sls. Mgr.:* T. Swift

MARINE ELECTRIC RPD, INC., See CML Macarr Div. Marine Electric RPD, Inc.

WILD OATS

MARKAT DIV., Wild Oats Corp., 902 Charles St., N. Myrtle Bch., SC 29582, Tel: 803-448-0083; Empl.: 216; *Sls. Mgr.:* K. L. Campbell; *Dist. Mgr.:* W. B. Heather

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AZ Scottsdale, Southworth Sls. 602-945-3464
IN Carmel, Hoosier Sls. 317-844-4535
NY Plainview, Indl. Controls, Inc. 516-349-0231
OH Centerville, Grimm & Co. 513-433-1717

Markel
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FAX: 215-270-3138

MARKEL CORP., P.O. Box 752, Norristown, PA 19404, Tel: 215-272-8960, TWX: 510-660-0929; FSC No.: 03890; Empl.: 228; *Dist. Mgr.:* L. J. Clemente ..... **C•1715**

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AR Hot Springs, MYA, Inc. 501-262-1365
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CA Santa Clara, Penmark Sls. 408-980-1303
CO Arvada, Arrowhead Sls. 303-423-5556
CT Hamden, Datcom 203-288-7005
FL Deerfield Bch., Jack Krutek & Assoc. .. 305-427-4202
IL Schiller Pk., Wm. R. Bolles 312-678-7888
IN Indianapolis, D. M. Assocs. 317-842-4424
KS Lenexa, Midtec 913-541-0505
MD Glen Burnie, F. Lott 301-744-4611
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MI Farmington, L. George & Assoc. 313-474-1505
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MO Florissant, O C B Sls. 314-837-3361
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OH Chagrin Falls, Electrolock 216-543-5125
OR Portland, James J. Backer 503-297-8744
PA Flourtown, C. Newson 215-248-3377
SC Greenville, Electrolock Inc. 803-297-9830
TN Murfreesboro, Alpha Mktg. 615-896-6102
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UT Salt Lake City, Arrowhead Sls. 801-261-1661
WA Seattle, James J. Backer 206-285-1300
WI Mequon, Wm. R. Bolles 414-241-3320
EXP Blue Bell, PA, Markel Corp., Exp. Dept. 215-825-5710
Can Mississauga, Ont., Marflex-Barrett Ltd. 416-828-0220

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CA Anaheim, Indl. Dielectrics West 714-776-5215
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CT Hartford, Atlantic Switch 203-527-7705
FL Davie, Arco Distrs. 305-473-2550
FL Lakeland, Switch Controls 800-282-7619
GA Atlanta, Accu-Tech Cable 404-455-6422
IL W. Chicago, J. J. Glenn 312-293-7800
IN Indianapolis, Marian Rubber 317-638-6525
KS Wichita, Midwest Aircraft Supp. 316-267-3318
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MI St. Clair Shores, Spemco 313-771-2700
MO St. Charles, Lectronix 314-946-6424
NJ Mt. Laurel, Jersey Switch 609-778-8190
NY Rochester, Simcona Elctrns. 716-328-3230
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SC Greenville, Electrolock, Inc. 803-297-9830
TN Chattanooga, Technitronics 615-875-5449
VA Norfolk, Read Plastics 804-627-0111
VA Roanoke, Control Distr. Inc. 703-989-7925
Can Mississauga, Ont., Marflex-Barrett Ltd. 416-828-0220

MARKEM CORP., 150 Congress St., Keene, NH 03431, Tel: 603-352-1130, TWX: 710-366-1800; FSC No.: 38360; Empl.: 1200; *Sls. Mgr.:* Carl Panza

MARKENRICH CORP., 1812 Flower Avenue, Duarte, CA 91010, Tel: 818-359-9190, TELEX: 298727, FAX: 818-359-9190; Empl.: 8

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FL Sarasota, Camtech, Inc. 813-923-2804
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IA Coralville, EPA, Inc. 319-354-5344
MA Reading, Lincoln Tech. Sls. 617-944-9594
MN Edina, EPA, Inc. 612-835-9022
NJ Vincentown, Imagineering Assocs. 609-268-8859
NY Syracuse, I. A. Hotze Assocs. 315-479-6641

MARK EYELET INC., AMP, Inc., 63 Wakelee Rd., Wolcott, CT 06716, Tel: 203-756-8847, TELEX: 69-6191, FAX: 203-755-9410; Empl.: 70

MARKTECH INTERNATIONAL CORP., 120 Broadway, Menands, NY 12204, Tel: 518-436-5865, FAX: 518-436-5877; Empl.: 14; *Dist. Mgr.:* Jayne Kenderian Moore ..... **B•1138-1139, 1275-1277**

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CA Maywood, Management Mktg. & Sls. .. 213-560-5584
CA San Jose, Eclipse Sls. 408-435-3800
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CT Cheshire, Connecticut Applied Technlg. 203-272-6564
FL Tampa, SRT Mktg. 813-884-4805
GA Roswell, Action Comp. Sls. 404-998-7227
IL Elk Grove Vl, Tristar Grp., Inc. 312-593-0200
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MA Westborough, Bay Colony Reps., Inc. 617-870-1930
MI Plymouth, Leading Edge Sls. Corp. 313-420-3344
MN Golden Valley, Ambassador Indl. Mkg. 612-542-8437
MO Ferguson, Technical Sls. Assocs. 314-521-2044
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OH maple Hgts., Versatron 216-581-0090
OK Tulsa, Mil-Co Mktg. 918-664-2277
TX Richardson, Mil-Co Mktg. 214-783-2785
UT Salt Lake City, Western Region Mktg. 801-486-1646
WA Bellevue, Caruso & Co. 206-455-8811
WI Brookfield, Tristar Group 414-782-2670
Can Markham, Avotronics 416-475-2024

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CA Irvine, J & J Elctrns. 714-455-0104
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CO Westminster, Future Elctrns. 303-650-0123
CT Danbury, Pilgrim Elctrns. 203-792-7274
FL Miami, All American Semiconductor ... 305-621-8282
GA Norcross, Future Elctrns. 404-441-7676
IL Schaumberg, Future Elctrns. 312-882-1255
MD Columbia, Future Elctrns. 301-995-1222
MA Westborough, Future Elctrns. 617-366-2400
MI Livonia, Future Elctrns. 313-261-5270
MN Bloomington, All American Semiconductor 612-884-2220
NJ Fairfield, Future Elctrns. 201-227-4246
NJ Moorestown, Marlac Elctrns. 609-234-4200
NY Ronkonkoma, All American Semiconductor 516-981-3935
NY Ronkonkoma, Baldwin Comps. 516-588-5700
NY Syracuse, Future Elctrns. 315-451-2371
NC Raleigh, Resco 919-781-5700
OR Beaverton, Norvac Elctrns. 503-644-1025
PA McKean, Advacom 814-476-7774
TX Dallas, Omni Pro Elctrns. 214-233-9368
UT Salt Lake City, Future Elctrns. 801-972-8489
WA Redmond, Future Elctrns. 206-881-8199
Can Pointe Claire, Future Elctrns. 514-694-7710

MarLee Switch Company

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MARQUARDT SWITCHES INC., Route 20 East, P.O. Box 465, Cazenovia, NY 13035, Tel: 315-655-8050, TELEX: 703-287-UD; *Sls. Mgr.:* J. J. Kennedy, VP Sls.; *Dist. Mgr.:* R. A. Philipchik, VP Mktg. ..... **B•1759-1763**

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FL Tampa, Stand. Mktg., Inc. 813-933-5833
FL W. Melbourne, Stand. Mktg., Inc. 305-725-7073
GA Atlanta, Electrosales Co. 404-394-1122
IL Franklin Pk., Stetco 312-671-4208
IN Fort Wayne, J & B Engrg. 219-483-2813
IN Indianapolis, J & B Engrg. Sls. Co. 317-842-3008
IA Marion, M-S-B Assocs., Inc. 319-377-6261
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MN St. Paul, Arkco Sls Co. 612-777-7454
MO St. Louis, M-S-B Assocs. 314-946-5577
NH Nashua, Bell Controls, Inc. 603-882-6984
NJ Medford, Champion Elctrn. Sls. Co., Inc. 609-983-0932/0807/9007
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NC New Bern, R-A Sls. 919-244-2672
OH Cleveland, J & B Engrg. Sls. Co. 216-642-9312
OR Portland, Elctrn. Comp. Sls. 503-245-2342
PA Phoenixville, Gil-Tronics, Inc. 215-933-8525
SC Easley, R-A Sls. Co. 803-859-1859
SC Pickens, S.T./Woolard Co., Inc. 803-878-3830
TX Dallas, Rem-Air Comps. 214-234-1069
TX Houston, Dunkel Assocs. 713-729-1670
CO Lakewood, Cristee Meade Co. 303-232-0287
VA Lynchburg, S.T./Woolard Co., Inc. 804-528-5421
WA Kirkland, Manon Engrg. 206-827-7449
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
WI Milwaukee, Key Entpr., Inc. 414-453-9462

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AZ Tempe, Control Design Supp., Inc. 602-829-7981
CA Covina, Selecta Switch 213-967-4123, 800-722-6445
CA Gardena, California Switch & Signal ... 213-770-2330, 800-225-7924
CA San Jose, Sierra West 408-435-7477
CA Van Nuys, Pacific Switch Controls, Inc. 213-873-4802
CO Aurora, Jet Elctrns. 303-364-1000
CO Denver, CSID, Inc. 303-292-9594
CT Hartford, Atlantic Switch Controls, Inc. 203-527-7705
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FL Ft. Lauderdale, N.R.C. Elctrns., Inc. 305-772-4500
FL Lakeland, Switch Controls 813-644-7564
FL Longwood, Stetco, Inc. 305-767-0209
FL West Palm Beach, Nurmi Electrns. 305-686-8553
GA Atlanta, KSM Elctrns., Inc. 404-458-2013
GA Stone Mtn., Control Design Supp. 404-979-3500
IL Addison, L Comp 312-628-1400
IL Bensenville, Voyager Elctrns. 312-860-1300
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NY Hempstead, Elctrn. Equip. Co. 516-538-5510
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OK Oklahoma City, Radio, Inc. 405-789-0741
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TN Chattanooga, Stetco, Inc. 615-899-6831
TN Chattanooga, Techni Tronics Inc. 615-842-0514
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TX Dallas, Texas Switch, Inc. 214-357-1768
TX Houston, Wofford Elctrns., Inc. 713-847-3583
TX Stafford, Southwest Electrns. 713-240-4000
WA Redmond, Murphy Electrns. 206-881-1234
Can Concord, Ont., Votron Elctrns., Ltd. 416-669-9870, 619-661-5190

MARSH PRODUCTS, INC., 336 McKee St., Batavia, IL 60510, Tel: 312-879-8008; *Sls. Mgr.:* Mel Ruskin

MARTEL ELECTRONICS, 27 Roulston Rd., P.O. Box 897, Windham, NH 03087, Tel: 603-893-0886, 800-821-0023, TELEX: 95-1232; *Sls. Mgr.:* David DeVries

MARTIN SOUND PRODS., 28 Alpha Park, Cleveland, OH 44143-2297, Tel: 216-442-2286; Empl.: 2; *Sls. Mgr.:* DeWayne (Bud) Martin; *Dist. Mgr.:* DeWayne (Bud) Martin

MARWAY PRODUCTS INC.

FAX: 714-973-2931

MARWAY PRODS. INC., 311 N. Clara St., Santa Ana, CA 92703, Tel: 714-973-1800; FSC No.: 800-833-3334...722332; Empl.: 12; *Sls. Mgr.:* Tom Goreth ..... **D•2132-2133**

Local Sales Offices & Reps

CT N. Haven, Marway Prods. 203-281-7270
MA Wellesley, Marway Prods. 617-235-7884
NH Londonderry, Power Conversion Sys. 603-434-2371
PA Bridgeport, Penncat Corp. 215-272-0505
TX Richardson, Interactive Comp. Sls. 214-669-2277

MASTECH, INC., Lorlin Test Systems, Precision Rd., Danbury, CT 06810, Tel: 203-744-0096, TELEX: 7104565030; Empl.: 48; *Sls. Mgr.:* Ruthe Ploskunyak

MASTER APPLIANCE CORP., 2420 18th St., Box 68, Racine, WI 53403, Tel: 414-633-7791, TELEX: 269-505; FSC No.: 83284; Empl.: 50; *Sls. Mgr.:* G. E. Mertins; *Dist. Mgr.:* G. E. Mertins

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MATH ASSOCS., 2200 Shames Dr., Westbury, NY 11590, Tel: 516-334-6800, TELEX: 238-667 RAPID UR, FAX: 516-334-6473; Empl.: 45; *Sls. Mgr.:* Ed Henckel

MATHEMATICAL SYSTEMS DESIGN, INC., 11835 W. Olympic Blvd., Suite 745, Los Angeles, CA 90064, Tel: 213-479-7180; *Sls. Mgr.:* Lorr Kramer

MATRA DESIGN SEMICONDUCTOR, 2840 San Tomas Expressway, Santa Clara, CA 95051, Tel: 408-986-9000, TELEX: 299-656; *Sls. Mgr.:* David T. Fletcher

MATRIX CORP., 2260 Distributors Dr., Indianapolis, IN 46241, Tel: 317-248-2036; Empl.: 10 ..... **D•1172**

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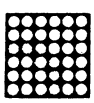
MATRIX CORP., 1203 New Hope Rd., Raleigh, NC 27610, Tel: 919-833-2000, FAX: 919-833-2550; Empl.: 50; *Sls. Mgr.:* Ray Alderman



FAX: 818-992-8521

MATRIX SYSTEMS CORP., 5177 N. Douglas Fir Rd., Calabasas, CA 91302, Tel: 818-992-6776, TWX: 910-494-4975; FSC No.: 33281; Empl.: 60; *Sls. Mgr.:* Randy Sue Rabideau ..... **A•1773**

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AL	Huntsville, Reynolds Assoc., Inc.	305-259-7000
AZ	Scottsdale, Faser Techn. Sls.	602-948-4404
CA	Milpitas, IFM Inc.	408-945-5920
CA	N. Hollywood, Crown Elctrns.	213-877-3550
CO	Broomfield, Scientific Dvcs.	303-469-5145
CT	Marion, Polytek Assocs.	203-621-4542
FL	Melbourne, Reynolds Assoc., Inc.	305-259-7000
FL	Tampa/Ft. Lauderdale, Reynolds Assocs.	305-259-7000
GA	Atlanta, Reynolds Assoc., Inc.	305-259-7000
IL	Arlington Hgts., Comtel Midwest	312-392-4040
IN	Indianapolis, Comtel Midwest	317-253-1681
KS	Shawnee Mission, Comtel Midwest	913-268-0762
MA	Ashland, PolyTek Assocs.	617-881-4741
MA	Falmouth Heights, RJC Assocs.	617-540-8832
MI	Southfield, Comtel-Instr.	313-358-2505
MN	Wayzata, Comtel Midwest	612-476-1551
MO	St. Louis, Comtel Midwest	314-991-5363
NY	Mamaroneck, Bassin Tech. Sls. Co.	914-698-9358
NC	Raleigh, Reynolds Assoc.	305-259-7000
OH	Cleveland, Comtel Instr.	216-442-8080
OH	Dayton, Comtel Instr.	513-426-5310
OH	Hillard, Comtel Instr.	614-876-8305
OR	Portland, Topp Engrg. Sls.	503-244-7265
PA	Pittsburgh, Comtel Instr.	412-922-5720
TX	Carrollton, Seaton Corp.	214-380-0414
VA	Fairfax, Schibley Assocs.	703-591-3008
WA	Bellevue, Topp Engrg. Sls.	206-747-5400
WI	New Berlin, Comtel Midwest	414-544-6042

MATROX ELECTRONIC SYSTEMS, 1055 St. Regis Blvd., Dorval, QU, Canada H9P 2T4, Tel: 514-685-2630, TELEX: 05-822798, FAX: 514-685-2853; Empl.: 462; *Sls. Mgr.:* Ed Dwyer

FAX: 714-960-6492

MATSUO ELECTRONICS, 2134 Main Street, Suite 200, Huntington Beach, CA 92648, Tel: 714-969-2491, TWX: 910-596-1828; FSC No.: (714) 960-6492; Empl.: 854; *Sls. Mgr.:* Emmalee Shaw ..... **A•1114-1119**

Local Sales Offices & Reps

AZ	Phoenix, Howe & Howe	602-264-7971
CA	Mission Viejo, Angle Assocs.	714-582-8858
CA	Redwood City, James S. Heaton Co.	415-367-7158
FL	Plantation, Gallagher	305-473-2101
GA	Norcross, Macro Mktg.	404-662-5580
ID	Boise, N. R. Schultz	208-377-8686
IL	Des Plaines, ESCO Assocs.	312-298-5310
IN	Indianapolis, Needler	317-255-8056
MD	Randallstown, Chesapeake Mktg.	301-922-5997
MA	Randolph, Hatch Assocs.	617-963-3306
MI	Grand Rapids, DEM Elctrn. Sls.	616-364-4024
MI	St. Clair Shores, DEM Elctrns.	313-777-1750
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Ft. Lee, Neptune Elctrns.	201-461-2789
NM	Albuquerque, FP Sls.	505-345-5553
NY	Clifton Pk., Net Sls.	518-371-6864
NY	Fairport, Net Sls.	716-223-1030
NY	Webster, Net Sls.	716-467-4538
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
OK	Tulsa, Beacon	918-252-5181
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Pittsburgh, Dolfuss-Root & Co.	412-221-4420
TX	Dallas, Beacon	214-437-1505
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Scarborough, Ont., Bach-Simpson	416-288-9932

Local Distributors

AZ	Phoenix, Camco	602-269-6241
CA	Garden Grove, Capacitor Supp.	714-638-0510
CA	Garden Grove, National Chip	714-892-7749
CA	San Diego, Projections	619-453-7900
CA	San Jose, Passive Technlg.	408-435-5566
CA	San Jose, Projections	408-748-9280
CA	Santa Maria, Garrett Instrs.	805-922-0594
CA	Tustin, Projection Unltd.	714-544-2700
CA	W. Covina, CSI	818-960-4761
MD	Gaithersburg, Axis Elctrns.	301-840-9640
MA	Billerica, A. W. Mayer Co.	617-229-2255
MA	Billerica, Baldwin Comps.	617-667-6710
MA	Wilmington, Aved Elctrns.	617-657-6310
NJ	Fairfield, C.H.P.S., Inc.	201-882-0997
NJ	Kenilworth, Ventronics	201-272-9262
NY	Ronkonkoma, Baldwin Comps.	516-588-5700
NY	Ronkonkoma, Prime Comps.	516-737-1730
PA	Norristown, Century Elctrn. Comps.	215-631-5400
TX	Dallas, C & W	817-831-0395
Can	Montreal, Que., Prelco	514-389-8051
Can	N. London, CM Peterson	519-434-3204
Can	Willowdale, Ont., Electro Sonic	416-494-1666

MATTHEY ELECTRONICS, Television Equipment Associates, Box 393, South Salem, NY 10590, Tel: 914-763-8893, TELEX: 493-0698, FAX: 914-763-9158; *Sls. Mgr.:* Bill Pegler ..... **A•1670**

MAUELL CORP., 31 Old Cabin Hollow Rd., P.O. Box 339, Dillsburg, PA 17019, Tel: 717-432-8686, TELEX: 466003, FAX: 717-437-8688; Empl.: 25; *Sls. Mgr.:* Haubold Vom Berg; *Dist. Mgr.:* Haubold Vom Berg

MAUREY INSTRUMENT CORP., 4555 W. 60th St., Chicago, IL 60629, Tel: 312-581-4555, FAX: 312-581-2576; FSC No.: 03942; Empl.: 50; *Sls. Mgr.:* E. Maurey; *Dist. Mgr.:* Louis Derdzinski ..... **A•2078-2085**

Local Sales Offices & Reps

CT	Killingworth, Gallagher Assocs.	203-663-2338
FL	Largo, L-P Sls.	813-531-2664
FL	Orlando, ASI	305-851-7929
FL	Plantation, Innovative Mktg.	305-583-8895
MA	Framingham, Gallagher Assocs.	617-626-2346
MI	Grand Blanc, Inter-Comm	313-595-0665
TX	Dallas, THT Sls. Co.	214-783-1501
WA	Vancouver, Sls. & Engrg. Assoc.	206-573-5161

Local Distributors

CA	Garden Grove, Allied Elctrns.	714-554-0731
CA	Santa Clara, Allied Elctrns.	408-727-1690
CO	Wheatridge, Allied Elctrns.	303-425-7144
CT	Ridgefield, PIC	203-451-1533
FL	Margate, Allied Elctrns.	305-973-3070
MA	Wilmington, Allied Elctrns.	617-942-0150
MI	Battle Creek, Great Lakes Elctrns.	616-963-6282
MI	Grand Rapids, SF Elctrn. Supp.	616-459-0216
MI	Westland, Allied Elctrns.	313-595-6565
MO	St. Louis, Allied Elctrns.	314-878-1229
NY	Mineola, Allied Elctrns.	516-248-2360
NC	Raleigh, Allied Elctrns.	919-821-0415
OH	Akron, Stotts-Friedman	216-253-7000
OH	Cincinnati, Stotts-Friedman	513-574-7701
OH	Dayton, Stotts-Friedman	513-298-5555
OH	Willoughby, Allied Elctrns.	216-951-0908
OK	Tulsa, Allied Elctrns.	918-663-7630
PA	Bala Cynwyd, Allied Elctrns.	215-267-6940
TN	Knoxville, Shields Elctrns.	615-588-2421
TX	Ft. Worth, Allied Elctrns.	817-336-5401
TX	Houston, Allied Elctrns.	713-932-7321
VA	Alexandria, Allied Elctrns.	703-836-5002
WA	Seattle, Allied Elctrns.	206-767-5772

MAURY MICROWAVE CORP., 8610 Helms Ave., Cucamonga, CA 91730, Tel: 714-987-4715, TWX: 910-581-3408, FAX: 714-987-1112; FSC No.: 13047; Empl.: 104; *Sls. Mgr.:* M. A. Maury, Jr.

MAXI-SWITCH CO., Sub. of EECO, 9697 East River Rd., Minneapolis, MN 55433, Tel: 612-755-7660, TWX: 910-576-2690; Empl.: 160; *Dist. Mgr.:* E. C. Helme, Jr.

MAXON PRECISION MOTORS, INC., 838 Mitten Rd., Burlingame, CA 94010, Tel: 415-697-9614, FAX: 415-697-2887; *Sls. Mgr.:* Edward Graham ..... **B•1232**

MAXTOR CORPORATION, 211 River Oaks Pkwy., San Jose, CA 95134, Tel: 408-432-1700, TELEX: 171074, FAX: 408-434-6469; Empl.: 2500; *Sls. Mgr.:* Jim Daly; *Dist. Mgr.:* Bob Cascarino

MAXWELL ELECTRONICS, P.O. Box 12033, Research Triangle Park, NC 27609, Tel: 919-846-1633; Empl.: 8; *Sls. Mgr.:* Joe Harrison

MAXWELL LABORATORIES, 8888 Balboa Avenue, San Diego, CA 92123-1506, Tel: 619-279-5100, TWX: 910-335-2063, FAX: 619-277-6754; Empl.: 600; *Sls. Mgr.:* William Fox (Prods.)

MCCOY ELECTRONICS CO., A Sub. of Oak Industries, 100 Watts St., P.O. Box B, Mt. Holly Springs, PA 17065, Tel: 717-486-3411, TWX: 510-650-3548, FAX: 717-486-5920; FSC No.: 00136; Empl.: 545 ..... **A•1406-1417**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Sls., Inc.	205-533-1735
AZ	Tempe, Sunwest Mktg.	602-893-7677
CA	Mountain View, Thorson West	415-964-9300
CA	Sherman Oaks, Wes-K	818-990-1302
CO	Littleton, Advanced Tech Mktg.	303-798-4200
CT	Hartford, JMG, Inc.	203-278-9709
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Norcross, Elctrn. Sls., Inc.	404-448-6554
IL	Glendale Heights, Beta Technlg. Sls., Inc.	312-790-9886
IN	Kokomo, Schillinger Assoc., Inc.	317-452-4057
IA	Cedar Rapids, Lorenz Sls.	319-377-4666
MD	Baltimore, Burgin-Kreh Assocs.	301-265-8500
MA	Norwood, JMG, Inc.	617-762-5333
MI	Southfield, Fred H. Gehrke & Assoc.	313-559-5363
MN	Minneapolis, Dunlop Consits.	612-544-1070
KS	Merriam, Lorenz	913-384-6556
MO	University City, Lorenz Sls., Inc.	314-997-4558
NJ	Medford Lake, Gray Assocs.	609-953-9109
NM	Albuquerque, Sunwest Mktg.	505-898-6471
NY	Binghamton, Foster & Wager, Inc.	607-724-7093
NY	New Rochelle, Ascor Elctrns.	914-235-8838
NY	Rochester, Foster & Wager, Inc.	716-385-7744
NC	Cary, Elctrn. Sls., Inc.	919-467-8486
OH	Cincinnati, Stegman Blaine Mktg.	513-729-1969
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
TX	Austin, R. F. Kimball Co.	512-443-5284
TX	Richardson, R. F. Kimball Co.	214-231-3447
VA	Lynchburg, Burgin-Kreh Assocs.	804-239-2626
WI	Milwaukee, Beta Technlg. Sls., Inc.	414-543-6609
EXP	NJ, Oradell, Sylvan Ginsbury Ltd.	201-261-3200

MCE SEMICONDUCTOR, INC., 1111 Fairfield Dr., West Palm Beach, FL 33407, Tel: 305-845-2837, TELEX: 441405 (MCE UI), FAX: 305-863-8275; Empl.: 54; *Sls. Mgr.:* Richard H. McCargar

MCFADDEN SYSTEMS, INC., 11835 E. Smith Ave., Santa Fe Springs, CA 90670, Tel: 213-948-4414, TELEX: 677161, FAX: 213-948-1291; FSC No.: 25750; Empl.: 49

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FAX: 516-586-5120

MCG ELCTRNS., 12 Burt Dr., Deer Park, NY 11729, Tel: 516-586-5125, TELEX: 645518; FSC No.: 29779; Empl.: 45; *Sls. Mgr.:* Carolyn Schultz ..... **B•1296, 1327-1341**

MCGILL MANUFACTURING CO., INC., 909 North Lafayette Street, Valparaiso, IN 46383, Tel: 219-465-2200, FAX: 219-465-2456; Empl.: 295; *Sls. Mgr.:* Tom Morris/Dave Rickards ..... **B•1764-1766**

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PA Levittown, Paul McCool 215-359-3708
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TX Dallas, Raley Sls. Co. 214-368-1683
UT Salt Lake City, J. R. Christensen & Assocs. 801-972-3970
UT Salt Lake City, Sage Sls. 801-467-5451
VA Ashland, Hutcheson & Co. 804-288-3236
WI Kenosha, Wally Coats 312-299-2354
Can Mississauga, Ont., Marr Elec. Ltd. 416-277-9481

MCGUIRK ELECTRONICS CO. INC., 212 So. Main St, P. O. Box 853, Middleton, MA 01949, Tel: 617-933-3500; FSC No.: 55902; Empl.: 10; *Sls. Mgr.:* L. McCarthy

MCI TRANSFORMER CORPORATION, 411 Manhattan Ave., Babylon, NY 11704, Tel: 516-587-0510, FAX: 516-587-0624; Empl.: 50; *Sls. Mgr.:* Timothy J. Williams ..... **A•2264-2279**

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MA Orange, MCI Transformers 617-544-8806,

MCKENZIE TECHNOLOGY, 44370 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-651-2700; Empl.: 85; *Sls. Mgr.:* Nancy Vinerts

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CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CA Westminster, West Elctrn. Sls., Inc. 213-493-5569
FL Orlando, Cartwright & Bean, Inc. 407-423-1756
GA Norcross, Cartwright & Bean, Inc. 404-368-0160
IL Elk Grove Vl, Parcom, Inc. 312-228-6360
MA Plainville, Entpr. Technlg. 617-695-4700
NY Hauppauge, Sticom 516-724-6814
NC Raleigh, Cartwright & Bean, Inc. 919-876-4130
OH Englewood, Allen Nace Co., Inc. 513-836-8931
PA Paktron Tech. Sls. 814-643-0240
TX Dallas, JYS Co., Inc. 214-349-1650
Can Ontario, White Radio Ltd. 416-632-6894

MCL, INC., 501 S. Woodcreek Rd., Bolingbrook, IL 60439-4999, Tel: 312-759-9500, TELEX: 910-683-1899; FSC No.: 16469; Empl.: 110; *Sls. Mgr.:* Frank Morgan ..... **D•1424-1425**

Local Sales Offices & Reps

GA Riverdale, MCL, Inc./Bob Lundy 404-996-6632

MCLEAN ENGINEERING, Zero Corp., 70 Washington Rd., Princeton Junction, NJ 08550, Tel: 609-799-0100, TWX: 510-685-2543; FSC No.: 03522; Empl.: 118; *Sls. Mgr.:* Craig A. Reed; *Dist. Mgr.:* Craig A. Reed ..... **C•1682-1683**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 818-246-8263
CA San Mateo, Halbar Assocs. 415-349-4700
CO Englewood, Component Tech. 303-758-5750
CT Canton, Motoreps, Inc. 800-243-1978
FL Ft. Lauderdale, R.I. Smith Assocs. 305-772-5100
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Elmhurst, Scott Assocs. 312-279-5681
LA Gretna, M. F. Sls. 504-361-4343
MD Hunt Valley, Marktron 301-628-1111
MD Rockville, Marktron 301-251-8990
MA Needham, Motoreps 617-449-3252
NY Rochester, Talty Assocs. 716-323-1210
MI Spring Lake, Jim Finnegan 616-846-4980
MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO Grandview, Harris-Hanson 816-763-6200
MO St. Louis, Harris-Hanson 314-432-3611
NJ Springfield, Sylvester Assocs. 201-376-3324
NM Albuquerque, Fry-Gates 505-262-1525
OH Cleveland, Jim Finnegan 216-398-6300
OH Dayton, Jim Finnegan 513-890-8322
OR Beaverton, Halbar Assocs. 503-226-0451
PA Huntingdon Valley, Inacker Sls. 215-947-5660
PA Pittsburgh, Jim Finnegan 412-823-5400
TX Dallas, Milco Mktg. 214-783-2716
TX Houston, Milco Mktg. 214-783-2716
WA Redmond, Halbar Assocs. 206-882-0990
Can Guelph, Ont., Hammond Mfg. Co. 519-822-2960

Local Distributors

FL Ft. Lauderdale, Component Distrs. 305-971-4950
GA Norcross, Component Distrs. 404-441-3320
MI Ann Arbor, Wedemeyer Elctrn. Supp. Co. 313-665-8611
NC Raleigh, Component Distrs. 919-834-9465
TX Dallas, Component Distrs. 214-644-0373
Can Guelph, Ontario, Hammond Mfg. Co. .. 519-822-2960

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FAX: 612-569-0533

MCLEAN MIDWEST, Sub. of Zero Corporation, 4000 83rd Ave. N., Brooklyn Pk., MN 55443, Tel: 612-561-9400, TELEX: 29-0883, TWX: 910-576-2951; *Sls. Mgr.:* J. Buyse ..... **C•1684-1685**

Local Sales Offices & Reps

AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Cupertino, T. Louis Snitzer Co. 408-257-8333
CA Del Mar, T. Louis Snitzer Co. 619-226-0305
CA Los Angeles, T. Louis Snitzer Co. 213-836-6170
CO Boulder, Comp. Prod. Sls. Co. 303-530-2800
GA Norcross, Hollingsworth & Still, Inc. 1-800-241-5712
IL Elmhurst, Scott Assocs., Inc. 312-279-5681
MD Rockville, Marktron, Inc. 301-251-8990
MA Chelmsford, John E. Boeing Co. 617-256-5800
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MN Minneapolis, Scott Elctrn. Sls. 612-929-2985
MO St. Louis, Harris-Hanson Co. 314-432-3611
NJ Franklin Lakes, Hansen & Hughes Co. 201-848-8900
NM Albuquerque, Fry-Gates, Inc. 505-262-1525
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WA Vashon, RTS Inc. 206-285-1363

3M ELECTRONIC PRODUCTS DIVISION, Board Mount Interconnect Components, 9450 Pineneedle Dr., P.O. Box 270, Mentor, OH 44060, Tel: 216-354-3544, TWX: 810-421-0017, FAX: 216-354-7827; FSC No.: 30146; *Sls. Mgr.:* Robert J. Whitely, Sls. Supv. ..... **C•1302-1303**

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CA So. San Francisco 415-571-6700
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HI Honolulu 808-422-2721
IL Chicago 312-496-6500
MA Boston 617-449-0300
MI Detroit 313-827-2450
MN Eagan 612-736-9378
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NC High Point 919-889-7181
OH Cincinnati 513-482-3100
OH Cleveland 216-362-1700
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TX Dallas 214-324-8100
WA Seattle 206-244-7200

Local Distributors

AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Arizona Comps. Co. 602-269-5655
AZ Tempe, Acacia/VWR Elctrns. 602-882-9054
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Garden Grove, Richey/Impact Elctrns. 714-895-0060,800-227-0060
CA Irvine, Acacia/VWR Elctrns. 714-660-0834, 213-971-2428
CA La Crescenta, Mulvin & Co. 213-245-1081
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
CA San Diego, Richey/Impact Elctrns., Inc. 619-271-4511
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Richey/Impact Elctrns., Inc. 408-432-7100
CA San Jose, Shelley/Ragon 408-942-9111
CA Santa Clara, DC Elctrn. Supp. 408-980-1199
CA Sun Valley, Richey/Impact Elctrns., Inc. 818-768-3800,213-875-2862
CA Sunnyvale, Acacia/VWR Elctrns. 408-745-7200
CA Tustin, DC Elctrns. 714-259-9066
CO Englewood, Shelley/Ragon 303-762-0670
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CT East Haven, JV Elctrns. 203-469-2321
CT Yalesville, Schaal Assocs./Deanco ... 203-269-3779
FL Clearwater, Tech. Sls. 813-539-7429
FL Ft. Lauderdale, Powell Elctrns. 305-979-5000
FL Winter Park, Deanco 305-671-5100
GA Marietta, Deanco 404-429-0126
IL Chicago, NEP Elctrns., Inc. 312-625-8400
IL Mt. Prospect, Magnuson Elctrns. 312-956-0700
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MD Columbia, Aztech Elctrns. 301-621-8890
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MN St. Paul, Shelley/Ragon Elctrns. 612-642-2828
MO Independence, Shelley/Ragon Elctrns. 816-254-3410
MO St. Charles, Lectronix ... 314-946-6424,800-325-3348
MO St. Louis, El/Mech 314-527-4830
NJ Clifton, J-Mar Elctrns. 201-772-6400
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Fairfield, Deanco 201-575-7960
NJ Union, Meridian Supp. 201-687-6220
NM Albuquerque, Alliance Elctrns. 505-292-3360
NY Farmingdale, Addem Distrs. 516-752-9303
NY Hauppauge, Schaal Assocs./Deanco 516-434-7100
NY Ithaca, Deanco 607-257-4444
NY Ronkonkoma, Zenith Wire & Cable ... 516-585-1444
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195, 800-432-0549
NC Raleigh, Deanco, Inc. 919-851-2065
NC Raleigh, Meridian Supp. Co. 919-872-1565
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Dayton, Elctrns. Mktg. Corp. 513-439-4711
OH Highland Heights, Elctrns. Mktg. Corp. 216-442-3441
OK Tulsa, Norvell Elctrns. 918-663-1247
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Shelley/Ragon 503-641-1691
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
PA Malvern, Transtek Inds. 215-296-4400
PA Philadelphia, Powell Elctrns. 215-365-1900
TN Nashville, Graham Elctrns. 615-367-4400
TX Allen, Prime Distrbg. 214-231-0170
TX Austin, Kent Elctrns. 512-834-1900
TX Austin, Norvell Elctrns. 512-837-5555
TX Dallas, Kent Elctrns. 214-669-2600
TX Dallas, Norvell Elctrns. 214-233-0020
TX El Paso, ERA Elctrns. 915-855-3600
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Norvell Elctrns. 713-777-1666
TX Plano, Tactic Elctrns. 214-422-0777
WA Lynwood, Blair Hirsh Co. 206-774-8151
WA Redmond, Shelley/Ragon Elctrns. 206-883-2220
WA Seattle, Carlyle Inc. 206-251-0700
VA Virginia Bch., Deanco, Inc. 804-499-3322
WI Milwaukee, Elctrn. Expeditors, Inc. 414-228-8100
Can London, Ont., 3M 519-451-2500

FAX: 512-834-6631

3M CO., STATIC CONTROL SYS. DIV., P.O. Box 2963, Bldg. 501-1W-30, Austin, TX 78769-2963, Tel: 800-328-1368; Empl.: 300; *Sls. Mgr.:* Mike Martin ..... **D•2168-2169**

Local Sales Offices & Reps

CA Los Angeles 800-221-1045
CA San Francisco 800-634-8909
CO Denver 800-328-0201
DC Washington 404-447-7170
GA Atlanta 800-241-3670
IL Chicago 800-942-3961
IN Indianapolis 800-323-4087
MA Boston 617-449-0300
MI Detroit 800-323-4087
MN St. Paul 800-392-0312
MO St. Louis 800-527-1648
NJ Newark 201-575-2155
NY Syracuse 212-285-9600
NC High Point 919-889-7181
OH Cincinnati 800-523-4441
OH Cleveland 800-523-4441
OH Columbus 800-523-4441
PA Philadelphia 800-524-0168
TN Memphis 800-241-3669
TX Dallas 800-442-8046
TX Houston 800-442-8046
WA Seattle 206-244-7200,206-241-2250
WI Milwaukee 800-323-4087

3M CO., TECH CERAMIC RESOURCES, 3M Center 225-4W, St. Paul, MN. 55101, Tel: 617-736-0601, TELEX: 29-7023, TWX: 910-563-3712; Empl.: 83000

MDF PRODUCTS INC., 7 Johnson Dr., Danbury, CT 06811, Tel: 203-743-3579, TELEX: 499-8051, FAX: 203-744-2704; FSC No.: 60628 ..... **D•1297**

MEA DIV., See Mechanized Elctrn. Assembly Div., Universal Instrs. Corp.

MEASUREMENTS GROUP, INC., Box 27777, Raleigh, NC 27611, Tel: 919-365-3800, TELEX: 62919594, FAX: 919-365-3945

FAX: 203-853-6244

MEASUREMENT SYSTEMS, INC., 121 Water St., Norwalk, CT 06854, Tel: 203-838-5561, TELEX: 6813573, TWX: 710-468-2185; Empl.: 97; *Sls. Mgr.:* Tom Brass, Gen. Sls. Mgr. ..... **D•1135**

Local Sales Offices & Reps

IA Cedar Rapids, S & O Sls. 319-393-1845
MD Columbia, Robert Elctrn. Sls. 301-995-1900
MA Hudson, Data Rep. 617-481-0333
OH Medina, J. C. Hofstetter Co. 216-241-4880
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Richmond, Robert Elctrn. Sls. 804-276-3979

MEC A/S, Industriparken 23, Ballerup, Denmark DK-2750, Tel: 011-452-973366, TELEX: 9125649, TWX: 2381-125649, FAX: 011-452 681514; Empl.: 40

Local Sales Offices & Reps

AZ Phoenix, Shackelford Assocs., Inc. 602-893-8893
CA Curpertino, F & F Assocs. 408-446-2349
CO Littleton, Electronic Comps. Sys. 303-797-0894
CT Cheshire, A & M Elctrns. Inc. 203-271-3065
FL Altamonte Springs, APM Assocs. 305-869-6831
FL Ft. Lauderdale, APM Assocs. 305-565-0056
FL Tampa, APM Assocs. 813-886-2457
GA Atlanta, Electro Sls., Inc. 404-394-1122
IL Downers Grove, Richmar Elctrns. 312-968-0118
IN Indianapolis, Richmar Elctrns. 317-846-6383
IA Cedar Rapids, Palatine Engrg. & Sls. .. 319-365-8071
LA Covington, Cartwright & Bean Inc. 504-892-1780
MA Needham, A & M Elctrns. Inc. 617-444-8170
MI Bloomfield, Obe, Inc. 313-332-4900
MI Grand Rapids, Obe, Inc. 616-458-8998
MI St. Joseph, Obe, Inc. 616-429-7788
MN Minneapolis, Milt Westlund Assocs. ... 612-886-5002
MS Jackson, Cartwright & Bean Inc. 601-981-1170
MO Blue Springs, Palatine Engrg. & Sls. ... 816-229-4007
MO Hazelwood, Palatine Engrg. & Sls. 314-839-0800
NJ Ho-Ho-Kus, D. J. Fisher Co., Inc. 201-652-0090
NM Albuquerque, Syntech 505-266-7951
NC Raleigh, Cartwright & Bean Inc. 919-876-4130
OH Cleveland, Components, Inc. 216-243-9200
OR Portland, A/D Elctrns. 503-641-6469
PA Westchester, TCA Assocs., Inc. 215-692-6853
TN Memphis, Cartwright & Bean Inc. 901-276-4442
TX Dallas, Rem Air Components Corp. ... 214-234-1069
UT Salt Lake City, Quality Comps. Sls. 801-268-8000
VA Forest, Beacon North 804-239-8486
VA Sterling, Beacon North 703-478-2480
WA Kirkland, A/D Elctrns. 206-821-3205
WI Butler, Richmar Elctrns. 414-781-1730

Local Distributors

CA Hollywood, Yale Elec. 213-465-3186
CA Manhattan Beach, Prime Electro 213-379-3642
CA Mountain View, Target Elctrns. 415-962-8649
CA Orange County, Pacific Switch Controls 714-953-1254
CA San Carlos, Logan Elctrns. 415-594-0700
CA San Diego, Pacific Switch Controls ... 619-264-6117
CA Santa Monica, Master Distrs. 213-452-1229
CA Van Nuys, Pacific Switch Controls 213-873-4802
CO Englewood, Industrial Supp. 303-694-9444
CT Hartford, Atlantic Switch Controls 203-527-7705
CT Shelton, Century Elec. 203-732-4257
FL Lakeland, Switch Controls, Inc. 813-644-7564
IL Carol Stream, Conectrix 312-653-1460
MD Beltsville, P.S.I. 301-937-4960
MD Columbia, D.K. Elctrns. 301-995-1950
MA Needham, 'You Do It' 617-449-1005
MN Minneapolis, Glen Mark 612-941-4825
NH Nashua, Atlantic Switch 603-880-1971
NJ Mt. Laurel, Jersey Switch 609-778-8190
OH Columbus, Ohio Switch 613-885-0391
OR Portland, Component Resources 503-641-8488
TX Dallas, TexaSwitch 214-357-1768
WA Seattle, Component Resources 206-454-8666
WA Seattle, Radar Elctrns. 507-747-3053
Can Toronto, Ont., Deskin Sls. 416-475-1412

MECHANICAL ENGRAVING, 4500 Bullard Ave, Bronx, NY 10470, Tel: 212-324-4455; FSC No.: 99040; Empl.: 35; *Sls. Mgr.:* Bernard W. Mandel

MECHANICAL ENTERPRISES, 461 Carlisle Dr., Herndon, VA 22070, Tel: 703-435-9496, TWX: 710-832-0942, FAX: 703-435-1837; Empl.: 25; *Sls. Mgr.:* R.H. Twyford ..... **B•1767, 1826-1827**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
CA Cupertino, West-Comp 408-245-3100
CA Irvine, Vale Electrn. Assocs. 714-551-4821, 619-693-0113
CT Bristol, Technlg. Prod. Grp. 203-793-9186
IL Arlington Heights, Coombs Assocs., Inc. 312-439-9810
MA Brookline, Technlg. Prods. 617-731-0858
MI Jackson, Norwood Scroggs Co. 517-750-1170
MS Jackson, Doby Assocs. 601-981-1138
NY Cooperstown, Fitzelle Assoc. 607-547-9333
NY LeRoy, Fitzelle Assocs. 716-494-1554
TN Memphis, Doby Assocs. 901-763-5730
TX Dallas, Stasco 214-239-4517
WI Milwaukee, Coombs Assocs., Inc. 414-351-6123

Local Distributors

CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
CA San Diego, Sigma Electrns. 619-565-2000
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
NY Yonkers, Kintronics, Inc. 914-968-7736, 800-431-1658
Can Burnaby, B.C., Rae Ind. Electrns.,LTD 604-291-8866

FAX: 517-782-2810

MECHANICAL PRODUCTS INC., 1824 River St. P. O. Box 729E, Jackson, MI 49204, Tel: 517-782-0391, TWX: 810-253-0827; *Sls. Mgr.:* Bob Vangermeersch ..... **B•1342**

Local Sales Offices & Reps

AL Huntsville, Electro-Mech 205-533-2100
AZ Tempe, Cantec Sls., Inc. 602-829-0191
CA Los Angeles, Universal Components Co. 213-641-4255
CA Sunnyvale, Pass Associates 408-735-9040
FL Orlando, OEM Mktg. 305-299-1000
GA Atlanta, Electro-Mech 404-447-6478
IL Barrington, Perhats Assocs. 312-381-6360
MD Pikesville, Muncy Sls. 301-484-6376
MN St. Paul, John J. Exon Co., Inc. 612-636-5533
NH Durham, C. H. Burnham Assocs. 603-868-2282
NJ West Caldwell, Grimm, Siegel Assocs., Inc. 201-575-9300
NY Pittsford, Noeth-Honsinger Assoc., Inc. 716-586-9002
NC Raleigh, Electro-Mech 919-851-8165
OH Dayton, Rockford Controls Ohio, Inc. .. 513-898-5452
OH Euclid, Rockford Controls Ohio, Inc. ... 216-725-3705,
OH Euclid, Rockford Controls Ohio, Inc. ... 216-731-5250
OK Tulsa, John B. Guenther, Inc. 918-660-5126
RI Johnston, C. H. Burnham Assocs. 401-231-7475
TN Jonesboro, Electro-Mech 615-753-2964
TX Austin, John B. Guenther, Inc. 512-472-3825
TX Dallas, John B. Guenther, Inc. 214-691-8500
Can Bells Corners, Nepean, Ont., Har Tech 613-726-9410
Can Downsview, Ont., Har Tech 416-665-7773
Can Pointe Claire, Que., Har Tech 514-694-6110

Local Distributors

CA Gardena, Cal Switch ... 213-770-2330/213-538-9830
CA Hawthorne, Electro-Sonics 213-970-0997
CA San Carlos, Campbell & George Co. .. 415-594-1994
CA So. San Francisco, Nasam, Inc. 415-872-1155
FL Ft. Lauderdale, Zelcon, Inc. 305-565-2555/6
IL Chicago, Nep Elctrns. 312-625-8400,
KS Edwards, Tennant Elctrns. 913-441-1801
KS Edwardsville, Tennant Elctrns. 913-441-1801
KS Wichita, Airtechnics 316-267-2849
MI Grand Rapids, S & F Elec. Supp. Co., Inc. 616-459-0216
MN Minneapolis, Berquist 612-835-2322
NJ Mount Laurel, Techtron Components Corp. 609-234-1940
NJ Oakland, Relay Specialties 201-337-1000
NY Hauppauge, Genelco 516-231-1144/800-645-9802
NY Plainview, Linrose Elctrns. 516-293-2520
NY Woodside, Switches Unlimited 800-221-0487
OH Euclid, Rockford Controls Ohio, Inc. ... 216-731-5250
TX Arlington, Bell Components Sls., Inc. .. 817-461-5303
TX Dallas, Associated Aircraft Supp., Inc. 214-331-4381
Can Montreal, Que., Ferro Technique Ltd. ..... TLX 05-824863
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can St. Laurent, Que., Tara Inds. Corp. 514-331-6550

MECHANIZED ELCTRN. ASSEMBLEY DIV., UNIVERSAL INSTRS. CORP., See Dover Electronics Manufacturing

MECHATRONICS/SAB INC., 2835 82nd Ave. S.E., P.O. Box 20, Mercer Island, WA 98040, Tel: 206-236-1000, TWX: 910-444-4126, FAX: 206-232-3734; Empl.: 40; *Sls. Mgr.:* David Ray ..... **C•1637**

Local Sales Offices & Reps

CA San Jose, SAB Mechatronics 408-370-7018
CA Westlake Vl, SAB Mechatronics 805-373-0631
GA Atlanta, SAB Mechatronics 404-928-7137
TX Dallas, SAB Mechatronics 817-488-6634
NH Exeter, SAB Mechatronics 603-772-4282

MEDA, INC., Macintyre Electronics Design Assocs., 11260 Roger Bacon Dr., Ste. 202, Reston, VA 22090, Tel: 703-471-1445, TELEX: 910-350-0132; Empl.: 8

MEDIA RECOVERY INC., Box 1407, Graham, TX 76046, Tel: 800-527-9497, 214-630-9625 (Texas), TELEX: 73-2561; Empl.: 130; *Sls. Mgr.:* J. Ricciardi

MEGATRAN ELECTRONIC POWER, Rising Sun Rd., Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645, FAX: 609-298-1982; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

MEISSNER INDUSTRIES, 551 Rte. 10, Dover, NJ 07801, Tel: 201-366-1700; Empl.: 10

MELCHER INC., 10 Cochituate St., Natick, MA 01760, Tel: 617-653-9979, TWX: 510-100-3630, FAX: 617-655-7984; *Sls. Mgr.:* Richard Sakakeeny

Local Sales Offices & Reps

AL Huntsville, Over & Over Inc. 205-837-7105
AZ Phoenix, Blackhart & Assocs. 602-893-3488
CA Santa Clara, Sourcetronics 408-988-8801
CO Englewood, Taylor Mktg. 303-850-0207
FL Altamonte Springs, Over & Over Inc. .. 305-332-1222
FL Tampa, Over & Over Inc. 813-626-9100
GA Norcross, Over & Over Inc. 404-449-6205
IL Arlington Hgts., Phoenix Elctrn. Sls. ... 312-394-4422
IA Des Moines, The Beams Co. 515-255-1148
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Whitinsville, Power Factor & Assocs. .. 617-234-6415
NJ Englewood, Technimat 201-569-4200
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-782-9111
PA Horsham, TMI 215-441-4300
TX Richardson, Jim D. Gray & Assocs., Inc. 214-699-9976
TX Richmond, Jim D. Gray & Assocs., Inc. 713-342-1710
UT Ogden, Taylor Mktg. 801-546-9570
WA Lynwood, Power Sources Unltd. 206-743-6641

FAX: 609-393-9461

MELCOR/MATERIALS ELCTRN. PRODS., 994 Spruce St., Trenton, NJ 08648, Tel: 609-393-4178, TELEX: 84-3314; FSC No.: 32333; Empl.: 150; *Sls. Mgr.:* M.A. Levine ..... **C•1686-1687**

Local Sales Offices & Reps

CO Fort Collins, Rep Sls., Inc./Andy Cornedi 303-226-1504
NY Rochester, R. G. Minges Agency 716-328-3410

MELFESS FIVE, INC., 12304 Santa Monica Blvd., No. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958; Empl.: 4; *Sls. Mgr.:* Michael S. Fisher

MELLES GRIOT, Optics, 1770 Kettering St., Irvine, CA 92714, Tel: 714-261-5600, TELEX: 678447; Empl.: 90; *Sls. Mgr.:* David W. Kuntz, Mktg. Mgr.

MEL-RAIN CONTROLS, 42974 M-43 Hwy., Paw Paw, MI 49079, Tel: 616-657-2527; FSC No.: 639; Empl.: 20; *Sls. Mgr.:* Howard F. Walter

MEL TEC, Div. Epsco, Inc., 411 Providence Hwy., Westwood, MA 02090, Tel: 617-329-1508, TELEX: 95-1110, TWX: 710-348-0484; Empl.: 180

MEMBRONICS DIVISION, Chicago Decal Company, 3310 North Elston Avenue, Chicago, IL 60618, Tel: 312-463-4007, FAX: 312-463-4065; *Sls. Mgr.:* Dick Gorney

FAX: 219-356-7376

MEMCOR-TRUOHM, INC., 1320 Flaxmill Rd., Huntington, IN 46750, Tel: 219-356-4300, TWX: 510-601-7258, ESYLNK: 62938315; FSC No.: 24681; Empl.: 250; *Sls. Mgr.:* Ray Vanderspool ..... **A•1956, 2086**

Local Sales Offices & Reps

AL Huntsville, Murcota 205-539-8476
CA Huntington Bch., Mil-Com Sls. 714-840-2424
CA Santa Clara, D.H. Ross 408-988-8111
FL Indialantic, Raycom 305-727-8860
GA Atlanta, Murcota 404-875-2525
IL Chicago, D. Dolin Sls. 312-286-6200
IN Ft. Wayne, Menze Sls. 219-747-5616
MI St. Clair Shores, J.M. Thorpe 313-779-6363
MO Blue Springs, Cairns Sls. Co. 816-229-1404
MO St. Charles, Hayes Elec. Sls. Co. 314-946-6677
NH Atkinson, Mark Rep Assoc. 603-382-9563
NJ Englewood Cliffs, Masin Esco 201-569-8868
NY Hauppauge, Masin Esco 516-273-3500
NY Marcellus, Mullahy Sls. Inc. 315-685-6280
NC Burlington, Murcota 919-585-1577
NC Winston-Salem, Murcota 919-723-1001
OH Cleveland, Glover Sls. 216-842-4520
PA Newtown Square, G.M. Conneen 215-353-2241
TX Dallas, SW Elctrn. Ind. 214-233-9816
TX Houston, SW Elctrn. Ind. 713-729-1670
WA Redmond, Barrett-Squibb 206-885-6991

MEMODYNE, 200 Reservoir St., Needham Hgts., MA 02194, Tel: 617-444-7000, TELEX: 92-2537, TWX: 510-600-8774, FAX: 617-449-7023; Empl.: 40; *Sls. Mgr.:* Leonard Sacon ..... **D•1096-1098**

Local Sales Offices & Reps

AZ Scottsdale, Williams Assocs. 602-947-4297
CA Carson, Amasco 213-516-8561
CO Commerce City, Williams Assocs. 303-289-5647
CT Portland, BBI Elctrns. 203-342-0648
FL Orlando, DAI Sls. 305-299-7754
IL Elmhurst, Scott Assocs. 312-279-5681
MA Holbrook, McLellan Assocs. 617-767-4771
MI Detroit, EQS Sys. 313-961-3042
MI Pontiac, EQS Sys., Inc. 313-338-2280
NM Albuquerque, Williams Assocs. 505-255-1638
OH Chesterland, EQS Sys. 216-729-2222
OH Columbus, EQS Sys. 614-228-3453
OH Dayton, EQS Sys., Inc. 513-236-7676
OH Huber Hgts., EQS Sys., Inc. 216-729-2222
OK Tulsa, J. Wisdom & Assocs., Inc. 918-663-4814
OR Lake Oswego, Syntek 503-636-6793
PA Sellersville, Penn-Tech Sls. 215-257-2756
UT Salt Lake City, Williams Assocs. 801-485-6511
WA Kirkland, Syntek 206-488-0394

MEMORY PROTECTION DEVICES, INC., See Bogen Communications, Inc.

FAX: 619-292-0774

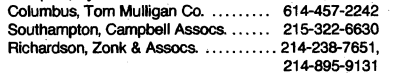
MEMORY X, 5205 Kearny Villa Way, No. 106, San Diego, CA 92123, Tel: 619-292-1151 ..... **A•1746**

FAX: 517-652-2659

MEMTRON TECHNOLOGIES, INC., 1400 Weiss St., Frankenmuth, MI 48734, Tel: 517-652-2656, 800-234-7525; FSC No.: 6 V 417; Empl.: 103; *Sls. Mgr.:* Daniel T. Ortner ..... **B•1828**

Local Sales Offices & Reps

AZ Mesa, Inmark 602-830-9104
AZ Mesa, R. F. Mayo & Assocs. 602-953-1295
CA Irvine, Cal-Rep 714-250-0567
CA Saratoga, Edward King & Assocs. 408-867-2111
CO Boulder, R. F. Mayo 303-442-2155
FL Maitland, EIR, Inc. 305-660-9600
GA Lawrenceville, Tek-Rep Mktg., Inc. 404-963-1600
IL Wheaton, Chadra-Schilke & Assocs., Inc. 312-653-8126
IN Indianapolis, EMCI, Inc. 317-253-1668
MA Framingham, Stone Comp. Sls. Corp. 617-875-3266
MI Detroit, Memtron Technlgs. 313-399-7078
MI Detroit, Memtron Technlgs., Inc. 313-545-8880
MO Saint Charles, Buckman & Assocs. 314-946-6201
NY Islip, ABS Technlgs., Inc. 516-277-7010
NY Liverpool, Syronics 315-451-0968
OH Columbus, Tom Mulligan Co. 614-457-2242
PA Southampton, Campbell Assocs. 215-322-6630
TX Richardson, Zonk & Assocs. 214-238-7651, 214-895-9131
VA Alexandria, Tech-Reps. Inc. 703-370-2600
WA Federal Way, K. R. Jensen Sls. 206-874-2772
Can Rexdale, Ont., Bestec Elctrns., Ltd. 416-674-1330



FAX: 407-881-3300

MEPCO/CENTRALAB CORP. HDQRTR., North American Philips Corporation, 2001 W. Blue Heron Blvd., Riviera Beach, FL 33404, Tel: 407-881-3200, TELEX: 136461, TWX: 810-848-0228 .. **A•1747, 1958, 1960, 2087; B•1014-1015, 1768-1770**

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
AZ Tempe, Mepco/Centralab 602-820-2225
CA Anaheim, Mepco/Centralab 714-441-0385
CA Harbor City, Refrigeration Comp. 213-325-3420
CA Mission Hills, Mepco/Centralab 818-891-6299
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CA Pleasanton, Mepco/Centralab 415-462-2833
CA San Diego, Mepco/Centralab 619-453-0332
CO Englewood, Mepco/Centralab 303-779-9696
FL Altamonte Springs, Mepco/Centralab 305-339-5073
FL Ft. Lauderdale, Mepco/Centralab 305-485-0115
GA Norcross, Over & Over, Inc. 404-449-6205
IL Bannockburn, GMR Sls., Inc. 312-295-8440
IL Des Plaines, Mepco/Centralab 312-827-4487
IN Ft. Wayne, Corrao Marsh, Inc. 219-482-2725
IN Greenfield, Carrao Marsh, Inc. 317-462-4446
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Lorenz Sls., Inc. 319-377-4666
KS Merriam, Lorenz Sls. 913-384-6556
MD Columbia, Delta III Assocs. 301-730-4700
MA Stoneham, Mepco/Centralab 617-438-6050
MI Farmington Hills, Mepco/Centralab ... 313-553-6010
MN Minneapolis, Electric Comps. Sls., Inc. 612-933-2594
MO University City, Lorenz Sls. 314-997-4558
NE Lincoln, Lorenz Sls. 402-475-4660
NJ Englewood Cliffs, Ed Glass Assocs. ... 201-592-0200
NJ Mendham, Mepco/Centralab 201-543-2556
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Skaneateles, Empire Tech. Assocs., Inc. 315-685-5703
NC Charlotte, Over & Over, Inc. 704-542-9111
NC Raleigh, Over & Over 919-782-9111
OH Dayton, Mepco/Centralab 513-436-0066
OH Wickliffe, Mepco/Centralab 216-731-7721
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Narberth, Bresson Assocs. 215-664-6460
TX Austin, Mepco/Centralab 512-331-8828
TX Richardson, Mepco/Centralab 214-231-8274
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WA Spokane, Eclipse Mktg. Grp. 509-922-3972
WI Milwaukee, Mepco/Centralab 414-228-4244
PR Hato Rey, M. Anderson Co. 809-751-2026
Can Montreal, PQ, Philips Elctrns. 514-342-9180
Can N. Vancouver, BC, Arwin Tech. Sls. ... 604-980-4557
Can Ottawa, Ont., Philips Elctrns. 613-722-1093
Can Pickering, Ont., Alltemp Prod. Co. 416-831-3311
Can Pickering, Ont., McHugh Elctrns. 416-831-4770
Can Scarborough, Ont., Philips Elctrns. 416-292-5161
Can Scarborough, Ont., Philips Elctrns. 416-292-8200
Can Vancouver, B.C., Philips Elctrns. 604-435-4411

MEPCO/CENTRALAB, North American Philips Corporation, 4561 Colorado Blvd., Los Angeles, CA 90039, Tel: 818-240-4880, TWX: 910-497-2282; *Sls. Mgr.:* G. Ollen ..... **A•1123, 1957-1958; B•1014-1015**

MEPCO/CENTRALAB, North American Philips Corporation, 5900 Australian Avenue, W. Palm Bch., FL 33407, Tel: 305-842-3201, TELEX: 820677, TWX: 510-952-7631, FAX: 305-863-1811 ..... **A•1120**

MEPCO/CENTRALAB, INC., A North American Philips Co., 2566 Northwestern Ave., West Lafayette, IN 47906, Tel: 317-463-2536, TELEX: 810-342-1889; *Sls. Mgr.:* Pierre Lavignette ..... **A•1959; B•1014-1015**

MEPCO/CENTRALAB, North American Philips Corporation, Hwy. 20 W., P.O. Box 858, Ft. Dodge, IA 50501, Tel: 515-573-1300, FAX: 515-573-1342; FSC No.: 71590 ..... **A•2087; B•1768-1770**

MEPCO/CENTRALAB, North American Philips Corporation, 6071 St. Andrews Rd., Columbia, SC 29212-3198, Tel: 803-772-2500, TELEX: 805024, FAX: 803-772-2445 ..... **A•1121-1122**

DC Aluminum Electrolytic Capacitors (Computer Grade, Radial) Military, Industrial & Consumer AC Motor Starts, Film Capacitors (Film/Foil, Metallized) Tantalum Capacitors (Foil) Film Trimmer Capacitors

MEPCO/CENTRALAB, North American Philips Corporation, 7158 Merchant Ave., El Paso, TX 79915, Tel: 915-779-3961, TWX: 910-964-1311, FAX: 915-775-0149; *Sls. Mgr.:* R. Michaels ..... **A•1124**

MEPCO/CENTRALAB, North American Philips Corporation, Airport Road, P.O. Box 760, Mineral Wells, TX 76067, Tel: 817-325-7871, TELEX: G.P.R.-881857/S.P.R.-820545, FAX: 817-325-7876 ..... **A•1957, 1960; B•1014-1015**

MEPCO/CENTRALAB, INC., A North American Philips Co., 2601 S. Moorland Rd., New Berlin, WI 53131, Tel: 414-785-6506, TWX: 910-262-3032 ..... **A•1747**

MEPCOPAL

FAX: 619-481-1123

MEPCOPAL COMPANY, 11468 Sorrento Valley Rd., San Diego, CA 92121, Tel: 619-453-0332, TELEX: 62547100, TWX: 910-337-1120; Empl.: 150 ..... **A•2088-2089; B•1771**

Potentiometers (Cermet, Carbon) Industrial & Military

Local Sales Offices & Reps

AL Huntsville, Over & Over, Inc. 205-837-7105
AZ Tempe, Mepco/Centralab 602-820-2225
CA Anaheim, Mepco/Centralab 714-441-0385
CA Mission Hills, Mepco/Centralab 818-891-6299
CA Mtn. View, Brooks Tech. Grp. 415-960-3880
CO Englewood, Mepco/Centralab 303-779-9696
FL Altamonte Springs, Mepco/Centralab 305-339-5073
GA Norcross, Over & Over Inc. 404-449-6205
IL Bannockburn, Heth Inc. 312-295-8440
IL Des Plaines, Mepco/Centralab 312-827-4487
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
IA Cedar Rapids, Lorenz Sls. Inc. 319-377-4666
KS Merrian, Lorenz Sls. Inc. 913-384-6574
MD Columbia, Delta III Assocs. 301-730-4700
MA Stoneham, Mepco/Centralab 617-438-6050
MI Farmington, Mepco/Centralab 617-438-6050
MI Lathrup Vl, Mepco/Centralab 313-559-9095
MN Minneapolis, Elec. Comps. 612-933-2594
MO University City, Lorenz Sls. Inc. 314-997-4558
NE Lincoln, Lorenz Sls. Inc. 402-475-4660
NJ Mendham, Mepco/Centralab 201-543-2556
NY Binghamton, Empire Tech. Assocs. ... 607-772-0651
NY Rochester, Empire Tech. Assocs. 716-425-3775
NY Skaneateles, Empire Tech. Assocs. ... 607-772-0651
NC Charlotte, Over & Over Inc. 704-542-9111
OH Dayton, Mepco/Centralab 513-436-0066
OH Mentor, Mepco/Centralab 216-354-4350
OR Beaverton, Eclipse Mktg. Grp. 503-642-1661
PA Narberth, Bresson Assocs. 215-664-6460
TX Austin, Mepco/Centralab 512-331-8828
TX Richardson, Mepco/Centralab 214-231-8274
WA Redmond, Eclipse Mktg. Grp. 206-885-6991
WI Milwaukee, Mepco/Centralab 414-228-4245
Can Ottawa, Philips Elctrns. 613-237-3134

mercer ELECTRONICS

FAX: 312-697-2272

MERCER ELECTRONICS, Simpson Electric Co., 853 Dundee Ave., Elgin, IL 60120, Tel: 312-697-2260, TELEX: 72-2416; *Sls. Mgr.:* Mike Scala; *Dist. Mgr.:* George Oskandy ..... **D•1298-1299**

Local Sales Offices & Reps

AL Huntsville, Cartwright & Bean, Inc. of GA 205-830-1540
AZ Tempe, Trembly Assocs. 602-967-2058
CA Burlingame, William J. Purdy Co. 415-347-7701
CA Downey, Simpson Elec. Co. 213-862-4259
CO Denver, William J. Purdy Co. 303-753-6800
CT Hartford, Sturgeon Co. 203-249-7800
FL Lauderdale Lakes, Seacom Sls. Co. ... 305-486-0260
GA Norcross, Cartwright & Bean, Inc. of GA 404-368-0160
IL Park Ridge, Bob Burns & Assocs. 312-823-9360
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
LA Covington, Cartwright & Bean, Inc. of TN 504-892-1780
MD Lisbon, Samuel K. Macdonald, Inc. 301-982-1088
MA Needham, Sturgeon Co. 617-444-6603
MI Farmington Hills, R. C. Merchant & Co., Inc. 313-476-4600
MI St. Joseph, R. C. Merchant & Co., Inc. 616-983-7378
MN Edina, Mel Foster Tech. Sls., Inc. 612-941-9790
MS Jackson, Cartwright & Bean, Inc. of TN 601-981-1170
MO Blue Springs, Kathrinus-Kelly-Baumhaure Co. 816-229-0001
MO St. Louis, Kathrinus-Kelly-Baumhauer & Co. 314-647-2400
NV Las Vegas, Trembly Assocs. 702-739-9770
NM Albuquerque, C. T. Carlberg & Asoc., Inc. 505-836-1448
NY Clarence Ctr., L. D. Allen, Inc. 716-835-1955
NY Clifton Pk., L. D. Allen, Inc. 518-371-2798
NY Rochester, L. D. Allen, Inc. 716-244-9618
NY Syracuse, Leonard D. Allen, Inc. 315-437-8387
NC Charlotte, Cartwright & Bean 704-377-5673
IL Elgin, Simpson Elec. 312-697-2260
NC Raleigh, Cartwright & Bean 919-876-4130
OH Dayton, Baehr-Greenleaf & Assocs. ... 513-439-0724
OH Westlake, Baehr-Greenleaf & Assoc., Inc. 216-892-1770
OH Worthington, Baehr-Greenleaf & Assocs. 614-847-0220
OK Oklahoma city, J. Y. Schoonmaker Co. 214-349-1650
OR Beaverton, Earl & Brown 503-643-5500
PA Monroeville, Samuel K. Macdonald ... 412-373-1723
PA Willow Grove, Samuel K. Macdonald .. 215-659-4414
TN Knoxville, Cartwright & Bean 615-693-7450
TN Knoxville, Cartwright & Bean, Inc. of GA 615-693-7450
TN Memphis, Cartwright & Bean Co. 901-276-4442
TX Dallas, J. Y. Schoonmaker Co., Inc. 214-349-1650
TX Houston, J. Y. Schoonmaker Co. 214-349-1650
WA Redmond, Earl & Brown Co., Inc. 206-885-5064
EXP IL/Elgin, Simpson Elec. 312-697-2260

MERCURY PLASTICS, A UNIT OF ZERO CORP., 672 Fuller Rd., Chicopee, MA 01020, Tel: 413-267-5561, TWX: 710-354-1450; Empl.: 100; *Sls. Mgr.:* Roger St. Martin

MERECO PRODUCTS DIV., Metachem Resins Corp., 1505 Main St., West Warwick, RI 02893, Tel: 401-828-4550; Empl.: 100; *Sls. Mgr.:* John E. Powell, Jr.

MERET, INC., 1815 24th St., Santa Monica, CA 90404-4998, Tel: 213-828-7496, TELEX: 65-246 8 SNM, FAX: 213-828-7567; Empl.: 45; *Sls. Mgr.:* Jonathan Medved ..... **B•1172**

Local Sales Offices & Reps

CA West Covina, Eureka Tech. Sls., Inc. .. 213-331-8766
CO Lakewood, Technical Mktg. Mfg. Inc. .. 303-232-1516
MA Brookline, Boston Elctrn. Corp. 617-566-3821
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NM Albuquerque, Tech. Mktg. & Mfg. 505-298-6893
IL Northrock, Emtech 312-564-2505
NY Elmsford, Metro-Tek Assocs. 914-347-4112
VA Fairfax, Schibley Assocs.,Inc. 703-591-3008

MERIX CHEMICAL CO., 2234 East 75th St., Chicago, IL 60649, Tel: 312-221-8242; Empl.: 15; *Sls. Mgr.:* E. O. Sonneman; *Dist. Mgr.:* E. O. Sonneman

MERRILL, POB 308, 1316 Sumneytown Pike, Gwynedd Valley, PA 19437, Tel: 215-643-2116; FSC No.: 58624; Empl.: 10; *Sls. Mgr.:* J. Fournier

MERRIMAC INDUSTRIES, 41 Fairfield Pl, West Caldwell, NJ 07006, Tel: 201-575-1300, TELEX: 6853128, FAX: 201-575-0531; FSC No.: 12457; Empl.: 300

Local Sales Offices & Reps

AZ Scottsdale, Territorial Mktg. 602-994-8665
CA Mountain View, Pacific Tech Mktg. 415-969-3010
CA Westlake Village, MCA Repco 818-889-5553
CO Boulder, Herb Bass Assoc. 303-530-7509
FL Orlando, Techn. Mktg. Assocs. 305-857-3760
IL Chicago, Techn. Sls. 312-237-7210
MD Baltimore, Burgin-Kreh Assocs. 301-265-8500
MA Wakefield, Spectrum Mktg. 617-246-4740
NJ Teterboro, Tech. Mktg. Assoc. 201-393-9330
NY Syracuse, T-Squared Elecs. 315-463-8592
PA S. Hampton, Eastern Instrmn. 215-355-7700
TX Richardson, Carl Tinch Sls. 214-231-1322

MERRIMACK MAGNETICS CORP., 121 Hale St., Lowell, MA 01851, Tel: 617-458-1487; Empl.: 450; *Sls. Mgr.:* Richard Boucher; *Dist. Mgr.:* Mellisa Lavers

J. R. MERRITT CONTROLS, INC., 8 Crimmins Rd., Darien, CT 06820, Tel: 203-656-0143, TWX: 510-601-6932JRMC, FAX: 203-656-0162

MESUR-MATIC ELCTRNS., 10 Colonial Rd., Ste. 6, Salem, MA 01970-2294, Tel: 617-745-7000; Empl.: 29; *Sls. Mgr.:* Kosma L. Evangelidis

METATEK INC., 290 Coon Rapids Blvd. N. W., P.O. Box 33129, Minneapolis, MN 55433, Tel: 612-786-8253, TELEX: 4994418 Metatek; Empl.: 6; *Sls. Mgr.:* Don Hallblade; *Dist. Mgr.:* Don Hallblade

METEREX CORP., 25 Industrial Park Rd., Hingham, MA 02043, Tel: 617-749-8100; Empl.: 4; *Sls. Mgr.:* K. Sharples

METERMASTER, 5646 Jullson St, Los Angeles, CA 90040, Tel: 213-685-4340

METHODE ELECTRONICS, INC., 7444 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-9600, TWX: 910-221-2468; Empl.: 2000; *Sls. Mgr.:* S. Landeene; *Dist. Mgr.:* K. Lindsey

METHODE ELECTRONICS, INC., Interconnect Prods Div, 1700 Hicks Rd, Rolling Meadows, IL 60008, Tel: 312-392-3500, TWX: 910-687-0760, FAX: 312-392-9404; FSC No.: 95354; Empl.: 250; *Sls. Mgr.:* Suzi Landeene; *Dist. Mgr.:* Kathy Lindsey

METIS, P.O. Box 1499, Bowie, MD 20716, Tel: 301-249-1702; Empl.: 2; *Sls. Mgr.:* Eric K. Pritchard

METRA BYTE CORP., 440 Myles Standish Blvd., Taunton, MA 02780, Tel: 617-880-3000, TELEX: 503989; FSC No.: 1 FG 11; Empl.: 50; *Sls. Mgr.:* Bendrix Bailey; *Dist. Mgr.:* Bendrix Bailey ..... **D•1173**

Local Sales Offices & Reps

AL	Huntsville, Magaro Assocs.	205-882-0827
AZ	Phoenix, Louis James & Assocs.	602-992-0872
CA	Orange, X. B. X. Sls.	714-998-8200
CA	Santa Clara, Nelson Elctrn.	408-980-1950
CO	Commerce City, Louis James & Assocs.	303-287-4657
GA	Atlanta, Magaro Assocs.	404-451-8862
IL	Chicago, Berndt Assocs.	312-283-0713
IN	Carmel, Berndt Assocs.	317-844-0114
MI	Livonia, Lowell-Wendt Mktg.	313-464-2722
MN	Minneapolis, Berndt Assocs.	612-546-2021
NJ	W. Caldwell, PCS	201-575-7464
NC	Greensboro, Magaro Assocs.	919-294-4783
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
UT	Salt Lake City, Louis James & Assocs.	801-487-3851
WA	Woodinville, Louis James & Assocs.	206-788-5228
WI	Milwaukee, Berndt Assocs.	414-545-8400
Can	St. Laurant, Quebec, Techmatron Inst., Inc.	514-689-5889

METRA INSTRUMENTS, 2056 Bering Dr., San Jose, CA 95131, Tel: 408-436-8530, TELEX: 296698; Empl.: 30; *Sls. Mgr.:* John R. Hook

METRAPLEX CORP., 5305 Spectrum Dr., Frederick, MD 21701, Tel: 301-662-8000, TELEX: 697-4248 MPX CORP, FAX: 301-695-8099

METRIC SYSTEMS, 645 Anchors St., Ft. Walton Beach, FL 32548-9990, Tel: 904-244-9600, TELEX: 70-2447; FSC No.: 12339; Empl.: 700

METRIX INSTRUMENT CO., 1711 Townhurst, Houston, TX 77043, Tel: 713-461-2131, TELEX: 77-5486, FAX: 713-461-8223; Empl.: 50; *Sls. Mgr.:* W. B. Brown

METROLAB INSTRUMENTS SA, 6, Chemin du Clos, Geneva (Lancy), Switzerland CH-1212, Tel: (41-22) 941121, FAX: 41-22-941120

METRON OPTICS INC., P.O. Box 690, Solana Beach, CA 92075-0690, Tel: 619-755-4477, FAX: 619-755-4752; Empl.: 22

METROPOLE PRODUCTS INC., P. O. Box 309, Stafford, VA 22554, Tel: 703-659-2132, 703-971-7082, FAX: 703-659-2133; FSC No.: 55908; *Sls. Mgr.:* John DePaola

METROSONICS, INC., Box 23075, Rochester, NY 14692-3075, Tel: 716-334-7300, TELEX: 853348, FAX: 716-334-2635; FSC No.: 55381; Empl.: 80; *Sls. Mgr.:* R. Branch; *Dist. Mgr.:* S. Macioulis

FAX: 201-679-3222

METUCHEN CAPACITORS, INC., 139 White Oak Ln., P.O. Box 499, Old Bridge, NJ 08857, Tel: 201-679-3366, TWX: 710-998-0892; FSC No.: 55969; Empl.: 25; *Sls. Mgr.:* George Wolter ..... **A•1126-1133, 1672-1673; C•1452-1455**

Local Sales Offices & Reps

MD	Potomac, C.E. Tech. Elctrns.	301-235-1942
MA	Lowell, Underwood Sls.	617-256-8191
MO	Ellisville, Gateway Tech. Sls.	314-391-6543
MO	Grandview, R. R. Burton Assocs.	816-763-5385
NJ	Brielle, EMC Technlgsts.	201-223-6699
NY	Islip, EMC Technlgsts.	516-277-2395

MEYER WIRE & CABLE CO., Div. of Cole Hersee Co., 1072 Sherman Avenue, Hamden, CT 06514, Tel: 203-281-0817, TWX: 910-240-0340, ESYLNK: 62938426, FAX: 203-281-9648; Empl.: 45; *Sls. Mgr.:* Spencer G. Molloy, VP Sls.

MFE INSTRUMENTS CORP., 19 Keewaydin Dr., Salem, NH 03079, Tel: 603-893-1921, ESYLNK: 953145; Empl: 60; *Sls. Mgr.:* Dennis Doscher; *Dist. Mgr.:* Dennis Doscher

MF ELCTRNS. CORP., 10 Commerce Dr., New Rochelle, NY 10801, Tel: 914-576-6570, TWX: 710-563-0643; FSC No.: 08111; Empl.: 100; *Sls. Mgr.:* Zaw Nawaday; *Dist. Mgr.:* Frank Aliberga ..... **A•1418-1419**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl Assocs.	602-944-3813
CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	San Jose, Mac Tron	408-446-8224
CO	Denver, Matthews & Assocs.	303-450-6476
CT	Meriden, Orion Group	203-621-8371
FL	Tampa, SRT Mktg.	813-884-4805
MA	Wakefield, The Orion Group	617-245-5220
MN	Edina, Peterson Sls. & Assoc.	612-944-0030
NC	Raleigh, Tingen Tech. Sls.	919-878-4440
OR	Portland, Core II	503-641-0877
PA	Prospect Park, ELF Sls.	215-534-3340
TX	Dallas, Matthews & Assocs.	214-248-7881
WA	Seattle, Core II Mktg.	206-467-0622

Local Distributors

CA	Anaheim, Pacesetter Elctrns.	714-779-5855
CA	Burbank, Atwater Elctrns.	714-670-1426
CA	Sunnyvale, Pacesetter	408-734-5470
NJ	Bellmawr, Mid Atlantic	609-931-5303
NY	Bohemia, RBD Elec.	516-589-7717
NY	Cen. Islip, Domino Comps.	609-931-5303
NY	Mt. Vernon, Janesway Elec.	914-699-6710

MFG-WEST, Parabam Div., 1130 Watsoncenter Rd., Carson, CA 90745, Tel: 213-549-5044; Empl.: 85

MFI, 12304 Santa Monica Blvd., Ste. 121, Los Angeles, CA 90025, Tel: 213-826-8133, 800-533-2297, FAX: 213-820-6958 ..... **D•1093**

MFM TECHNOLOGY, INC., Affiliate of Unitrode Corp., 200 Thirteenth Ave., Ronkonkoma, NY 11779, Tel: 516-467-5151, TELEX: 221-500ASAS, FAX: 516-467-5176; Empl.: 25 ..... **B•1233**

Local Sales Offices & Reps

CT	Vernon, Jerry Pfau Assocs.	203-647-9852
MN	Cottage Grove, Applied Motion Technlg.	612-459-0600
NJ	Princeton, Associated Controls, Inc.	609-799-7020
NC	Charlotte, Servicon Sls. Corp.	704-525-4800
OH	Toledo, Cubbedge Controls, Inc.	419-535-5530
TX	Denton, Texonics, Inc.	817-382-4159
CA	San Jose, Motion Control-North	408-997-0544

FAX: 516-582-3229

MG ELECTRONICS, 32 Ranick Rd., Hauppauge, NY 11788, Tel: 516-582-3400, TELEX: 645113; Empl.: 14; *Sls. Mgr.:* John Kibbit; *Dist. Mgr.:* Stan Grey ..... **D•1039**

MHOTRONICS., INC., 444 Lake Cook Rd., Ste. 8, Deerfield, IL 60015, Tel: 312-948-5600, TWX: 910-686-0630, FAX: 312-948-5604; Empl.: 10; *Sls. Mgr.:* David McFadden

MICA CORPORATION, 8536 National Blvd., Culver City, CA 90232, Tel: 213-837-8100, TELEX: ITT 4720769; FSC No.: 06216;Multiple; Empl.: 300

MICHIGAN MAGNETICS, 203 W. Third St., Vermontville, MI 49096, Tel: 517-726-0590; Empl.: 35; *Sls. Mgr.:* Tom Krul

MICOM SYSTEMS, INC., 4100 Los Angeles Ave, P.O. Box 8100, Simi Valley, CA 93062-8100, Tel: 805-583-8600, TELEX: 687-497, TWX: 910-494-4910

MICRA CORP., 120 Ricefield Lane, Hauppauge, NY 11788, Tel: 516-231-8600, TWX: 882633 MICRA US; FSC No.: 63071; Empl.: 200; *Sls. Mgr.:* Ronald P. Colino

MICREL, INC., 1235 Midas Way, Sunnyvale, CA 94086, Tel: 408-245-2500, TWX: 910-379-0007, FAX: 408-245-4175; FSC No.: 60496; Empl.: 120; *Sls. Mgr.:* Stan Ericsson

MICROAVIONICS CORP., 3198-K Airport Loop Dr., Costa Mesa, CA 92626, Tel: 714-957-6904; Empl.: 15; *Sls. Mgr.:* B. H. Corzine ..... **C•1634; D•1136**

Local Sales Offices & Reps

CA	Los Angeles, Forbes Pacific, Inc.	714-722-6174

MICROBAR SYSTEMS, INC., 785 Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-720-9300, TWX: 910-373-2047; *Sls. Mgr.:* W. Barrett Burton

MICROCAP, INC., A MicroSemi Company, 501 South Andreasen Drive, Escondido, CA 92025, Tel: 619-480-1906, FAX: 619-480-6741; Empl.: 65; *Sls. Mgr.:* Ken Miller, Sls. Mgr.

MICROCHIP TECHNOLOGY INC., Sub. of General Instrument Corp., 2355 W. Chandler Blvd., Chandler, AZ 85224, Tel: 602-963-7373, TWX: 910-950-1963, FAX: 602-899-9210; *Sls. Mgr.:* Phil Hubbert

MICRO-CIRCUIT ENGRG., See MCE Semiconductor

MICRO-CIRCUITS CO., INC., 10792 Maublin Rd., New Buffalo, MI 49117, Tel: 616-469-2727, FAX: 616-469-2742 ..... **C•1121**

MICRO-COAX COMPONENTS, INC., a UTI Company, Box E, Collegeville, PA 19426, Tel: 215-489-3700, TELEX: 84-6428, TWX: 510-660-6107, ESYLNK: 62961019, FAX: 215-489-1103; Empl.: 50; *Sls. Mgr.:* Lloyd Deery

MICROCOMPUTER POWER, 15875 Concord Circle, Morgan Hill, CA 95037, Tel: 408-779-5700, TWX: 910-338-7694; Empl.: 60; *Sls. Mgr.:* Ray Parker; *Dist. Mgr.:* Ray Parker

MICROCOSM, INC., 15275 S.W. Koll Parkway, Beaverton, OR 97006, Tel: 503-626-6100, TELEX: 759527 (Microcosm UD); Empl.: 30; *Sls. Mgr.:* M. L. Epperson

MICRO CRYSTAL DIVISION / SMH

FAX: 212-505-6787

MICRO CRYSTAL DIVISION, SMH, 35 E. 21st Street, New York, NY 10010, Tel: 212-505-5340, TELEX: 239 865 eta ur; *Dist. Mgr.:* Thomas Camazza ..... **A•1421-1423**

Local Sales Offices & Reps

CA	Palo Alto, Saronix	415-856-6900
FL	Pompano Bch., H H P Assocs.	305-971-5750
NH	Nashua, Bell Controls	603-882-6984
OH	Mt. Orab, Ben Jenn Engrg.	513-444-3175

MICRO DEVICES PRODUCT GROUP

FAX: 419-756-4542

MICRO DEVICES PRODUCT GROUP, Therm-O-Disc, Inc., 1320 South Main Street, P.O. Box 3538, Mansfield, OH 44907, Tel: 419-756-5911, TELEX: 987455 ..... **B•1343, 1873**

MICRODOT, INTERCONNECT SYSTEMS DIVISION, 201 Progress Dr., Montgomeryville, PA 18936, Tel: 215-699-5373, FAX: 215-699-5536; FSC No.: 91886; *Sls. Mgr.:* K. A. Neumuller ..... **B•1016-1017; C•1456-1459, 1730-1731, 1862-1863**

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-461-9069
CA	Fullerton, Libratronix	714-871-1513
CO	Longmont, Todd & Fry Assocs.	303-776-7331
CT	Simsbury, Pettigrew Co.	203-651-4321
FL	Largo, Q Rep	813-393-6393
IL	Rolling Meadows, Heartland Tech. Mktg.	312-577-9222
IA	Cedar Rapids, S & O Sls.	319-363-7323
KS	Overland Park, AME Sls.	913-262-3971

MA Needham, Component Tech. 617-449-8490
MI Farmington Hills, Carter, McCormic & Pearce 313-477-7700
MN Eden Prairie, The Twist Co. 612-941-2040
NM Albuquerque, Reptronix 505-292-1718
NY E. Syracuse, Ossman Assocs. 315-437-7052
NY Ossmann Assocs., Ossman Comps. .. 716-424-4460
NY Yonkers, Sonkin Assocs. 914-968-8282
OH Berea, Carter, McCormic & Pearce 216-826-0400
OR Beaverton, Blair Hirsh Co. 503-641-1875
PA Horsham, Jacobsen Assocs. 215-674-2937
TX Dallas, M Rep 214-484-5711
VA Sterling, Beacon North 703-478-2480
WA Lynnwood, Blair Hirsh Co. 206-774-8151
WI Brookfield, Heartland Tech. Mktg. 414-796-1128

Local Distributors

AZ Tempe, Hamilton Avnet 602-231-5100
CA Chatsworth, Hamilton Avnet 818-700-6500
CA Culver City, Hamilton Avnet 213-558-2657
CA Placentia, Telesis Elctrns. 714-579-7555
CA San Diego, Hamilton Avnet 619-571-7510
CA Santa Clara, Pyramid Elctrns. 408-727-9810
CA Sunnyvale, Hamilton Avnet 408-743-3372
CT Danbury, Hamilton Avnet 203-797-2800
FL Ft. Lauderdale, Hamilton Avnet 305-971-2900
FL Winter Park, Hamilton Avnet 305-628-3888
IL Bensenville, Hamilton Avnet 312-860-7700
MD Columbia, Hamilton Avnet 301-995-3500
MA Peabody, Hamilton Avnet 617-531-7430
NH Manchester, Yankee Elctrn. Supp. 603-625-9746
NJ Cherry Hill, Hamilton Avnet 609-424-0100
NJ Fairfield, Hamilton Avnet 201-575-3390
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PA Wayne, Peak Elctrn. Corp. 215-293-9000
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MICRODRY CORP., Golden Grain Macaroni Co., 3111 Fostoria Way, San Ramon, CA 94583, Tel: 415-866-9012, TELEX: 33-5320; Empl.: 40; *Sls. Mgr.:* Dave Northrup

MICRO ELECTRONIC SYSTEMS, INC., 3 Quarry Road, Brookfield, CT 06804, Tel: 203-775-1440, 800-243-7254, TELEX: 969659, FAX: 203-775-6903

MICRO-ETCH PRODUCTS, INC., 94 Dodge Ave., P.O. Box 9712, Stratford, CT 06497, Tel: 203-378-8610, FAX: 203-375-6276; FSC No.: 24846; Empl.: 42; *Sls. Mgr.:* Frank Dichiara; *Dist. Mgr.:* Frank Dichiara

MICROFLECT CO., INC., 3575 25th St. S.E., P.O. Box 12985, Salem, OR 97309-0985, Tel: 503-363-9267, TWX: 510-599-0107, FAX: 503-363-4613; Empl.: 100; *Sls. Mgr.:* John J. Kranitz

MICRO HYBRIDS, INC., 2864 Route 112, Medford, NY 11763, Tel: 516-732-3448, FAX: 516-732-3393; FSC No.: 5962; Empl.: 7; *Sls. Mgr.:* Bruce Richardson

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MICRONICS TECHNOLOGY INC., 7 Alexander Place, Glen Cove, NY 11542, Tel: 516-759-5600, FAX: 516-759-5603; *Sls. Mgr.:* John Mruz

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WA Seattle, Datacom 206-285-2525

FAX: 818-358-6478

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IL Lake Bluff, R & R Mktg. Assocs. 312-295-6600
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TX Austin, Sage Mktg. 512-335-0300

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CA San Diego, Shelley Elctrns. 619-453-7133
MN Minneapolis, Electronic Ctr. 612-371-5200
NH Hampstead, Astrum Elctrns. 603-329-5656
NY New Rochelle, Derf Elctrns. 914-235-4600
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MA	Newton	617-969-0265
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MN	Minneapolis	612-830-3516
MO	St. Louis	314-569-7620
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NY	Rochester	716-424-2700
NC	Charlotte	704-364-4770
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OH	Dayton	513-237-4075
PA	Valley Forge	215-666-8340
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MICRO SYSTEMS ENGINEERING, INC., 6024 S.W. Jean Rd., Lake Oswego, OR 97035, Tel: 503-635-4016, TELEX: 151-538; FSC No.: 75800; Empl.: 60; *Sls. Mgr.:* Maury Reiter

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WA	Seattle, Core II Mktg., Inc.	206-451-8163
WA	Spokane, Core II Mktg., Inc.	509-922-2971

MICRO-TEL DIVISION, Adams Russell Elctrns., 10713 Gilroy Rd., Hunt Valley, MD 21030, Tel: 301-771-0077, TELEX: 87442, FAX: 301-771-6025; FSC No.: 29644; *Sls. Mgr.:* William R. Trussell

MICROTOUCH SYSTEMS INC., Ten State Street, Woburn, MA 01801, Tel: 617-935-0080, TELEX: 530264; FSC No.: 935-0133; Empl.: 60; *Sls. Mgr.:* William N. Keller

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MICROTRAN CO. INC., 145 E. Mineola Ave., P. O. Box 236, Valley Stream, NY 11582, Tel: 516-561-6050, TWX: 510-225-8412; FSC No.: 00348; Empl.: 75; *Sls. Mgr.:* W. Benscher ..... **A•1246, 2152, 2280-2296**

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FL	Altamonte Springs, Over & Over, Inc./Florida	305-332-1222
FL	Brandon, Over & Over, Inc./Florida	813-689-9104
GA	Norcross, Over & Over	404-449-6205
IL	Wheaton, Chadra-Schilke Assoc.	312-653-8126
IN	Noblesville, R & D Elctrn. Sls.	317-849-2026
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NC	Charlotte, Over & Over	704-542-9111
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PA	Jenkintown, Arnold Assocs.	215-887-7870
PA	Pittsburgh, J.O. Olsen Co.	412-279-2550
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CA	Santa Clara, Pyramid Elctrns.	408-727-9810
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CO	Englewood, Shelley/Ragon Inc.	303-762-0670
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FL	Largo, Elctrn. Precepts of Florida	813-544-3636
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IN	Indianapolis, Graham Elctrns.	317-634-8202
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NY	Johnson City, Help Elctrns.	607-729-3528
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Summit Distrs.	716-334-8110
NC	Raleigh, Southeastern Elctrns.	919-828-2311
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PA	McKeesport, Barno Radio Co.	412-751-5971
PA	Philadelphia, Shap Elctrns.	215-969-3300
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WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Mequon, Lake-View Elctrns. Corp.	414-377-8250
WI	New Berlin, Classic Comp.	414-786-5300

MICROWAVE APPLICATIONS GROUP, 3030 Industrial Pkwy., Santa Maria, CA 93455, Tel: 805-928-5711, TWX: (MAGSAMA) 910-351-5808, FAX: 805-925-5903; Empl.: 55; *Sls. Mgr.:* D. W. Prigge

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MICTRON INC., 6050 Porter Way, Sarasota, FL 33582, Tel: 813-371-6659; *Sls. Mgr.:* M. Weinstein

MIDCOM, INC., 121 Airport Dr., Watertown, SD 57201, Tel: 605-886-4385, FAX: 605-886-4486; Empl.: 200; *Sls. Mgr.:* Dean Ward

MIDDLEBURG CORP., Middco Connectors, 95 Albany Turnpike, Canton, CT 06019, Tel: 203-693-8361, TELEX: 643529; Empl.: 20; *Sls. Mgr.:* Judy Nelson

MID-EASTERN INDUSTRIES, 100 Campus Dr., RR30, Mt. Holly, NJ 08060, Tel: 609-267-3811; FSC No.: 06179; Empl.: 10; *Sls. Mgr.:* Daniel Ellenback .... **D•1840-1844**

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FAX: 915-772-1116

MIDTEX RELAYS, INC., 9B2 Butterfield Trail, El Paso, TX 79906, Tel: 915-772-1061, 1-800-MIDTEX1, TWX: 910-240-3407, ESYLNK: 62752541; Empl.: 275; *Sls. Mgr.:* Ted Anderson; *Dist. Mgr.:* Ted Anderson ..... **B•1538-1543**

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AZ	Tempe, A5 Co.	602-968-4923
AR	Hot Springs, Automation Suppliers, Inc.	501-767-5444
CA	Hayward, Pacific Mktg., Inc.	415-887-1620
CA	Tustin, Schoenbachler-Dobson	714-544-1888
GA	Norcross, Twentieth Century Mktg.	404-446-1999
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Indianapolis, Richmar Elctrns.	317-577-9950
KS	Overland Pk., Thomas Dowell	913-638-7373
MN	Edina, Graydon & Flemmer	612-941-1120
MO	St. Louis, Thomas Dowell & Assocs.	314-849-4234
NH	Nashua, Bell Controls	603-882-6984
NJ	Englewood, Harold Gray & Assocs.	201-894-0894
NY	Rochester, Lamb Comps.	716-323-1250
NC	Cary, Twentieth Century Mktg.	919-481-3370
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
PA	Trevose, PSA	215-245-0513
TN	Knoxville, Twentieth Century Mktg.	615-966-2099
TX	Richardson, Milco Mktg.	214-783-2716
WA	Vashon, RTS, Inc.	206-285-1363
WI	Butler, Richmar Elctrns.	414-781-1730
Can	Toronto, Ont., CEA Assocs.	416-231-9717

Local Distributors

AL	Huntsville, Hall-Mark	205-837-8700
AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Control Design Supp.	602-829-7981
AR	Little Rock, Newark Elctrns.	501-225-8130
CA	Anaheim, Control Design Supp.	714-821-1516
CA	Bay Area, Hall-Mark	408-432-0900
CA	Irvine, Integrated Elctrns.	714-837-9960
CA	Orange County, Hall-Mark	714-669-4100
CA	San Carlos, Control Design Supp.	415-592-4806
CA	Santa Monica, Master Dists.	213-452-1229
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Wallingford, Mid State Elctrns.	203-265-9900
FL	Altamonte Springs, Control Design	305-788-3220
FL	Ft. Lauderdale, Hall-Mark	305-971-9280
GA	Stone Mtn., Control Design	404-979-3500
IL	Chicago, Hall-Mark	312-860-3800
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Genoa, Control Design	312-882-7232
IN	Indianapolis, Control Design	317-788-4559
IA	Cedar Rapids, Dee Elctrns.	319-365-7551
KS	Kansas City, Control Design	913-362-4248
KY	Louisville, Newark	502-423-0280
LA	Shreveport, Indl. Elec. Supp.	318-222-9459
MD	Columbia, Hall-Mark	301-988-9800
MA	Boston, Hall-Mark	617-935-9777
MA	Newton, Green-Shaw Inc.	617-969-8900
MA	Woburn, Control Design Supp.	1-800-537-0045
MI	Oak Pk., Newark	313-967-0600
MI	St. Clair Shores, Spemco	313-771-2700
MN	Minneapolis, Control Design	612-721-1628
MN	Minneapolis, Hall-Mark	612-941-2600
MS	Jackson, Newark	601-956-3834
MO	St. Louis, Control Design Supp.	314-426-3150
NE	Omaha, Newark	402-392-1221
NV	Las Vegas, Newark	702-796-5090
NH	Nashua, Newark	603-883-9110
NY	Buffalo, Genesse Indl.	716-873-9661
NY	Long Island, Hall-Mark	516-737-0600
NJ	Oakland, Relay Specialties	201-337-1000
NJ	Paterson, Feldman Bros.	201-742-7329
NY	Rochester, Masline	716-546-5373
NY	Woodside, Switches Unltd.	718-478-5000
NC	Charlotte, Control Design	704-588-4410
NC	Raleigh, Hall-Mark	919-872-0712
OH	Cinicinnati, Schuster Elec.	513-489-1400
OH	Twinsburg, Advacom	216-425-8477
OK	Tulsa, Hall-Mark	918-251-1108
OR	Tigard, Integrated Elctrns.	503-641-1690
PA	Malvern, Control Design Supp.	215-296-0150
PA	McKean, Advacom	814-476-7774
PA	Philadelphia, Hall-Mark	215-355-7300
SC	Greenville, Newark	803-288-9610
TN	Memphis, Newark	901-365-8060
TX	Dallas, Control Design Supp.	1-800-441-0385
TX	Dallas, Force-Heiland	214-247-9955
TX	Dallas, Hall-Mark	214-343-5000
TX	El Paso, Midtex (Export)	915-772-1061
TX	Houston, Hall-Mark	713-781-6100
UT	Murray, Hall-Mark	801-268-3779
VA	Arlington, Newark	703-522-0880
WA	Bellevue, Integrated Elctrns.	206-455-2727
WV	Charleston, Newark	304-345-6511
WI	Milwaukee, Marsh Elctrns.	414-475-6000
WY	Gillette, Gifford	307-682-7203
Can	Scarborough, Ont., Carsten Elctrns.	416-495-7705

MIDWAY MFR. CO., 10750 W. Grand Ave., Franklin Park, IL 60131, Tel: 312-451-1360, TELEX: 72-1596; Empl.: 2000; *Dist. Mgr.:* Allan Stearns

MIDWEC, See Industrial Midwec Capacitors

MIDWEST COMPONENTS INC.

FAX: 616-773-4307

MIDWEST COMPONENTS, INC., 1981 Port City Blvd., Muskegon, MI 49443, Tel: 616-777-2602, TWX: 510-394-4130; FSC No.: 50157; Empl.: 125; *Sls. Mgr.:* Greg Hoffman ..... **B•1852-1859**

Local Sales Offices & Reps

AL	Huntsville, Glen White Assoc.	205-883-7938
CA	San Diego, Hadden Assocs.	619-565-9444
CA	Saratoga, Testco	408-253-1900
CA	Westminster, West Elctrns.	714-898-0120
GA	Norcross, Glen White Assoc.	404-441-1447
IL	Chicago, D. Dolin Sls.	312-286-6200
IN	Ft. Wayne, TMC Corp.	219-432-5553
MD	Timonium, Glen White Assoc.	301-252-6360
MN	St. Paul, R. G. Ragon	612-488-0201
NJ	West Cauldwell, Grimm, Siegel Assoc.	201-575-9300
NC	Raleigh, Glen White Assoc.	919-787-7023
OH	Dayton, Jay Engrg.	513-253-2151
OH	N. Royalton, Jay Engrg.	216-237-4235
OK	Tulsa, Norcom	918-664-9526
TN	Gray, Glen White Assoc.	615-477-8850
TX	Dallas, Norcom	214-386-4888
TX	Houston, Norcom	713-988-0022
VA	Lynchburg, Glen White Assoc.	804-237-6291
WA	Seattle, Jas. J. Backer	206-285-1300
WI	Milwaukee, D. Dolin Sls.	414-482-1111

MIKRON INSTR., 445 W. Main St., Wyckoff, NJ 07481, Tel: 201-891-7330, TELEX: 361870, FAX: 201-891-1205; Empl.: 60; *Sls. Mgr.:* K. Irani

MIL-COMM DISTRIBUTORS, INC., 9400 Lurline Ave. 6C, Chatsworth, CA 91311, Tel: 818-998-3111 ..... **D•1452**

MIL ELECTRONICS, INC., 1 Mill st., Dracut, MA 01826, Tel: 617-453-8000, TELEX: 4998157, FAX: 617-957-6761; FSC No.: 07862; Empl.: 40; *Sls. Mgr.:* Mark Ryan

MILFORD RIVET & MACH., 857 Bridgeport Ave., Milford, CT 06460, Tel: 203-878-4631, TELEX: 964363, TWX: 710-462-0538, FAX: 203-878-5071; Empl.: 250

MILLEN COMPONENTS, Electronic Instr. & Specialty Corp., 42 Pleasant St., Stoneham, MA 02180, Tel: 617-438-6951, TELEX: 948-025; FSC No.: 57285; Empl.: 20; *Sls. Mgr.:* R. A. Boisseau

MILLER DIAL CORP., 4400 N. Temple City Blvd., El Monte, CA 91731, Tel: 818-444-4555, TWX: 910-587-3438, FAX: 818-443-3267; Empl.: 200; *Sls. Mgr.:* P. J. Wener, V.P. Membrane

MILLER, J.W., CO., See Bell Inds.

MILLER, L.C., CO., 717 Monterey Pass Rd., Monterey Pk., CA 91754, Tel: 213-268-3611; Empl.: 45

MILLER, SANFORD, CORP., See Sanford-Miller Corp.

MILLER, W. A., CO., Mingo Loop, P.O. Box 337, Oquossoc, ME 04964-0337, Tel: 207-864-3344, 800-227-1415; Empl.: 15; *Sls. Mgr.:* Wes Miller, Jr.

MILLER-STEPHENSON CHEM. CO., INC., George Washington Hwy., Danbury, CT 06810-7378, Tel: 203-743-4447, TELEX: 643-711

MILLIFLECT, 37444 Sycamore St., Bldg. A, Newark, CA 94560, Tel: 415-791-5188, TELEX: 466465, FAX: 415-791-5237; Empl.: 39; *Sls. Mgr.:* Don Koijane

MILLI-SWITCH CORP., Box 67, Gladwyne, PA 19035, Tel: 215-MI2-9222; Empl.: 15

MILLIVAC INSTRUMENTS, INC., Box 997, Curry Rd. Ext., Schenectady, NY 12301, Tel: 518-355-8300; FSC No.: 85711; Empl.: 30; *Sls. Mgr.:* (Mrs.) Pola Metzger ..... **D•1301**

Local Sales Offices & Reps

MA	Needham, Addelco Corp.	617-444-4754
NY	Fayetteville, Martin P. Andrews	315-637-5291
PA	Media, S & S Div. of Klinetics	215-565-5388
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Scientific Sls.	214-231-6541
Can	Downsview, Ont., Tradeport Elctrns. Grp.	416-736-0866

MILL-MAX MANUFACTURING CORP., P.O. Box 300, Oyster Bay, NY 11771-0300, Tel: 516-922-6000, TWX: 510-221-1820, FAX: 516-922-9253; FSC No.: 3N087; Empl.: 160 ..... **C•1461-1463**

Local Sales Offices & Reps

CA	Dana Point/W. Covina, Patrick M. Conahan Assocs.	714-493-9822
CA	San Jose, Patrick M. Conahan Assocs.	408-723-2200
CO	Boulder, R. G. Enterprises, Inc.	303-447-9211
FL	Seminole, Chaco Sls. of America, Inc.	813-397-4843
IL	Palatine, Houlihan Sls. Co.	312-705-0400
IA	Davenport, Electro-Tech Assocs.	319-386-1134
ME	Kittery, Olsen Tech. Sls.	207-439-6872
NY	Edgewood, Olsen Tech. Sls.	516-242-6606
MN	Minneapolis, Electro-Tech. Assocs.	612-927-5878

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NY South Huntington, JSA Sls. 516-939-0844
NC Matthews, Cardinal Sls. Co. 704-847-0248
PA Doylestown, G. A. Recentio Assocs. ... 215-348-7577
TX 214-247-9955
TX Dallas, deForest Sls. Co. 214-349-3290

Local Distributors

AZ Tempe, Acacia/VWR Elctrns. 602-894-2874
AZ Tempe, Electronic Hardware, Ltd. 602-967-1691
AZ Tucson, Pioneer Screw & Nut 602-623-9800
CA Anaheim, Bisco Inds. 714-635-0380
CA Campbell, Gourmet Elctrns. 408-374-0552
CA Chatsworth, West Valley Inds. 818-700-0700
CA Fremont, Alatec Prods. 415-657-7701
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA N. Hollywood, Electronic Hardware, Ltd. 818-982-6100
CA San Jose, Bisco Inds., Inc. 408-946-8980
CA San Jose, Pro Fasteners 408-943-9177
CO Denver, Hardware Specialty Co., Inc. .. 303-322-3700
CT Bethel, Heilind Elctrns., Inc. 203-797-8600
FL Lake Mary, Electronic Fasteners, Inc. 305-321-4000
FL Winter Pk., Hardware Specialty 305-677-8500
GA Norcross, Atlanta Hardware Specialty Co. 404-449-3000
IL Addison, Belford Elctrns., Inc. 312-691-1100
IL Franklin Park, Bisco Inds., Inc. 312-451-1230
MD Gaithersburg, Capital Fasteners 301-948-9310
MA Canton, EPC Elctrns., Inc. 617-821-2111
MA Marlborough, Hardware Specialty Co., Inc. 617-481-8622
MA Wilmington, Heilind Elctrns., Inc. 617-657-4870
MA Winchester, Rush Inds., Inc. 617-729-5800
MI Grand Rapids, S. F. Elctrn. Supply, Inc. 616-459-0216
MN Minneapolis, Aero-Space Computer Supplies, Inc. 612-884-4725
MO Bridgeton, Alatec Prods. 314-298-0010
NJ Cherry Hill, Hardware Specialty 609-663-0034
NJ Pinebrook, Alatec Prods. 201-227-8140
NJ Union, Meridian Mfg. & Supply Co., Inc. 201-687-6220
NY Baldwinsville, Scibetta Distr. 315-622-3993
NY Fairport, Willex Indl. 716-223-9365
NY Hauppauge, Kaytech Inds. 516-435-0560
NY Holtsville, Tower Fasteners Co. 516-289-8800
NY Long Island City, Hardware Specialty Co., Inc. 718-361-9393
NY Mount Vernon, QAR Industrial Elctrn. Sls., Inc. 914-699-2224
NC Greensboro, Meridian Mfg. & Supply Co., Inc. 919-674-7042
NC Raleigh, Century Fasteners 919-787-1800
OR Beaverton, Acacia/VWR Elctrns. 503-646-3377
OR Beaverton, Component Resources 503-641-8488
PA McKean, Advacom 814-476-7774
TX Farmers Branch, Force Elctrns. of Texas 214-351-2050
TX Houston, Wofford Elctrns. 713-847-3583
Can Mississauga, Ont., Rush Elctrns., Ltd. 416-677-7280

MILROSS CONTROLS, INC., 511 Second St. Pike, Southampton, PA 18966, Tel: 215-355-0200, TWX: 510-667-1702, FAX: 215-355-6326; FSC No.: 07047; Empl.: 100; *Sls. Mgr.:* Patricia J. Matthews

MILLS RESISTOR CO., 3840 Catalina St., Los Alamitos, CA 90720, Tel: 213-598-2454; FSC No.: 34238; Empl.: 50 ..... **A•1968**

Local Sales Offices & Reps

CA Los Altos, Frauman Assocs. 415-941-0660
CA Sacramento, Mills Resistor Co. 916-422-5461
CT Rocky Hill, Jim McPhail 203-721-1802
KS Leawood, James Dick Co. 913-649-0805
MA Waltham, Dynasel Assocs. 617-890-6777
OR Gaston, SPS Elctrns. 206-323-4140
TX Houston, Ev Smith Co. 713-649-5756
WA Seattle, SPS Elctrns. 206-323-4140

Local Distributors

FL Ft. Lauderdale, Jaro Elctrns. 800-327-5551
PA Harrisburg, ADTECH 717-939-8337
PA McKean, Advacom 814-476-7774

MILTOPE BUSINESS PRODUCTS, Miltope Grp., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803, FAX: 516-756-7606; Empl.: 650

MILTOPE CORP., 1770 Walt Whitman Rd., Melville, NY 11747, Tel: 516-420-0200, TWX: 510-221-1803; Empl.: 500; *Sls. Mgr.:* R. Douglas Shute; *Dist. Mgr.:* William Jennings

MRC

FAX: 414-271-9876

MILWAUKEE RESISTOR CORP., 700 W. Virginia St., Milwaukee, WI 53204, Tel: 414-271-9900; FSC No.: 82807;15109; Empl.: 65; *Sls. Mgr.:* W. R. Pollock; *Dist. Mgr.:* W. R. Pollock ..... **A•1970-1974**

Local Sales Offices & Reps

CA San Carlos, Electro Pacific 415-592-3114
IL Burr Ridge, PVA Corp. 312-655-3355
LA Covington, Cartwright & Bean 504-892-1780
MA Stoughton, EECS-Mel Boysian 617-586-3385
MS Jackson, Cartwright & Bean 601-981-1170
NY Rochester, Gislason Sls. 716-328-7400
NY Whitestone, M. H. Lynn co. 718-352-9233
OH Westlake, Assocd. Elctrl. Comps. 216-835-9960
TN Memphis, Cartwright & Bean 901-362-8345

MILWAUKEE TRANSFORMER CO., MTE Corporation, 7901 W. Clinton Avenue, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* Fred A. Lewis; *Dist. Mgr.:* Fred A. Lewis

MIMIC, INC., P. O. Box 705, Islington, MA 02090-0705, Tel: 617-329-9593; Empl.: 5; *Sls. Mgr.:* S. Thurston

MINCO PRODUCTS, 7300 Commerce La., Minneapolis, MN 55432, Tel: 612-571-3121, FAX: 612-571-0927; FSC No.: 09359; Empl.: 475; *Sls. Mgr.:* J. Anderson

MIN-E-CON, 1791 Reynolds, Irvine, CA 92714, Tel: 714-250-0474, TWX: 910-595-1144, FAX: 714-250-1713; FSC No.: 54455; *Sls. Mgr.:* Jeff Sander

MINELCO INC. - A TALLEY IND., 135 S. Main St., Thomaston, CT 06787-0459, Tel: 203-283-8261, TWX: 710-475-1091, FAX: 203-283-6527; FSC No.: 07479; Empl.: 70; *Sls. Mgr.:* James A. Myles ..... **B•1140-1141**

Local Sales Offices & Reps

AL Huntsville, L & D Inc. 205-837-1469
AZ Phoenix, R. W. Riedel & Co. 213-283-7694
CA Alhambra, M.W. Riedel & Co. 213-283-7694
CA Hayward, Liaison, Inc. 415-783-1131
CO Denver, West Inc. 303-477-8180
CT Old Saybrook, FJS Assocs. 203-388-5374
FL Orlando, Delmac 305-831-0040
GA Atlanta, L & D, Inc. 404-395-7079
MI Grand Rapids, Midwest Meridian 616-698-7391
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Owings Mills, Walker-Houk Assocs. ... 301-356-9500
MA Burlington, F.J.S. Assocs. 617-273-5959
MN Minneapolis, TWC Sls. 612-636-1770
MO St. Louis, Midwest Meridian 314-878-4441
NJ Hasbrouck Hgts., Comp-Tech Sls. 201-288-7400
NY Syracuse, J. R. Costello 315-472-0322
NC Greensboro, L & D, Inc. 919-292-3201
OH Cleveland, Jim Finnegan & Co. 216-238-5905
PA Downingtown, McCoy, Inc. 215-363-0350
TX Fort Worth, CMR 817-379-6540
WA Bellevue, Caruso & Co. 206-455-8811
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

MINIATURE METAL FORMING DIV., 4819 Emerald St., P.O. Box 2962, Torrance, CA 90509, Tel: 213-370-3679, FAX: 213-370-5430; Empl.: 35; *Sls. Mgr.:* Fred Kramer

Mini-Circuits

FAX: 718-332-4661

MINI-CIRCUITS LAB., 2625 E. 14th St., P.O. Box 350166, Brooklyn, NY 11235-0003, Tel: 718-934-4500, TELEX: 125460, 620156 (Intl.); FSC No.: 15542 ... **A•1774-1837**

Local Sales Offices & Reps

AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, Thorson Desert States, Inc. 602-998-2444
CA Los Altos, Cain-White & Co. 415-948-6533
CA N. Hollywood, Crown Elctrns. 213-877-3550
CO Aurora, Thorson Desert States, Inc. ... 303-671-7344
FL Boca Raton, Beacon Elctrns. 305-997-5740
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Longwood, Beacon Elctrns. 305-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Mount Prospect, Cain Forlaw Co. 312-253-3578
MD Columbia, M. Lader & Co. 202-296-2497
MA Waltham, Scientific Devices 617-890-2252
NM Albuquerque, Thorson Desert States, Inc. 505-293-8555
NY Hartsdale, Spectrum Sales, Inc. 914-472-8600
NY Skaneateles, Robtron 315-685-5731
NC Raleigh, Beacon Elctrns. 919-787-0330
NC Raleigh, M. Lader Co. 919-828-3870
OH Lancaster, Cain Forlaw Co. 614-654-4800
OK Tulsa, Beacon Elctrns. 918-622-1494
PA Lafayette Hill, M. Lader & Co. 215-825-3177
TX Austin, Beacon Elctrns. 512-345-3543
TX Dallas, Beacon Elctrns. 214-437-1505
UT Salt Lake City, Thorson Rocky Mtn., Inc. 801-973-7969
WA Bellevue, Cain-White & Co. 206-462-2118
PR Santurce, Beacon Elctrns. 809-728-5040
Can Brockville, Ont., R.F. Specialists 613-345-2343
Can Ottawa, Ont., Giga-Tron Assocs., Ltd. 613-225-4000
Can Vancouver, B.C., Penstock/Canada ... 604-662-3475

Local Distributors

AL Huntsville, Comp. Distrs., Inc. 205-883-7501
AZ Scottsdale, Spirit Elctrns. 602-998-1533
AR Little Rock, Comp. Distrs., Inc. 501-227-6278
CA N. Hollywood, Crown Elctrns. 213-877-3550
CA Sunnyvale, Penstock, Inc. 408-730-0300
CO Aurora, Spirit Distrs. 303-671-7344
FL Melbourne, Comp. Distrs., Inc. 305-724-9910
GA Norcross, Comp. Distrs., Inc. 404-441-3320
IL Mt. Prospect, CFC Distrs., Inc. 312-253-3578
MD Columbia, MLC Distrs. 215-825-3177
NY New Rochelle, RDI Dists. Inc. 914-632-2828
NC Raleigh, Comp. Distrs., Inc. 919-834-9465
NC Raleigh, MLC Distrs. 919-848-3253
PA Lafayette Hills, MLC Distrs. 215-825-3177
TX Dallas, Comp. Distrs., Inc. 214-644-0373

MINI COMPUTER TECHNOLOGY, 696 E. Trimble Rd., San Jose, CA 95131, Tel: 408-435-1616, TWX: 910-338-2281, FAX: 408-435-2709; Empl.: 16; *Sls. Mgr.:* John P. Lazare; *Dist. Mgr.:* John P. Lazare

MINI-MAGNETICS CO., INC., 1100 Fulton Place, Fremont, CA 94539, Tel: 415-490-7500, FAX: 415-490-7502; Empl.: 45; *Sls. Mgr.:* William Fine

MSI

FAX: 617-695-6076

MINI-SYSTEMS, INC., 20 David Rd., North Attleboro, MA 02761, Tel: 617-695-0203, TWX: 710-348-0564; FSC No.: 50316; Empl.: 150 ..... **A•1975**

Local Sales Offices & Reps

TX Lewisville, C & J Assocs. 214-539-0140

MINI-SYSTEMS, INC., Electronic Package Div., 168 E. Bacon St., P.O. Box 1597, Plainville, MA 02762, Tel: 508-695-2000, TWX: 510-600-4340, FAX: 508-695-8758; *Sls. Mgr.:* Heather Edwards ..... **A•1748**

MINNTRONICS CORPORATION, 2599 White Bear Ave., St. Paul, MN 55109, Tel: 612-770-5247

MINOR RUBBER CO., INC., Ackerman St., Bloomfield, NJ 07003, Tel: 201-338-6800, 800-631-8574, TELEX: 138817; *Sls. Mgr.:* Stan Messing

MISCO/MINNEAPOLIS SPEAKER CO, 3806 Grand Avenue, Minneapolis, MN 55409, Tel: 612-825-1010; FSC No.: 14208; *Sls. Mgr.:* Don Ringham

MITEC ELECTRONICS, 104 Gun Avenue, Pointe Claire, Quebec, Canada H9R 3X3, Tel: 514-694-6666, TWX: 510-101-2790, FAX: 514-694-3814; FSC No.: FSCM 38494; Empl.: 100; *Sls. Mgr.:* M. Monzon

MITEL SEMICONDUCTOR, Mitel Corp., P. O. Box 13320, Kanata, ON, Canada K2K 1X5, Tel: 613-592-5630, TELEX: 053-3221, TWX: 610-562-8529; Empl.: 700; *Sls. Mgr.:* Howard Tweddle; *Dist. Mgr.:* Howard Tweddle

MITEQ INC., 100 Davids Drive, Hauppauge, NY 11788, Tel: 516-436-7400, TELEX: 6718148, FAX: 516-864-1586; Empl.: 200

MITRONICS, 2908 Oregon Court - Bldg. I-2, Torrance, CA 90503, Tel: 213-320-7011

MITSUBISHI ELECTRONICS, 991 Knox Street, Torrance, CA 90502, Tel: 213-515-3993, TELEX: 06-4703-M USA LSA, TWX: 66-4787-MELA TRNC; Empl.: 423; *Sls. Mgr.:* Mike Foster

MITSUBISHI ELCTRNS. AMERICA, INC., Semiconductor Div., 1050 East Arques Ave., Sunnyvale, CA 94086, Tel: 408-730-5900, TELEX: 172296, TWX: 910-339-9549, FAX: 408-749-0453; Empl.: 105; *Sls. Mgr.:* John Zucker; *Dist. Mgr.:* Bob Olszewski

MITSUMI ELEC. CO., LTD., 8-2, 8-Chome, Kokuryo, Chofu-City, Tokyo, Japan, Tel: 489-5333, TELEX: J28846/J24935; Empl.: 1700; *Sls. Mgr.:* H. Sato; *Dist. Mgr.:* U. Nishimura

MIYAKAWA AMERICA CORP., 408 E. Devon Ave., Elk Grove Village, IL 60007, Tel: 312-640-0515, FAX: 312-640-0531

MIZAR, INC., 20 Yorkton Court, St. Paul, MN 55117, Tel: 612-224-8941, TELEX: 469542; Empl.: 35; *Sls. Mgr.:* William K. Simons

MKC ELECTRONICS CORP., 9205 Quivira Road, Overland Park, KS 66215, Tel: 913-894-9711; Empl.: 26

MKS INSTRUMENTS, INC., Six Shattuck Road, Andover, MA 01810, Tel: 617-975-2350, TELEX: 94-9375, FAX: 617-975-0094; Empl.: 350

MOBILE-TRONICS CO., INC., Box 1022, Tustin, CA 92680, Tel: 714-546-0884; Empl.: 2

MODERN CONTROLS CORP., 2233 Indl. Blvd., Sarasota, FL 33580, Tel: 813-355-5183; FSC No.: 66258; Empl.: 9

MODICON PROGRAMMABLE CONTROL DIV., Gould Inc., P.O. Box 83 S.V.S., Andover, MA 01810, Tel: 617-475-4700, TELEX: 94-7402, TWX: 710-347-6610; *Sls. Mgr.:* Steven Mader (PC's); *Dist. Mgr.:* George Dannecker (Micro 84)

MODULAR AUDIO PRODUCTS, Modular Devices, Inc., 50 Orville Dr., Bohemia, NY 11716, Tel: 516-567-9620; *Sls. Mgr.:* C. Liptman

MODULAR DEVICES, Brookhaven R & D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-3100, TELEX: 4949781; FSC No.: 52202; Empl.: 65; *Sls. Mgr.:* C. Liptman ..... **D•1846-1847, 2128**

Local Sales Offices & Reps

GA	Roswell, Electro Comp. Sls.	404-992-2344
MD	Linthicum, Advanced Technlg. Sls., Inc.	301-789-9360
NH	Manchester, Northeast Comps.	603-627-7242
NY	Wantagh, Tri-Tek Assocs.	516-221-7600

MODULAR DEVICES INC., 4115 Spencer St., Torrance, CA 90503, Tel: 213-542-8561, FAX: 213-371-6331; Empl.: 90; *Sls. Mgr.:* A. C. Augusta

MODULAR SYSTEMS, INC., 905 Albemarle St., Charlottesville, VA 22901, Tel: 804-295-7882; Empl.: 9; *Sls. Mgr.:* H. N. Patel

MODUTEC, 18 Marshall St., Norwalk, CT 06854, Tel: 203-853-3636, TWX: 710-468-2039, FAX: 203-853-2147; Empl.: 300

MOISTURE REGISTER PRODUCTS DIV., Aqua Measure Instrument Co., 2583 Pomona Blvd., Pomona, CA 91768-3267, Tel: 714-594-5545, TELEX: 6503137369 MRP; Empl.: 25; *Sls. Mgr.:* G. Dean Curd

MOLDCON, Div. of K & M Electronics, 221 Interstate Dr., W. Springfield, MA 01089, Tel: 413-736-0371, TWX: 710-350-6463; Empl.: 200; *Sls. Mgr.:* Robert Krzynowek

MOLDTRONICS, INC., 703 Rogers St., Downers Grove, IL 60515, Tel: 312-968-7000, FAX: 312-968-5068; Empl.: 140; *Sls. Mgr.:* Jack Beal

Molecu Wire

FAX: 201-938-3189

MOLECU-WIRE, P.O. Box 495, Farmingdale, NJ 07727, Tel: 201-938-9473, TWX: 710-723-6943; Empl.: 125 ..... **C•1865-1869**

Local Sales Offices & Reps

CA	Montrose, Roger D. Dahl	213-245-3817
CT	Orange, KLS Sls.	203-795-6210
MO	Independence, Hi Tech Cen.	816-796-6684
KY	Louisville, Waddle & Assocs.	502-897-6419
NC	Charlotte, QED	704-525-3053
PA	Ligonier, Patterson Elec.	412-238-6238
WA	Seattle, Comptronics	206-284-4842
WI	Mequon, Robco	414-241-3348

molex®

FAX: 312-969-1352

MOLEX, INC., 2222 Wellington Ct., Lisle, IL 60532, Tel: 312-969-4550, TELEX: 25-4069; Empl.: 5000; *Sls. Mgr.:* Ed Parkinson; *Dist. Mgr.:* Dave Root ..... **B•1775; C•1464-1467, 1871**

Local Sales Offices & Reps

CA	Laguna Hills, Molex	714-586-0950
CA	Milpitas, Molex	408-946-4700
CO	Englewood, Molex	303-779-8321
GA	Atlanta, Molex	404-396-6120
IL	Lisle, Molex	312-969-4550
IN	Indianapolis, Molex	317-299-0099
KY	Louisville, Molex	502-245-8337
MA	Woburn, Molex	617-935-8983
MI	Troy, Molex	313-879-7400
TX	Dallas, Molex	214-931-0999

Local Distributors

AL	Huntsville, Hamilton/Avnet	205-837-7210
AL	Huntsville, Time Elctrns.	205-721-1133
AZ	Chandler, Hamilton Avnet	602-961-6400
AZ	Tempe, Harper S.I.D.	602-967-1464
AZ	Tempe, Time Elctrns.	602-967-2000
AR	Ft. Smith, Carlton Bates	501-646-8201
AR	Little Rock, Carlton Bates	501-562-9100
AR	Pine Buff, Carlton Bates	501-535-1354
AR	Springdale, Carlton Bates	501-756-5012
CA	Anaheim, Time Elctrns.	714-937-0911
CA	Chatsworth, Hamilton Avnet	818-700-1222
CA	Chatsworth, Time Elctrns.	818-998-7200
CA	Compton, Harper S.I.D.	800-253-5527,213-979-5090
CA	Costa Mesa, Avnet Elctrns.	714-754-6111
CA	Costa Mesa, Hamilton Electro Sls.	714-641-4110
CA	Culver City, Hamilton Avnet	213-558-2143
CA	El Segundo, Force Elctrns.	213-772-1324, 714-522-1324
CA	Garden Grove, Richey Western Elctrns. Ltd.	800-227-0060,714-895-0060
CA	Gardena, Hamilton Avnet	213-217-6700
CA	Ontario, Hamilton Avnet	714-989-4602
CA	S. San Francisco, Peters-de Laet	415-873-9595
CA	Sacramento, Hamilton Avnet	916-920-3150
CA	San Diego, Force Elctrns.	619-569-9661
CA	San Diego, Hamilton Avnet	619-571-7510
CA	San Diego, Harper S.I.D.	619-578-2500
CA	San Diego, Richey Western Elctrns. Ltd.	619-271-4511
CA	San Diego, Time Elctrns.	619-586-1331
CA	San Jose, Force Elctrns.	408-435-1324
CA	San Jose, Richey Western Elctrns. Ltd.	408-432-7100
CA	Sunnyvale, Hamilton Avnet	408-743-3355
CA	Sunnyvale, Hamilton Avnet	408-743-3000
CA	Sunnyvale, Harper S.I.D.	408-747-0333
CA	Sunnyvale, Time Elctrns.	408-734-9888
CA	Torrance, Time Elctrns.	213-320-0880
CO	Denver, Integrated Elctrns.	303-292-6121
CO	Englewood, Hamilton Avent	303-740-1000
CO	Englewood, Time Elctrns.	303-799-8851
CO	Wheatridge, Bell Inds.	303-424-1985
CT	Bethel, Heilind Elctrns.	203-797-8600
CT	Cheshire, Time Elctrns.	203-271-3200
CT	Danbury, Hamilton Avnet	203-797-2800
CT	Milford, RC Comps.	203-874-0006
FL	Ft. Lauderdale, Hamilton Avnet	305-979-2802
FL	Ft. Lauderdale, Time Elctrns.	305-974-4800
FL	Orlando, Time Elctrns.	305-841-6565
FL	St. Petersburg, Hamilton Avnet	813-576-3930
FL	Winter Pk., Hamilton Avnet	305-628-3888
GA	Atlanta, Electro Air Corp.	404-351-3545
GA	Norcross, Hamilton Avnet	404-447-7500
GA	Norcross, Time Elctrns.	404-448-4448
IL	Bensenville, Hamilton/Avnet	312-860-7700
IL	Chicago, Waldom Elctrns. Inc.	312-585-1212
IL	Crystal Lake, Sub-Sem, Inc.	312-782-3954
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IL	Wood Dale, Time Elctrns.	312-350-0610
IN	Carmel, Hamilton Avnet	317-844-9333
IN	Indianapolis, Gateway Megatech	317-844-3906
IA	Cedar Rapids, Hamilton Avnet	319-362-4757
KS	Overland Pk., Hamilton Avnet	913-888-8900
KY	Lexington, Hamilton Avnet	606-259-1475
LA	Shreveport, Carlton Bates	318-636-9975
MD	Baltimore, Hamilton Avnet	301-995-3500
MD	Columbus, Time Elctrns.	301-964-3090
MD	Savage, Pyttronic Inds.	301-792-0780
MA	Canton, Richey/Impact Elctrns. Ltd.	617-821-1500
MA	Peabody, Hamilton Avnet	617-532-3701
MA	Peabody, Time Elctrns.	617-532-6200
MA	Wilmington, Heilind Elctrns.	617-657-4870
MA	Wilmington, RC Jaco	617-273-1860
MA	Wilmington, SAI	616-657-5700
MI	Ann Arbor, Gateway Megatech	313-761-2980
MI	Grand Rapids, Gateway Megatech	616-243-8805
MI	Livonia, Gateway Megatech	313-522-4700
MI	Troy, Empire Elctrns.	313-585-8130
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Minneapolis, Indl. Comps.	612-831-2666
MN	Minnetonka, Hamilton Avnet	612-932-0600
MO	Earth City, Hamilton Avnet	314-344-1200
MO	St. Charles, Lectronix ... 800-325-3348,314-946-6424	
MO	St. Louis, Time Elctrns.	314-391-6444
NH	Manchester, Hamilton Avnet	603-624-9400
NJ	Camden, Gen. Radio	609-964-8560
NJ	Cherry Hill, Hamilton Avnet	609-424-0100
NJ	Clifton, JMAR Elctrns.	201-772-6400
NJ	Fairfield, Hamilton Avnet	201-575-3390
NJ	Lake Hiawatha, Time Elctrns.	201-316-8644
NM	Albuquerque, Hamilton Avnet	505-765-1500
NY	Buffalo, Summit Dists.	716-887-2800
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Melville, Diplomat Westates	516-454-6334
NY	Melville, S.A.I.	516-293-2710
NY	Rochester, Hamilton Avnet	716-475-9130
NY	Rochester, S.A.I.	716-334-8110
NY	Syracuse, Hamilton Avnet 315-437-2641/2541	
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Raleigh, Hamilton Avnet	919-878-0819
NC	Raleigh, Resco/Raleigh	919-781-5700
OH	Cleveland, Hamilton Avnet	216-831-3500
OH	Columbus, Gateway Megatech	614-447-0222
OH	Dayton, Hamilton Avnet	513-439-6700
OH	Dublin, Time Elctrns.	614-761-1100
OH	Solon, Hamilton Avnet	216-349-5100
OH	Westerville, Hamilton Avnet	614-882-7004
OH	Wickliffe, Gateway Megatech	216-944-5601
OH	Willoughby, Gateway Megatech	800-331-7628, 216-953-0333
OK	Oklahoma City, Carlton Bates	405-691-4446
OK	Tulsa, Carlton Bates	918-250-1626
OK	Tulsa, Hamilton Avnet	918-252-7297
OR	Lake Oswego, Hamilton Avnet	503-635-8157
OR	Portland, Radar Elec.	503-232-3404
OR	Portland, Time Elctrns.	503-684-3780
PA	King of Prussia, Time Elctrns.	215-337-0900
PA	McKean, Advacom	814-476-7774
PA	Montgomeryville, Pyttronic Inds.	215-643-2850
PA	Pittsburg, Hamilton Avnet	412-281-4150
TN	Hixson, Techni-Tronics, Inc.	615-842-0514
TN	Memphis, Carlton Bates	901-365-3539
TN	Nashville, Carlton Bates	615-244-3562
TX	Austin, Hamilton Avnet	512-837-8911
TX	Austin, Kent Elctrns.	512-834-1900
TX	Austin, Time Elctrns.	512-339-3051
TX	Carrollton, Time Elctrns.	214-241-7441
TX	Dallas, Force Elctrns.	214-247-9955
TX	Houston, Force Elctrns.	713-561-8644
TX	Houston, Kent Elctrns.	713-780-7770
TX	Houston, Time Elctrns.	713-530-0800
TX	Irving, Hamilton Avnet	214-550-6111
TX	Irving, Harper S.I.D.	214-621-0500
TX	Richardson, Kent Elctrns.	214-669-2600
TX	Stafford, Hamilton Avnet	713-240-7733
TX	Texarkana, Carlton Bates	214-792-6923
UT	N. Salt Lake City, Integrated Elctrns.	801-298-1869
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Hamilton Avnet	801-972-2800
UT	Salt Lake City, Time Elctrns.	801-973-8181
UT	West Valley, Time Elctrns.	801-973-8181
WA	Bellevue, Hamilton Avnet	206-643-3950
WA	Redmond, Time Elctrns.	206-882-1600
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	New Berlin, Hamilton Avnet	414-784-4510

MOLI ENERGY LIMITED, 3958 Myrtle St., Bunaby, BC, Canada V5C 4G2, Tel: 604-437-6927, TELEX: 04-356708, FAX: 604-437-5195; FSC No.: 6140; Empl.: 160; *Sls. Mgr.:* Mary Connolly; *Dist. Mgr.:* Noulan Bowker

MOLON MOTOR & COIL CORP., 3737 Industrial Ave., Rolling Meadows, IL 60008, Tel: 312-259-8700, TWX: 910-687-0428; Empl.: 350; *Sls. Mgr.:* J. Bailey

MONITOR LABORATORIES, INC., 10180 Scripps Ranch Blvd., San Diego, CA 92131, Tel: 619-578-5060, TELEX: 182794; Empl.: 96; *Sls. Mgr.:* Paul Stenberg

FAX: 619-434-0255

MONITOR PRODUCTS CO., INC., 502 Via Del Monte, Oceanside, CA 92054, Tel: 619-433-4510, ESYLNK: 629 5085; FSC No.: 54331; Empl.: 65; *Sls. Mgr.:* Matthew J. Mulvihill; *Dist. Mgr.:* Matthew J. Mulvihill ..... **A•1426-1427**

Local Sales Offices & Reps

AL	Huntsville, CSR Elctrns.	205-533-2444
AZ	Phoenix, Eltron	602-266-2164
CA	Los Angeles, Monitor Prods. Co.	619-433-4510
CA	Mountain View, Straube Assocs.	415-969-6060
CA	Orange County, Monitor Prods. Co.	618-433-4510
CO	Aurora, Electrodyne	303-695-8903
CT	Bloomfield, Zaslow Sls., Inc.	203-242-7781
FL	Apopka, Tech Rep Assocs.	813-576-9900
FL	Ft. Lauderdale, Tech Rep Assocs.	813-576-9900
FL	Lake Worth, Tech-Rep Assocs.	813-576-9900
FL	St. Petersburg, Tech-Rep Assocs.	813-576-9900
GA	Atlanta, CSR Elctrns.	404-396-3720
MA	Westboro, Zaslow Sls., Inc.	617-393-8150
MN	Eden Prairie, Elctrn. Innovators	612-941-0830
NY	Fayetteville, C. W. Floring & Assocs.	315-637-4552
NY	Poughkeepsie, C. W. Floring & Assocs.	914-471-2973
NY	Scottsville, C. W. Floring & Assocs.	716-889-4614
NC	Raleigh, CSR Elctrns.	919-878-9200
PA	Gladwyne, J. S. Wurts Co.	215-649-6300
TN	Knoxville, CSR Elctrns.	615-673-0222
TX	Austin, Mil-Rep Assocs.	512-346-6331
TX	Houston, Mil-Rep Assocs.	713-444-2557
TX	Richardson, Mil-Rep Assocs.	214-644-6731

Local Distributors

AL	Huntsville, Component Distrs., Inc.	205-883-7501
AL	Huntsville, Resistacap, Inc.	205-883-4270
AZ	Tempe, Harper SID	602-967-1464
AR	Little Rock, Component Distrs., Inc.	501-227-6305
CA	Compton, Harper SID	213-979-5090
CA	San Diego, Harper SID	619-560-8545
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Sherman Oaks, Delay Line Distrs.	818-986-9455
CA	Sunnyvale, Harper SID	408-747-0333
CA	Tustin, Added Value Elctrns.	714-259-8258
CO	Wheatridge, Added Value Elctrn.	303-422-1701
FL	Ft. Lauderdale, Component Distrs., Inc.	305-723-8874
FL	Melbourne, Rome Elctrns.	305-242-8151
GA	Norcross, Component Distrs., Inc.	404-441-3320
IL	Bensenville, Voyager Elctrns.	312-773-4900
MA	Hudson, DSC, Inc.	617-562-6920
MN	Fridley, Voyager Elctrns.	612-571-7766
NY	Johnson City, Help Elctrns.	607-729-3528
NC	Greensboro, Golden Elctrns.	919-294-4653
TX	Dallas, Component Distrs., Inc.	214-644-0373
TX	Fort Worth, C & W Supply	817-831-0395
TX	Richardson, Harper SID	214-235-3177
VA	Falls Church, Component Distrs., Inc.	703-241-8227

MONOLITHIC SYS., 84 Inverness Circle E., Englewood, CO 80112, Tel: 303-790-7400, TELEX: 45-4498; Empl.: 100; *Sls. Mgr.:* Mike Hart

MONSANTO CO., 800 N. Lindbergh Blvd., St. Louis, MO 63167, Tel: 314-694-1000, TELEX: 44-7282; Empl.: 50,000

MONTEK MICROSYSTEMS, P.O. Box 1845, Huntsville, AL 35807, Tel: 205-723-2927; *Sls. Mgr.:* Paul Rainosek; *Dist. Mgr.:* Paul Rainosek

MOODY TOOLS, INC., 43 Crompton Ave., E. Greenwich, RI 02818, Tel: 401-885-0911; Empl.: 11; *Sls. Mgr.:* J. H. Moody; *Dist. Mgr.:* D .H. Moody

J. L. MOON & COMPANY, 11323 East 20 Street, Tulsa, OK 74128, Tel: 918-234-6330; Empl.: 5; *Sls. Mgr.:* Karen Moon; *Dist. Mgr.:* Karen Duggan

MORRIS, J. I., CO., 372 Elm St., Southbridge, MA 01550, Tel: 617-764-4394, FAX: 617-764-7350; FSC No.: 95548; Empl.: 30

MORRIS ENTERPRISES, 16799 Schoenborn St, Sepulveda, CA 91343, Tel: 818-894-9103, TELEX: 6-74681, TWX: 910-496-1525; FSC No.: 54918; Empl.: 50; *Sls. Mgr.:* J. Dumpert

MORS TECHNOLOGIES INC., Mors Group-France, 3430 Griffith, St. Laurent, Quebec, Canada H4T 1A7, Tel: 514-735-4411, TELEX: 05-824132, FAX: 514-735-8000; *Sls. Mgr.:* Christian Acard; *Dist. Mgr.:* Christian Acard

MOTION CONTROL DEVICES, An EG & G Torque Systems Co., 80 Stedman St., Lowell, MA 01851, Tel: 617-454-3407, FAX: 617-924-0254; Empl.: 25; *Sls. Mgr.:* Carl M. Pauli

MOTION CONTROL GROUP, American Precision Industries, 3229 Roymar Rd., Oceanside, CA 92054, Tel: 619-439-7500, TELEX: 18-1196; FSC No.: 32423; Empl.: 100; *Sls. Mgr.:* Andrew Boyer

MOTION SENSORS, INC., 12 Park Street, Cranford, NJ 07701, Tel: 201-925-3553; Empl.: 6; *Sls. Mgr.:* Arthur Bergman

MOTOROLA CERAMIC PRODUCTS, Components Division, 4800 Alameda Blvd. N.E., Albuquerque, NM 87113, Tel: 505-822-8801, TELEX: 4999100; Empl.: 250; *Sls. Mgr.:* Tom Gilder

MOTOROLA INC., Auto. & Indl. Elctrns. Grp., 1299 E. Algonquin Rd., Schaumburg, IL 60196, Tel: 312-576-4850, TELEX: 4999036 MOT APD; *Sls. Mgr.:* Jay A. Bonk

MOTOROLA, INC., Compt. Divs. Clock Oscillator Dept., 2553 N. Edgington, Franklin Park, IL 60131, Tel: 312-451-1000, TELEX: 4990104, TWX: 910-255-4619; Empl.: 1400; *Sls. Mgr.:* Ed Feldman

MOTOROLA MICROELECTRONICS DIV., 8000 W. Sunrise, Ft. Lauderdale, FL 33322

MOTOROLA SEMICONDUCTOR PRODS. SECTOR, 3102 North 56th Street, Phoenix, AZ 85018-6606, Tel: 602-244-6900, TWX: 910-951-1334, FAX: 602-952-4002; FSC No.: 04713; *Sls. Mgr.:* Brian Hilton; *Dist. Mgr.:* Bruce Brammer

MOTOR TECHNOLOGY, INC., 2798 Culver Ave., Dayton, OH 45429, Tel: 513-294-1041, FAX: 513-294-8336; Empl.: 35 ..... **B•1239-1241**

Local Sales Offices & Reps

OH	Dayton, Motor Technology, Inc.	513-294-1041

MOTOR-TRONICS, INC., 2142 Industrial Ct., Bldg. 'F', Vista, CA 92083, Tel: 619-727-7430; *Sls. Mgr.:* Bill Linko

MOTRONICS CORP., 15 Industrial Park, Little Falls, NY 13365, Tel: 315-823-4050; Empl.: 90; *Sls. Mgr.:* Otto Demuth

MOUSER ELECTRONICS, 11433 Woodside Ave., Santee, CA 92071, Tel: 619-449-2222, TWX: 910-331-1175; Empl.: 200; *Sls. Mgr.:* J. L. Kahler

MOUSER ELECTRONICS, 2401 Hwy. 287 North, Mansfield, TX 76063, Tel: 817-483-4422, TWX: 510-601-0375; Empl.: 200; *Sls. Mgr.:* D. L. Niedecken

MOXNESS PRODUCTS, INC., Versa Technologies, 1914 Indiana St., Racine, WI 53405, Tel: 414-554-5050, 800-558-5706, FAX: 414-554-2321; Empl.: 300; *Sls. Mgr.:* Thomas D. Hynes; *Dist. Mgr.:* Thomas D. Hynes

MPB CORP., Miniature Precision Bearings Div., Precision Park, Keene, NH 03431, Tel: 603-352-0310, TWX: 710-366-1801; Empl.: 1600; *Dist. Mgr.:* R. F. Chartier

MPB CORPORATION, Split Ballbearing Division, Highway 4, Lebanon, NH 03766

MPC, Div. of Consulting Systems, RFD No. 1, Box 441, Fremont, NH 03044, Tel: 603-642-5913, FAX: 603-642-5913; *Sls. Mgr.:* W. Morse ..... **D•1848**

Local Distributors

TN	Knoxville, Indl. Elctrns.	615-573-7135

MPI, 4426 S. Century Dr., Salt Lake City, UT 84107, Tel: 800-821-8848; *Sls. Mgr.:* Jamie Johnston

MSC TECHNOLOGIES, INC., 2600 San Tomas Expressway, Santa Clara, CA 95051, Tel: 408-988-0211, TELEX: 467848; *Sls. Mgr.:* David Witkowski; *Dist. Mgr.:* Alan Pettit

MSI DATA CORP., 340 Fischer Ave., Costa Mesa, CA 92626, Tel: 714-549-6000, TWX: 910-595-1719; Empl.: 700; *Sls. Mgr.:* Jack Bertch; *Dist. Mgr.:* Janis Agopran

MSI ELECTRONICS, INC., 34-32 57th St., Woodside, NY 11377, Tel: 718-672-6500, TELEX: 426407, FAX: 718-397-0972; FSC No.: 18518; Empl.: 22; *Sls. Mgr.:* A. Lederman

Local Sales Offices & Reps

AZ	Glendale, Fetty/Schoenduve	602-241-9009
CA	San Diego, Fetty/Schoenduve	619-292-5136
CA	El Segundo, Fetty/Schoenduve	213-322-4991
CA	Palo Alto, Tri-Rep	415-965-1822
FL	Lighthouse Pt., R. C. Simon & Co.	305-941-2757
FL	Riverview, R. C. Simon & Co.	813-689-1947
IL	McHenry, Mesa, Inc.	815-344-2820
IN	Ft. Wayne, Menze Sls. Inc.	219-747-5616
MD	Laurel, CSDS Inc.	301-490-3800
MA	Framingham, Stone Comp. Sls.	617-875-3266
PA	Elkins Park, Arnold Assocs.	215-887-7870
TX	Richardson, Eagle Mktg. Inc.	214-238-5358

MTE CORP., 7901 W. Clinton Ave., P.O. Box 23957, Milwaukee, WI 53223, Tel: 414-358-5300; *Sls. Mgr.:* T. Kettner

MTI TECHNOLOGY CORPORATION, 6385 Rose Lane, Carpinteria, CA 93013, Tel: 805-684-6676, FAX: 805-684-6319; *Sls. Mgr.:* William Henrikson

FAX: 605-665-1709

M-TRON INDUSTRIES, P.O. Box 630, E. Hwy. 50, Yankton, SD 57078, Tel: 605-665-9321, TWX: 910-668-3603; FSC No.: 23875; Empl.: 110; *Sls. Mgr.:* S. D. Sinkler ..... **A•1428-1429**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Phoenix, Howe & Howe Sls., Inc.	602-264-7971
CA	San Diego, Bestronics	619-693-1111
CA	Sunnyvale, Electec Sls. Inc.	408-747-1722
CA	Thousand Oaks, SC Cubed	805-496-7307
CA	Tustin, SC Cubed	714-731-9206
CO	Littleton, Simpson Assoc.	303-794-8381
CT	Broad Brook, Comptech	203-623-8014
CT	Torrington, Phoenix Sls.	203-496-7709
FL	Ft. Lauderdale, QXI of Florida	305-978-0120
FL	Orlando, QXI of Florida	813-894-4556
FL	St. Petersburg, QXI of Florida	813-894-4556
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Arlington Hgts., Micro Sls.	312-956-1000
IN	Ft. Wayne, Alpha Tech, Inc.	219-447-0040
IA	West Des Moines, SPS Assoc.	515-225-0607
KS	Olathe, SPS Assoc.	913-764-4460
MD	Hunt Valley, Eagle Sls.	301-666-3930
MA	Tyngsboro, Comptech, Inc.	617-649-3030
MI	Detroit, Rathsburg Assoc.	313-559-9700
MN	Eden Prairie, Com-Tek Sls.	612-941-7181
MS	Corinth, Hughes Assocs. Inc.	601-287-2915
MO	Earth City, SPS Assoc.	314-291-0520
NE	Panama, SPS Assoc.	913-764-4460
NJ	E. Brunswick, Winch Sls. Assocs.	201-613-1515
NJ	Marlton, Naudain Assoc., Inc.	609-983-5300
NM	Albuquerque, Syntech	505-266-7951
NY	Pittsford, James E. Zimmerman Sls.	716-381-3186
NY	Plainview, Winch Sls. Assocs.	516-681-3163
NC	Matthews, ADI	704-847-4323
NC	Smithfield, ADI	919-934-8136
OH	Dayton, Lyons Corp.	513-278-0714
OH	Richfield, Lyons Corp.	216-659-9224
OH	Westerville, Lyons Corp.	614-895-1447
TX	Austin, Texoma Tech. Sls.	512-331-4694
TX	Freeport, Texoma Tech. Sls.	409-233-8192
TX	Houston, Texoma Tech. Sls.	713-462-1432
TX	Lewisville, Texoma Tech. Sls.	214-324-8097
UT	Midvale, Simpson Assoc.	801-566-3691
WA	Redmond, Quadra Sls.	206-883-3550
WI	Menominee, Micro Sales Inc.	414-251-0151
Can	Mississaqua, Ontario, John Weiss Co.	416-673-0011
Can	Nepean, Ontario, John Weiss Co.	613-825-0545
Can	St. Laurent, Quebec, John Weiss Co.	514-377-5022
Can	Vancouver, B. C., John Weiss Co.	604-873-1112

Local Distributors

AL	Huntsville, Bell Inds.	205-837-1074
AL	Huntsville, Pioneer Elctrns.	205-837-9300
AZ	Phoenix, Sterling Elect.	602-268-2121

AZ	Phoenix, Wyle Distr. Grp.	602-866-2888
AZ	Tempe, Bell Inds.	602-966-7800
AR	Little Rock, Carlton-Bates	501-562-9100
CA	Agoura, Image Elctrns.	818-707-0911
CA	Calabasas, Wyle Labs.	818-880-9000
CA	El Segundo, Wyle Labs.	213-322-8100
CA	Fullerton, Pyramid Elctrns.	714-773-0781
CA	Garden Grove, Bell Inds.	714-895-7801
CA	Gardena, Bell Inds.	213-515-1800
CA	Irvine, Wyle	714-863-9953
CA	Los Angeles, Bell Inds.	213-826-6778
CA	Orange, Ryno Elctrns.	714-637-0200
CA	Rancho Cordova, Wyle	916-638-5282
CA	Sacramento, Bell Inds.	916-969-3100
CA	San Diego, Bell Inds.	619-268-1277
CA	San Diego, Ryno Elctrns.	619-453-8430
CA	San Diego, Wyle	619-565-9171
CA	San Jose, Compass Comps.	408-432-7525
CA	Santa Clara, Pyramid	408-727-9810
CA	Santa Clara, Wyle Distr. Grp.	408-727-2500
CA	Stanton, Inductive Comp/Crystal	714-828-3420
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	805-499-6821
CA	Tustin, Image Elctrns.	714-259-0900
CO	Englewood, Sterling Elctrns.	303-796-7338
CO	Thornton, Wyle Distr. Grp.	303-457-9953
CO	Wheatridge, Bell Inds.	303-424-1985
CT	E. Haven, J. V. Elctrns.	203-469-2321
CT	Norwalk, Pioneer Elctrns.	203-853-1515
CT	Wallingford, Mid-State Elect.	203-265-9900
FL	Altamonte Springs, Pioneer	305-834-9090
FL	Deerfield Bch., Bell Inds.	305-421-1997
FL	Deerfield Beach, Pioneer Elctrns.	305-428-8877
FL	Ft. Lauderdale, Reptron Elctrns.	305-735-1112
FL	Largo, Bell Inds.	813-541-4434
FL	Tampa, Reptron Elctrns.	813-855-4656
GA	Norcross, Bell Inds.	404-662-0923
GA	Norcross, Pioneer Elctrns.	404-448-1711
GA	Norcross, Reptron Elctrns.	404-446-1300
IL	Elk Grove, Pioneer Elctrns.	312-437-9680
IL	Elk Grove VL, Bell Inds.	312-640-1910
IL	Schamberg, Reptron Elctrns.	312-882-1700
IL	Urbana, Bell Inds.	217-328-1077
IN	Ft. Wayne, Bell Inds.	219-423-3422
IN	Indianapolis, Advent	317-872-4910
IN	Indianapolis, Bell Inds.	317-875-8200
IN	Indianapolis, Pioneer/IN	317-849-7300
IA	Cedar Rapids, Advent	319-363-0221
IA	Cedar Rapids, Bell Inds.	319-395-0730
KS	Lenexa, Pioneer Elctrns.	913-492-0500
MD	Baltimore, Resco Washington	301-529-0500
MD	Beltsville, Resco/Wash.	301-937-9100
MD	Gaithersburg, Pioneer	301-921-0660
MA	Billerica, A. W. Mayer Co. Inc.	617-229-2255
MA	Lexington, Pioneer Elctrns.	617-861-9200
MA	Wilmington, J.V. Elctrns.	617-657-6523
MA	Winchester, Bell Inds.	617-729-5800
MI	Ann Arbor, Bell Inds.	313-971-9093
MI	Farmington Hills, Advent Elec.	313-477-1650
MI	Grand Rapids, Pioneer Elctrns.	616-698-1800
MI	Livonia, Pioneer Elctrns.	313-525-1800
MN	Bloomington, All American	612-884-2220
MN	Hibbing, Minntech Elctrns.	218-262-5228
MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Minneapolis, Stark Elec.	612-332-1325
MN	Minnetonka, Pioneer	612-935-5444
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	St Louis, Ric-tronics	314-576-9816
NH	Judson, Bell Inds.	603-882-1133
NH	Nashua, Brevan Elctrns.	603-889-7230
NJ	Berlin, GCI	609-768-6767
NJ	Mt. Laurel, P.A.C. Elctrns.	609-234-1940
NJ	Pinebrook, Pioneer Elctrns.	201-575-3510
NM	Albuquerque, Bell Inds.	505-292-2700
NM	Albuquerque, Sterling Elect.	505-884-1900
NY	Binghamton, Pioneer Elctrns.	607-748-8211
NY	Bohemia, Key Comps. Inc.	516-567-7500
NY	Fairport, Pioneer	716-381-7070
NY	Long Island, Bell Inds.	516-752-9303
NY	Stony Brook, Dove Elctrns.	516-689-7733
NY	Woodbury, Pioneer Elctrns.	516-921-8700
NC	Charlotte, Pioneer Elctrns.	704-527-8188
NC	Raleigh, Century Elctrns.	919-782-2116
NC	Raleigh, QC Southeast Inc.	919-876-7767
OH	Cleveland, Pioneer Elctrns.	216-587-3600
OH	Dayton, Bell Inds. (Industrial)	513-435-8660
OH	Dayton, Bell Inds. (Military)	513-434-8231
OH	Dayton, Pioneer Elctrns.	513-236-9900
OH	Worthington, Reptron	614-436-6675
OK	Oklahoma City, Radio Inc.	405-789-0741
OK	Tulsa, Altair	918-252-5781
OK	Tulsa, Radio Inc.	918-587-9123
OR	Hillsboro, Wyle Distr. Grp.	503-640-6000
OR	Lake Oswego, Bell Inds.	503-241-4115
PA	Horsham, Pioneer Elctrns.	215-674-4000
PA	Norristown, Century Elec.	215-631-5400
PA	Pittsburgh, Pioneer Elctrns.	412-782-2300
TN	Nashville, Bell Inds.	615-367-4400
TX	Austin, Altair	512-837-4970
TX	Austin, Pioneer	512-835-4000
TX	Austin, Wyle Distr.	512-834-9957
TX	Dallas, Pioneer Elctrns.	214-386-7300
TX	Houston, Altair	713-462-3029
TX	Houston, Pioneer	713-988-5555
TX	Houston, Wyle Laboratories	713-879-9953
TX	Richardson, Altair	214-231-5166
TX	Richardson, Bell Inds.	214-690-0466
TX	Richardson, Wyle Electric	214-235-9953
UT	Salt Lake City, Bell Inds.	801-972-6969
UT	Salt Lake City, Standard Supp.	801-486-3371
UT	Salt Lake City, Wyle Distr. Grp.	801-974-9953
VA	Richmond, Sterling Elctrns.	804-226-2190
VA	Sterling, Sterling Elctrns.	703-450-2373
WA	Bellevue, Bell Inds.	206-747-1515
WA	Bellevue, Wyle Distr. Grp.	206-453-8300
WA	Kent, Pyramid Elec.	206-872-5800
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Milwaukee, Marsh Elect.	414-475-6000
WI	Waukesha, Bell Inds.	414-547-8879
Can	Burnaby, BC, R A E Ltd.	604-291-8866
Can	Burnaby, BC, R-A-E Ltd / Camgaard	604-291-8866
Can	Calgary, Alberta, Future	403-235-5325
Can	Calgary, AB, Cardinal Elec. Ltd.	306-934-3443
Can	Calgary, AB, Saynor Varah	403-255-9550
Can	Dartmough NS, R A E Ltd.	902-465-2350
Can	Dartmouth, N. S., Saynor Varah	902-465-2322
Can	Downsvie, Ont., R A E Ltd.	416-736-1750
Can	Downsview, Ont., Future	416-638-4771
Can	Edmonton, Alberta, Future	403-438-2858
Can	Edmonton, AB, R A E Ltd.	403-451-4001
Can	Edmonton, AB, Saynor Varah	403-461-2222
Can	Edmonton, ALB., Cardinal Elec.	403-483-6266
Can	Moncton, NB, R A E Ltd.	506-855-2200
Can	Montreal, Que., Versatech	514-481-0196
Can	Nepeon, Ont., Saynor Varah	613-726-8884
Can	Oakville, ONT., Saynor Varah	416-842-8484
Can	Ottawa, Ont., Future	613-820-8313
Can	Pointe Claire, Que., Future	514-694-7710
Can	Saskatoon, SK, Cardinal Elec. Ltd.	306-934-3443
Can	Saskatoon, SK, R A E Ltd.	306-933-2888
Can	Vancouver, B.C., Future	604-294-1166
Can	Vancouver, BC, Saynor Varah	884-873-3211
Can	Willowdale, Ontario, Electro Sonic	416-494-1666
Can	Winnipeg, MN, R A E Ltd.	204-786-8401
Can	Winnipeg, MN, Saynor Varah	204-633-6190

MTS SYSTEMS, Box 24012, Minneapolis, MN 55424, Tel: 612-937-4000, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 1200; *Sls. Mgr.:* Ted Beaudoin

MU-DEL ELECTRONICS, INC., 2426 Linden Lane, Silver Spring, MD 20910-1288, Tel: 301-587-6087, TELEX: 292038; FSC No.: 31563; Empl.: 8; *Sls. Mgr.:* Heinz E. Blum

MUELLER ELEC. CO., 1583 E. 31st St., Cleveland, OH 44114, Tel: 216-771-5225, FAX: 216-771-3068; Empl.: 156; *Sls. Mgr.:* J. E. Wisneski ..... **C•1468-1473**

Local Sales Offices & Reps

AZ	Phoenix, The Heath Grp.	602-248-9091
CA	Gardena, Ungar Sls. Assocs.	213-532-6837
CA	Mountainview, Del Bucchia/Onken	415-965-8045
FL	Pensacola, Mfg. Sls. & Mktg.	904-479-7472
GA	Buckhead, Mfg. Sls. & Mktg.	404-342-3503
IL	Bensenville, Heighway Tech. Sls.	312-860-7900
IN	Indianapolis, M & L Elctrns.	317-359-4742
MD	Randallstown, Chesapeake Inds.	301-922-5997
MA	Adams, Richard W. Bieniek Assocs.	413-743-4164
MA	Lynnfield, Keene Sls. Co.	617-245-9400
MA	Scituate, Olsen Tech. Sls.	617-878-9386
MA	Springfield, Keene Sls. Co.	413-525-1049
MI	Royal Oak, Hilltronics	313-435-0920
MN	Minneapolis, Boerger & Assocs.	612-561-2819
MS	Hattiesburg, Mfg. Sls. & Mktg.	601-264-4755
NJ	Clifton, R.O.I. Sls. Co.	201-340-1515
NJ	Medford, Champion Elctrns.	609-983-0932
NY	Rochester, Richard W. Bieniek	716-342-3098
OH	Cleveland, James Erwin	216-771-5225
OR	Portland, Jud Lebrun Co.	503-244-6805
PA	Pittsburgh, F. P. Yarussi Co.	412-221-1717
TN	Memphis, Mfg. Sls. & Mktg.	901-377-5382
TX	Austin, SW Mktg. Assocs.	512-442-8715
TX	Dallas, SW Mktg. Assocs.	214-341-8631
TX	Houston, SW Mktg. Assocs.	713-537-8166
EXP	Tecnolink Elctrns. Co.	216-543-7710
Can	Markham, Ont., Birde Mktg. Inc.	416-477-7722

MULTI-AMP CORP., TBG, 4271 Bronze Way, Dallas, TX 75237, Tel: 214-333-3201, TELEX: 163548 MULAM DL, FAX: 214-333-3533; Empl.: 350; *Sls. Mgr.:* Robert D. Libbey

MULTICORE SOLDERS, Cantiague Rock Rd., Westbury, NY 11590, Tel: 516-334-7997, TWX: 510-222-5185; Empl.: 1000

MULTI PRODUCTS INTERNATIONAL, 218 Little Falls Rd., P.O. Box 238, Cedar Grove, NJ 07009, Tel: 201-239-8183, TELEX: 219289, FAX: 201-239-8449; Empl.: 25; *Sls. Mgr.:* LeRoy Gray ..... **A•1135, 2298-2299; D•1849-1851**

Local Sales Offices & Reps

CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Westminster, West Elctrn. Sls.	714-898-0120,
UT	Ogden, Taylor Mktg.	801-546-9570,
FL	Longwood, Elctrn. Mfgs. Agt.	305-682-1202,
GA	Lawrenceville, Tek Rep Mktg.	404-963-1600
IL	Des Plaines, Esco Assocs.	312-298-5310
IN	Frankfort, C-S Elctrns. Sls.	317-659-1874
KS	Overland Park, Electri-Rep	913-649-2168
MD	Ellicott City, Eastern Tech. Corp.	301-461-7720
MA	Norwood, Mac Innis Co.	617-762-8090
MI	Lathrup VL, R. C. Nordstrom & Co.	313-559-7373
MN	St. Paul, Proud Inds.	612-646-9428
NJ	Cedar Grove, Legtonics Assocs.	201-239-4098
NY	Fairport, Hi Tec Sls.	716-223-5922,
OH	Columbus, McFadden Sls.	614-459-1280
TX	Dallas, MGR Elctrns.	214-238-5246
WA	Bellevue, Eltech	206-643-4330
Can	Lachine, Bytewide Mktg.	514-636-4121

MULTI-TECH SYSTEMS, INC., 82 Second Ave. S.E., New Brighton, MN 55112, Tel: 612-631-3550, 800-328-9717, TWX: 910-563-3610, FAX: 612-631-3575; Empl.: 145; *Sls. Mgr.:* Thomas Heimerman; *Dist. Mgr.:* Peter Hanlon/Jan Hubbard

MULTIWIRE DIVISION, Kollmorgen Corp., 250 Miller Place, Hicksville, NY 11801, Tel: 516-933-8300, TWX: 510-223-0639; Empl.: 500; *Sls. Mgr.:* Frank Melaccio

MULTIWIRE NE, Kollmorgen, 41 Simon St., Nashua, NH 03061, Tel: 603-889-0083; FSC No.: 60490; Empl.: 165; *Sls. Mgr.:* Paul Lavigne

MUPAC®
IC PACKAGING SYSTEMS

FAX: 508-588-0498

MUPAC, 10 Mupac Dr., Brockton, MA 02401, Tel: 508-588-6110; Empl.: 130; *Sls. Mgr.:* James L. Gallagher ..... **C•1732-1733**

Local Sales Offices & Reps

AL	Huntsville, Macro Mktg. Assocs., Inc.	205-883-9630
AZ	Tempe, Piper Sls.	602-949-0048
AR	Richardson, Lear Assocs., Inc.	214-231-5388
CA	Burbank, Gemini Assocs.	818-846-2633
CA	Los Alamitas, Gemini Assocs.	213-594-9618
CA	San Diego, Hadden Assocs. Inc.	619-565-9444
CA	Santa Clara, Interconnect Sls. Grp.	408-980-1166
CA	Sepulveda, Gemini Assocs.	818-891-1000
CA	Sunnyvale, Computer Modules	408-737-7727
CA	Tustin, Gemini Assocs.	714-838-1675
CA	West Covina, Mupac - West Coast Off.	213-960-3042
CO	Longmont, Piper Sls. Co.	303-443-5337
FL	Jupiter, Southern Elctrns. Sls. Co.	305-744-0028
GA	Norcross, Macro Mktg. Assocs.	404-662-5580
IL	Hoffman Estates, Micro-Tex, Inc.	312-382-3001
IN	Batesville, Applied Data Mgt.	317-257-8949
MD	Baltimore, Rep-Tron	301-799-7490
MI	Whitmore Lake, Applied Data Mgt.	313-965-5859
MN	Minneapolis, L. F. Green Assoc.	612-571-6666
NM	Albuquerque, Piper Sls. Co.	505-883-9090
NY	Great Neck, F & F Metro, Inc.	516-482-4080
NY	Syracuse, Labtronics	315-455-7314
OH	Cincinnati, Applied Data Mgt.	513-579-8108
PA	Norristown, RJI	215-631-1414
PA	Pittsburgh, Applied Data Mgt.	412-642-4202
TX	Houston, Lear Assoc.	713-488-7893
TX	Richardson, Lear Assocs.	214-231-5388
TX	Seagoville, Delta Comps.	214-287-6333
UT	Salt Lake City, Piper Sls.	801-466-9336
WA	Bellevue, Comtec	206-453-1188
WI	Waukesha, Micro-Tex, Inc.	414-542-5352

Local Distributors

CT	Wallingford, Sager Electrical Supp. Co.	203-265-4600
MA	Hingham, Sager Electrical Supp. Co.	617-749-6700

muRata ERIE

FAX: 404-436-3030

MURATA ERIE NORTH AMERICA, INC., 2200 Lake Park Dr., Smyrna, GA 30080, Tel: 404-436-1300, TELEX: 54-2329, TWX: 810-766-1531; Empl.: 1800; *Sls. Mgr.:* Jack Driscoll; *Dist. Mgr.:* Kenneth O'Connor ..... **A•1136-1140, 1430-1431, 1675-1676, 1838, 1976-1977, 2090-2092; B•1899; D•1040-1042**

Local Sales Offices & Reps

AL Madison, Jack Harvey & Assocs. 205-461-8591
AZ Scottsdale, American Mktg. Reps., Inc. 602-948-2778
AZ Scottsdale, Murata Erie N. America ... 602-941-2667
CA El Toro, English/Damco Sls. 714-837-3801
CA Los Altos, Recht. Assocs. 415-964-6321
CA San Diego, Murata Erie North America, Inc 619-259-1055
CA Santa Ana, Murata Erie North America 714-835-4822
CA Santa Clara, Murata Erie N. America, Inc. 408-496-0177
CO Longmont, Luscombe Engrg. Co. 303-772-3342
FL Clearwater, Glen White Assocs. 813-726-0577
FL Ft. Lauderdale, Glen White Assocs. ... 305-977-5885
FL Maitland, Murata Erie North America, Inc. 407-644-0954
GA Norcross, Jack Harvey & Asssocs. 404-449-4643
IL Park Ridge, Metcom Assocs 312-696-1490
IL Schaumburg, Murata Erie North America, Inc. 312-397-0099
IN Indianapolis, Jack Harvey & Assocs. .. 317-872-1031
IN Kokomo, Jack Harvey & Assocs., Inc. 317-453-4260
IA Cedar Rapids, C-Tron Inc. 319-373-2029
KS Olathe, C-Tron, Inc. 913-829-0073
KY Prospect, Jack Harvey & Assocs. 502-228-4100
MD Baltimore, Glen White Assocs. 301-321-7235
MD Columbia, Murata Erie North America 301-992-6612
MA North Adams, Jack Harvey & Assocs 413-664-9993
MA Wakefield, Murata Erie North America 617-245-7880
MA Westwood, Apex Assocs. 617-326-5042
MI W. Bloomfield, Jack Harvey & Assocs. 313-737-9122
MN Minneapolis, Stan Clothier Co., Inc. 612-944-3456
MO St. Charles, C-Tron, Inc. 314-928-8078
NJ Springfield, Radix, Inc. 201-467-4970
NY Syracuse, Rep. Tech, Inc. 315-437-2845
NC Raleigh, Glen White Assocs 919-848-1931
OH Dayton, K W Elctrn. Sls., Inc. 513-890-2150
OR Beaverton, Murata Erie North America 503-646-4973
PA Allison Pk., K W Elctrn. Sls., Inc. 412-487-4300
TN Knoxville, Jack Harvey & Assocs., Inc. 615-524-7057
TX Austin, Murata Erie North America, Inc. 512-343-9484
TX Richardson, Murata Erie North America 214-238-8211
VA Lynchburg, Glen White Assocs. 804-525-1993
WA Bellevue, Murata Erie North America 206-454-9699
WI West Allis, Metcom Assocs. 414-476-1300
Can Mississuaga, Ont., Gidden Morton Assocs. 416-671-8111
Can Nepean, Ont., Gidden Morton Assocs. 613-726-0844
Can St. Laurent, Que., Gidden Morton Assocs. 514-335-9572

Local Distributors

AL Huntsville, Time Elctrns. 205-721-1133
AZ Phoenix, Cetec-Future 602-268-2121
AZ Tempe, Acacia Sls. 602-894-2874,602-882-9054
AZ Tempe, Time 602-967-2000
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Cetec-Future 818-700-0914
CA Chatsworth, Passive Technlg. 818-882-2277
CA Chatsworth, Time Elctrns. 818-998-7200
CA Garden Grove, Natl. Elctrns. Corp. 714-892-7749
CA Inglewood, Newark Elctrns. 213-671-7377
CA Irvine, Acacia Sls. 213-971-2428,714-660-0834
CA Irvine, Cetec-Future 714-250-4141
CA San Diego, Acacia Sls. 619-565-4365
CA San Diego, Cetec-Future 619-278-5020
CA San Diego, Time Elctrns. 619-586-1331
CA San Jose, Cetec-Future 408-434-1114
CA San Jose, Future Elctrns. 408-434-1122
CA San Jose, Passive Technlg. Sls. 408-435-5566
CA Sunnyvale, Acacia Sls. .. 408-745-7200,916-442-5300
CA Sunnyvale, Capsco 408-734-3020
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Denver, Newark Elctrns. 303-423-7941
CO Englewood, Sterling Elctrns. 303-796-7338
CO Englewood, Time Electrns. 303-799-8851
CO Lakewood, Acacia Sls. 303-232-2882
CO Westminster, Future Elctrns. 303-650-0123
CT Cheshire, Time Elctrns. 203-271-3200
CT Orange, Milgray Elctrns. 203-795-0711
CT Wallingford, Cronin Elctrns. 203-265-3134
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Time Elctrns. 407-841-6565
FL Tampa, Pass Tech 813-623-1935
FL Winter Park, Milgray Elctrns. 305-647-5747
GA Norcross, Milgray Elctrns. 404-446-9777
GA Norcross, Spectrum Elctrns. 404-448-1516
GA Norcross, Time Elctrns. 404-448-4448
IL Bensenville, Milgray Elctrns. 312-350-0490
IL Chicago, Newark Elctrns. 312-784-5100
IL Elk Grove Vl., Goold Elctrns. Corp. 312-593-3220
IL Rosemont, Advent Elctrns. 312-297-6200
IL Wooddale, Time 312-350-0610
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. Inc. 319-363-0221
KS Overland Park, Milgray Elctrns. 913-236-8800
KS Overland Pk., Sterling Elctrns. 913-236-5589
MD Beltsville, Resco (Washington) 301-937-9100
MD Columbia, Milgray Elctrns. 301-621-8169
MD Columbia, Time Elctrns. 301-964-3090
MD White Marsh, Resco (Baltimore) 301-529-0500
MA Hopkinton, Interface Elctrns. Corp. 617-435-6858
MA Needham, Cronin Elctrns. 617-449-5000
MA Peabody, Time 617-532-6200
MA Wilmington, Milgray Elctrns. 617-657-5900
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CA Costa Mesa, Phase II Technlg. 714-556-4760
CA Cupertino, NEC Elctrns., Inc. 408-446-0650
CA San Diego, Mission Technlg. 619-587-0288
CA San Jose, Exis 408-287-6680
CA Santa Ana, NEC Elctrns., Inc. 714-546-0501
CA Woodland Hills, NEC Elctrns., Inc. 818-716-1535
CO Boulder, Promotional Technlg. 303-447-9181
CO Englewood, NEC Elctrns., Inc. 303-694-0041
CT Torrington, Datatrack Engrg. 203-482-6774
FL Altamonte Springs, V.G. Sls. Co., Inc. .. 305-831-8688
FL Ft. Lauderdale, Nec Elctrns., Inc. 305-776-0682
FL Largo, V.G. Sls. Co., Inc. 813-584-2246
FL Pompano Beach, V.G. Sls. Co., Inc. 305-971-0900
GA Norcross, Glenn White Assocs. 404-441-1447
GA Norcross, NEC Elctrns., Inc. 404-447-4409
IL Arlington Heights, NEC Elctrns., Inc. ... 312-577-9090
IL Schaumburg, Sieger Assocs. 312-310-8844
IN Ft. Wayne, M/S Sls. & Assocs. 219-436-3023
IN Indianapolis, Advanced Comp Sls 317-545-6441
IN Indianapolis, M/S Sls. & Assocs. 317-257-8915
IA Cedar Rapids, Geo. Russell & Assocs. 319-369-9134
KS Overland Park, AME Sls. 913-262-3971
MD Columbia, Professional Reps. 301-992-7460
MA Burlington, NEC Elctrns., Inc. 617-272-1774
MA Woburn, Compass Technlg. 617-933-3336
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MI Southfield, NEC ELctrns., Inc. 313-559-4242
MN Bloomington, Geo. Russell & Assocs. 612-854-1166
MN Bloomington, NEC Elctrns. Inc. 612-854-4443
MO St. Charles, AME Sls. 314-947-0333
NJ Ft. Lee, Metro Logic 201-592-8137
NM Albuquerque, BFA Sls. 505-292-1212
NM Las Cruces, BFA Sls. 505-524-9693
NY Fairport, NEC Elctrns. Inc. 716-425-4590
NY Melville, NEC Elctrns. Inc. 516-423-2500
NY Poughkeepsie, NEC Elctrns. Inc. 914-452-4747
NY Rochester, Elcom Sls. 716-385-1400
NY Skaneateles, Elcom Sls. 315-685-8245
NC Raleigh, Glenn White Assocs. 919-848-1931
OH Columbus, NEC Elctrns. Inc. 614-436-1778
OH Dayton, K W Elctrn. Sls. 513-890-2150
OH Shaker Heights, K W Elctrn. Sls. 216-491-9177
OH Worthington, K W Elctrn. Sls. 614-888-0483
OR Beaverton, Elec. Tech. Sls. 503-641-5180
OR Portland, NEC Elctrns. Inc. 503-245-1600
PA Allison Park, K W Elctrn. Sls. 412-487-4300
TX Austin, NEC Elctrns. Inc. 512-346-9280
TX Austin, T L Mktg. Inc. 512-453-4586
TX Dallas, NEC Elctrns. Inc. 214-931-0641
TX Dallas, T L Mktg. Inc. 214-357-1752
UT Salt Lake City, Aspen Sls. 801-467-2401
VA Lynchburg, Glenn White Assocs. 804-384-0173
VA Richmond, NEC Elctrns. Inc. 804-282-8303
WA Kirkland, Elec. Tech. Sls. 206-827-8086
PR Caguas, V. G. Sls. Co., Inc. 809-744-5568
Can Br. Columbia/Surrey, Kaytronics Western 604-581-5005
Can Ontario/Concord, Kaytronics 416-669-2262
Can Ontario/Kanata, Kaytronics 613-592-6606
Can Quebec/Ville St. Pierre, Kaytronics ... 514-367-0101

NEC INFORMATION SYSTEMS, INC., 1414 Massachusetts Ave., Boxborough, MA 01719, Tel: 617-264-8000, TELEX: 92-3434; Empl.: 1500; *Sls. Mgr.:* Richard Gilbert/Robert Henderson; *Dist. Mgr.:* Joseph Bane

NEDAP N.V., P.O. Box 6, Groenlo, Holland 7140 AA, Tel: 031-5440-71111, TELEX: 44253, FAX: 031.5440.62745; Empl.: 325; *Sls. Mgr.:* W. Bonnemeier

N.E.D. CABLE CO., Div. of Electro-Prep, Inc., 16 Proctor St., Salem, MA 01970, Tel: 617-745-9911; Empl.: 10; *Sls. Mgr.:* R. M. Sullivan

NEDCO ELECTRONICS, INC., 6216 Oakton St., Morton Grove, IL 60053, Tel: 312-966-6000, FAX: 312-966-6009; Empl.: 10

NEFF INSTR., 700 S. Myrtle Ave., Monrovia, CA 91016, Tel: 818-357-2281, TWX: 910-585-1833; Empl.: 125; *Sls. Mgr.:* James T. Barber

NEI
Ferranti-Packard

FAX: 416-625-6197

NEI FERRANTI-PACKARD ELECTRONICS LTD., NEI Canada, 6030 Ambler Dr., Mississauga, Ont., Canada L4W 2P1, Tel: 416-624-3020, TELEX: 06-961437; Empl.: 100; *Sls. Mgr.:* Paul A. Manuel .... **B•1143-1145**

Local Sales Offices & Reps

AL Huntsville, Effective Mktg. Force 205-233-2947
CA Los Angeles, A-F Sls. Engrg., Inc. 213-681-5631
CA Orange County, A-F Sls. Engrg., Inc. .. 714-641-2903
CA Pasadena, A-F Sls. Engrg., Inc. 818-795-7081
CA San Diego, A-F Sls. Engrg., Inc. 619-226-8424
GA Atlanta, Effective Mktg. Force 404-948-6023
IL Chicago, NEI Svc. 800-263-4346
IL Schaumburg, Golden Technlgs. Inc. .. 312-885-2892
MA Hopkinton, FP Displays, Inc. 617-742-2335
NH Nashua, Bell Controls Inc. 603-882-6984
NC Lillington, Effective Mktg. Force 919-893-9650
OH Brunswick, Power Mktg., Inc. 216-225-8618
PA Paoli, Tyler Griffin Co. 215-647-1550
TX Dallas, NEI Svc. 800-263-4346
Can Mississauga, Ont., NEI Ferranti-Packard Elctrns. 416-624-3020

NEL FREQUENCY CONTROLS, INC., 357 Beloit St, Burlington, WI 53105, Tel: 414-763-3591, TWX: 910-278-2450, FAX: 414-763-2881; FSC No.: 00815; Empl.: 225; *Sls. Mgr.:* Dick Griebel, VP Sls. & Mktg.; *Dist. Mgr.:* Lyann Jung

NEPENTHE, INC., 2471 E. Bayshore Road, Palo Alto, CA 94303, Tel: 415-856-9332, 800-NEPENTHE, TWX: 910-373-2060; FSC No.: 415.856 8650; Empl.: 50; *Sls. Mgr.:* Mark Urban

NESCO BATTERY SYSTEMS, National Electro-Sales Corp., 7110 Gerald Ave., Van Nuys, CA 91409-7840, Tel: 818-781-0505, FAX: 818-786-2758

Local Sales Offices & Reps

CA Palo Alto, Mollard Mktg. 415-961-0456
CA San Diego, C-Tronics 619-291-5700
IA Marion, MSB Assocs. 319-377-6261
KS Shawnee Mission, MSB Assocs. 913-432-2131
MA Framingham, Gallagher Assocs. 617-626-2346
MI Detroit, Qualitron 313-534-1511
MO St. Charles, MSB Assocs. 314-946-5577
PA Willow Grove, Delta Tech. Sls. 215-657-7250
TX Dallas, Herbtronics Inc. 214-357-0592

NESHAMINY TRANSFORMER, Neshaminy Electronics Corp., Edison-Furlong Road, Furlong, PA 18925, Tel: 215-794-7411; *Sls. Mgr.:* Philip Klein

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For the finest in Panel Meters!

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NES, INC. (NATIONWIDE ELECTRONIC SYSTEMS), 3003 Wakefield, Carpentersville, IL 60110, Tel: 312-426-5900; Empl.: 1200; *Sls. Mgr.:* Jerry Bestler; *Dist. Mgr.:* Jerry Bestler ... **B•1083; D•1137, 1382-1387**

Local Sales Offices & Reps

OH	Cincinnati, Anderson-Bolds	513-528-5680
OH	Cleveland, Anderson-Bolds	216-229-4700
WA	Bellevue, Al Smith Co.	206-746-6770

Local Distributors

IL	Bridgeview (Chicago), Norman Equip. Co.	312-430-4000
IL	Countryside, Pacific Indicator	312-352-3500
IL	Mt. Prospect, Feed Controls	312-253-3898
KY	Louisville, Main Elec.	502-587-6511
WI	Appleton, G.W.S. Supp.	414-739-6066
Can	Montreal, Que., Mod-tronic Instr. Ltd.	514-848-7205

NETCOM, 3002 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-5100, TWX: 910-686-5478; FSC No.: 57193; Empl.: 105; *Sls. Mgr.:* Wayne Roeder

NETWORKS INTERNATIONAL CORPORATION, 13924 W. 108th St., Lenexa, KS 66215, Tel: 913-469-6494, FAX: 913-469-6495; Empl.: 15; *Sls. Mgr.:* Abhay Bisarya; *Dist. Mgr.:* Abhay Bisarya

NEUTRIK PRODUCTS, See Kulka Smith

NEW ENGLAND SMELTING WORKS, INC., 502 Union St., Box 29, W. Springfield, MA 01090, Tel: 413-734-6491; FSC No.: 3439; Empl.: 40; *Sls. Mgr.:* David R. Saffer

NEW HAMPSHIRE BALL BEARINGS, INC., NMB (USA), Inc., Rte. 202, Peterborough, NH 03458, Tel: 603-924-3311, TWX: 710-364-1805; Empl.: 1000

NEWMAN, M. M., CORP., Heli-Tube Div., P.O. Box 615, Marblehead, MA 01945, Tel: 617-631-7100, FAX: 617-631-8887; FSC No.: 09106; *Sls. Mgr.:* C. Loutrel; *Dist. Mgr.:* C. Loutrel ..... **C•1890**

NEW MEDIA GRAPHICS CORP., Matrix Corp., 780 Boston Rd., Billerica, MA 01821, Tel: 617-663-0666, FAX: 617-663-6678; Empl.: 44

NEWPORT

FAX: 714-546-3022

NEWPORT ELECTRONICS, 630 E. Young St., Santa Ana, CA 92705, Tel: 714-540-4914, TWX: 910-595-1787; Empl.: 150; *Sls. Mgr.:* Jim Way ..... **D•1388-1389**

Local Sales Offices & Reps

AZ	Phoenix, CPS Assocs.	602-246-1097
CA	Milpitas, IFM, Inc.	408-945-5920
CA	Orange, Electramation	714-997-8420
CO	Denver, AKI Entprs.	303-388-4488
FL	Orlando, Datarep, Inc.	305-843-5224
IL	Arlington Hgts., Brainard-Wilson	312-437-2700
IN	Ft. Wayne, Walter M. Bierberich Inc.	219-432-2537
IA	Des Moines, H & H Vega Sls. Assocs.	515-280-8088
KS	Wichita, H & H Vega Sls.	316-722-7856
MD	Joppa, Electra-Tech	301-877-0344
MA	Billerica, Eastronix, Inc.	617-670-2400
MI	Livonia, Amtech Reps.	313-474-8300
MN	Eden Prairie, Rockmore Sls. Corp.	612-941-1390
MO	St. Charles, Power Transmission Sys.	314-928-1750
NJ	Parlin, JMR Sls.	201-254-8484
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Wading River, JMR Sls., Inc.	516-929-5756
NC	Charlotte, SPK Instrmn.	704-535-2345
OH	Dayton, Dolfuss-Root & Co.	513-433-6776
OH	Strongsville, Dolfuss-Root & Co.	216-238-0300
PA	Bridgeville, Dolfuss-Root & Co.	412-221-4420
PA	Valley Forge, J. E. Cuesta & Co., Inc.	215-935-0400
SC	Greenville, SPK Instrmn.	803-297-4133
TX	Addison, Associated Dyn., Inc.	214-387-3800
VA	Dumfries, Electra-Tech	703-670-6962
WA	Redmond, Sls. & Engrg. Assocs.	206-883-4999
WI	Waukesha, Brainard-Wilson	414-797-7940

Local Distributors

AL	Birmingham, Brownell Instrs.	205-332-3374
AZ	Phoenix, Metermaster	602-437-1425
AR	Little Rock, Brownell Instrs.	501-562-2061
CA	Costa Mesa, FLW, Inc	714-751-7512
CA	Foster City, Therm-X	415-571-1166
CA	Hayward, FLW, Inc.	415-786-9070
CA	Los Angeles, EIL Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster	213-685-4340
CA	S. San Francisco, Steven Engrg.	415-588-9200
CA	San Leandro, Coast Instr.	415-483-3774
CO	Aurora, R & R Instrmn.	303-340-8728
CT	Middletown, EIL Instrs., Inc.	203-346-6646
FL	Orlando, FLW, Inc.	305-894-1100
GA	Atlanta, Sesco, Inc.	404-458-6423
GA	Atlanta (Hapeville), Brownell Electro	404-762-5181
GA	Marietta, FLW Southeast	404-424-1731
HI	Kailua, FLW, Inc.	808-945-1030
IL	Chicago, Data Elctrns. Co.	312-283-0300
IL	Countryside, Pacific Indicator	312-352-3500
IL	Itasca, CMI Metermaster	312-250-0606
IN	Evansville, Electro-Lab Svcs.	812-423-5211
IA	Davenport, Universal Precision Instr.	319-326-5757
KS	Kansas City, Kornfeld Thorp	913-321-7070
KS	Silver Lake, Universal Precision	913-582-4050
KY	Louisville, P. I. Burkes Co.	502-589-3960
LA	Slidell, Process & Engrg. Prod.	504-641-0652
MD	Gaithersburg, Pioneer Instrs.	301-948-2242
MD	Sparks, EIL Instr.	301-771-4800
MA	Waltham, Calibron Instrs.	617-894-6440
MI	Royal Oak, George Instr.	313-280-1111
MN	Minneapolis, Instrmn. Svcs.	612-544-8916
MN	Minneapolis, Process Meas.	612-544-4035
MN	Plymouth, Data Elctrns.	612-559-1434
MO	Kansas City, ISL Corp.	816-587-5400
MO	St. Louis, Universal Precision Inst.	314-394-4693
NE	Omaha, Interstate Indl.	402-331-3535
NJ	Newfoundland, Hosica Labs.	201-697-6111
NY	Buffalo, KOM Lamb	716-874-3530
NY	Clarence, EIL/Trott Elctrns.	716-634-8500
NY	Fairport, Pioneer Instr. Div.	716-381-7070
NY	Farmingdale, Brownell Electro	516-420-5990
NC	Charlotte, EIL/Trott Elctrns.	704-376-2237
OH	Cincinnati, Schlemmer	513-522-8340
OH	Cleveland, Pioneer Instr.	216-587-3600
OH	Cleveland, Weschler Elec.	216-238-2550
OH	Dayton, Pioneer Instr.	513-236-9900
OH	Toledo, Girkins Elec.	419-478-5600
OK	Tulsa, Inotek	918-627-1500
OR	Portland, Eicher-Richards	503-221-1123
OR	Portland, Westcon	503-283-0132
PA	Philadelphia, Sunshine Scientific	215-673-5600
PA	York, Trola Inds.	717-848-3700
SC	Columbia, Brownell Instrs.	803-772-6111
TN	Knoxville, Brownell	615-966-3441
TX	Dallas, Dallas Meter Tek	214-349-6044
TX	Dallas, Inotek	214-243-7000
TX	Houston, American Analog	713-941-7265
UT	N. Salt Lake, Western Controls	801-292-5900
VA	Richmond, Metermetrics	804-275-1431
WA	Seattle, Branom Instrs.	206-762-6050
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Milwaukee, E-M Instrs.	414-272-7799
WI	Waukesha, Machine Drive Sls.	414-549-9063

NEW WAVE INSTRUMENTS, 3760 Masters Court, San Jose, CA 95111, Tel: 408-629-3105, TWX: 510-601-2474, ESYLNK: 62925379; *Sls. Mgr.:* Larry Christensen ..... **D•1067**

THE J. M. NEY COMPANY, Ney Industrial Park, Bloomfield, CT 06002, Tel: 203-242-2281, TELEX: 9-9238; *Sls. Mgr.:* Hal Poschmann

NGK BERYLCO, NGK Metals Corporation, P.O. Box 13367, Reading, PA 19612-3367, Tel: 215-921-5000, TWX: 510-651-0677; Empl.: 600; *Sls. Mgr.:* Robert E. Strock

NH RESEARCH

FAX: 714-474-7062

NH RESEARCH, INCORPORATED, Instrumentation Products Division, 16601 Hale Ave., Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377; Empl.: 120; *Sls. Mgr.:* Fred Sabatine ..... **D•1302-1303, 2129**

Local Sales Offices & Reps

FL	Treasure Island, NH Research	813-367-5101
NJ	Franklin Lakes, Hansen & Hughes	201-848-8900

NH RESEARCH, Powertest Automatic Power Supply Test Systems, 16601 Hale Avenue, Irvine, CA 92714, Tel: 714-474-3900, TELEX: 67-8377, FAX: 714-474-7062; FSC No.: 24862; Empl.: 125; *Sls. Mgr.:* Sam Duran ..... **D•2129**

Local Sales Offices & Reps

CA	Irvine, NH Research, Inc.	714-474-3900
IL	Naperville, NH Research, Inc.	312-355-5991
NJ	Totowa, NH Research, Inc.	201-785-2261

NIC COMPONENTS CORP., 6000 New Horizons Blvd., N. Amityville, NY 11701, Tel: 516-226-7500, TELEX: 221-228, FAX: 516-226-6262; Empl.: 50; *Sls. Mgr.:* Robert Schatz; *Dist. Mgr.:* Nancy Lamendola

NICHICON (AMERICA) CORP., 927 E. State Pkwy., Schaumburg, IL 60173, Tel: 312-843-7500, TELEX: 20-6577, FAX: 312-843-2798/7125; *Sls. Mgr.:* Russ Edwards; *Dist. Mgr.:* Buddy Black

NICHIFU AMERICA, INC., 1494 N. Charlotte St., Pottstown, PA 19464, Tel: 215-323-7120, FAX: 215-970-2096; *Sls. Mgr.:* Roy Allen

NICOLET INSTRUMENT CORP., Test Instrument Division, 5225 Verona Rd., P.O. Box 4288, Madison, WI 53711, Tel: 608-271-3333, TELEX: 608-273-5061, TWX: 910-286-2737; Empl.: 700; *Sls. Mgr.:* Mike Dambach

NICOLET PARATRONICS, 201 Fourier Ave., Fremont, CA 94539, Tel: 415-490-8300, TWX: 910-381-7030; FSC No.: 6625; Empl.: 95; *Sls. Mgr.:* Bob Francisco

NICOLET COMPUTER GRAPHICS DIV., See Bruning Computer Graphics

NIDEC-TORIN CORPORATION, 100 Franklin Drive, Torrington, CT 06790, Tel: 203-482-4422, TELEX: 643963; Empl.: 350; *Sls. Mgr.:* Robert Murphy; *Dist. Mgr.:* Rich Brache

NIDUS SYSTEMS, 4333 Orange St., No. 17, Riverside, CA 92501, Tel: 714-781-0531, TWX: 910-240-5178, ESYLNK: 6275-3594; Empl.: 3; *Sls. Mgr.:* Earl Chafin

NISSEI SANGYO AMERICA, LTD., 1701 Golf Rd., Ste. 401, Rolling Meadows, IL 60008, Tel: 312-981-8989, TELEX: 28-0547, TWX: 910-233-5865; *Sls. Mgr.:* Y. Hamada

NITTANY PIEZO CERAMICS, See Piezo Kinetics, Inc.

NJE

FAX: 201-329-6185

NJE CORPORATION, 329 Culver Rd, P.O. Box 669, Dayton, NJ 08810-0669, Tel: 201-329-4611, TWX: 710-480-5674; FSC No.: 98380; Empl.: 105; *Sls. Mgr.:* John Slavik ..... **D•1853-1855**

Local Sales Offices & Reps

CA	Palo Alto, Bytec Sls., Inc.	415-493-1053
CA	San Jose, Bytec Sls., Inc.	408-435-8004
MN	Edina, Grayden & Flemmer	612-941-1120
NV	Reno, Bytec Sls., Inc.	702-852-4006
NJ	Dayton, NJE Corp.	201-329-4611

nkk switches OF AMERICA INC.

FAX: 602-998-1435

NKK SWITCHES OF AMERICA, INC., 14415 N. Scottsdale Rd., Scottsdale, AZ 85260, Tel: 602-991-0942; FSC No.: 63426; Empl.: 50; *Sls. Mgr.:* Joseph Nessim; *Dist. Mgr.:* Joseph Nessim ..... **B•1776-1777**

Local Sales Offices & Reps

AL	Huntsville, Over & Over	205-837-7105
AZ	Mesa, Elec-Com Assocs. Inc.	602-844-0566
AZ	Scottsdale, NKK Switches	602-991-0942
CA	Anaheim, Spectrum Assocs. Inc.	714-630-6977
CA	Santa Clara, Caltron Components Corp.	408-980-0181
CO	Wheatridge, Cluff & Assocs. Inc.	303-425-6604
CT	Sandy Hook, Schumacher & Yarrington, Inc.	203-426-3874
FL	Altamonte Springs, Over & Over, Inc.	305-332-1222
FL	Coral Springs, Over & Over Inc.	305-753-7050
FL	Tampa, Over & Over Inc.	813-626-9100
GA	Norcross, Over & Over, Inc.	404-449-6205
ID	Boise, Bob Sickler Sls. Co.	208-344-9588
IL	Mt. Prospect, The Dombrow Co., Inc.	312-253-3326

IN Carmel, Frank E. Kahsar Sls. 317-844-9353
IA Cedar Rapids, Midwest Tech. Sls. 319-365-4011
KS Goddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MA Winchester, Schumacher & Yarrington, Inc. 617-721-2515
MI Ann Arbor, Frank E. Kahsar Sls. 313-769-0131
MN Minnetonka, J. P. & Assocs. 612-935-7930
MO St. Charles, Midwest Tech. Sls. 314-441-1012
NH Nashua, Schumacher & Yarrington, Inc. 603-882-2664
NY Clifton Pk., NET Sls. Co. 518-371-6864
NY Cortland, NET Sls. Co. 607-756-6592
NY De Ruyter, NET Sls. Co. 315-662-7996
NY Fairport, NET Sls. Co. 716-223-1030
NY Melville, Comtronic Assocs., Inc. 516-249-0505
NY Webster, NET Sls. Co. 716-223-1030
NC Charlotte, Over & Over Inc. 704-542-9111
NC Raleigh, Over & Over Inc. 919-782-9111
OH Cincinnati, Frank E. Kahsar Sls. 513-922-3133
OH Columbus, Frank E. Kahsar Sls. 614-252-4009
OH Mentor, Frank E. Kahsar Sls. 216-257-1166
OR Portland, James J. Backer Co. 503-297-8744
PA Sewickley, Frank E. Kahsar Sls. 412-741-4155
PA West Conshohocken, Eastern Comps. Sls. 215-825-8610
RI Warwick, Schumacher & Yarrington, Inc. 401-884-5671
TX Dallas, Rem Air Components Corp. 214-234-1069
TX Houston, Rem-Air Assocs. 713-729-7160
UT Salt Lake City, Cluff & Assocs. 801-486-7297
WA Seattle, James J. Backer Co. 206-285-1300
Can Mississauga, Ont., John G. Weiss Co., Ltd. 416-673-0011
Can Nepean, Ont., John G. Weiss Co., Ltd. 613-825-0545
Can St. Laurent, Que., John G. Weiss Co., Ltd. 514-337-5022
Can Vancouver, B.C., John G. Weiss Co., Ltd. 604-873-1112
Can Winnipeg, Manitoba, John G. Weiss Co., Ltd. 204-949-1877

Local Distributors

AL Huntsville, Allied Elctrns. 205-721-3500
AL Huntsville, Powell Elctrns. 205-539-2731
AZ Phoenix, Dalis Elctrn. Supp. 602-275-2885
AZ Phoenix, Powell Elctrns. 602-938-5552
AZ Tucson, Inland Elctrn. Supp. 602-889-5301
AR Ft. Smith, Radio, Inc. 501-646-5200
AR Little Rock, Bluff City Elctrns. 501-376-7044
CA Costa Mesa, Eric Elctrns. 714-751-1185
CA Costa Mesa, Powell Elctrns. 714-754-1717
CA Fountain Valley, Components Ctr. 714-979-0433
CA Fremont, Allied Elctrns. 415-770-0590
CA Los Angeles, Electric Switches, Inc. 213-660-1310
CA Milpitas, Zack Elctrns. 415-326-5482
CA Monterey, Zack Elctrns. 408-375-3144
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Mock III Sls. Co., Inc. 619-560-0515
CA San Diego, Shanks & Wright 619-239-0176
CA San Diego, Southland Comps. 619-578-6634
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Eric Elctrns. 408-432-1111
CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Rose Elctrn. Dist. Co. 408-263-9700
CA Santa Clara, Components Ctr. 408-988-3751
CA Tustin, Allied Elctrns. 714-669-4190
CA Tustin, Western Switches & Controls 714-259-8144
CA Vallejo, Zack Elctrns. 707-644-6676
CO Arvada, Denver Beta 303-431-7161
CO Aurora, Jet Elctrns. Supp. Co. 303-364-1000
CO Colorado Springs, Kimball Elctrns. 303-528-7066
CO Denver, Allied Elctrns. 303-790-1664
CO Englewood, NEP Elctrns. 303-799-9898
CT Danbury, Pilgrim Elctrns., Inc. 203-792-7274
CT Middletown, Midstate Elctrns. 203-632-1138
CT Wallingford, Midstate Elctrns. 203-265-9900
FL Altamonte Springs, Control Des. Supp., Inc. 305-788-3220
FL Altamonte Springs, Control Design Supp. 305-788-8220
FL Clearwater, Allied Elctrns. 813-539-0369
FL Ft. Lauderdale, Bros. Elctrns. 305-561-6700
FL Ft. Lauderdale, Powell Elctrns. 305-979-5000
FL Miami, Electronic Equip. Co. 305-871-3500
FL Pompano Bch., Allied Elctrns. 305-978-3008
FL Tampa, Elctrn. Equip. Co., Inc. 813-988-0810
FL West Palm Beach, Nurmi Elctrn. Supp., Inc. 305-686-8553
GA Augusta, Dixie Elctrns., Inc. 404-772-2055
GA Norcross, Allied Elctrns. 404-446-8595
GA Norcross, Applied Power, Inc. 404-263-0421
GA Norcross, Whitehead Elctrns. 404-923-6667
ID Boise, Kimball Elctrns., Inc. 208-342-3559
ID Pocatello, Kimball Elctrns., Inc. 208-232-2201
IL Addison, Belford Elctrns. 312-691-1100
IL Addison, L Comp, Inc. 312-628-1400
IL Chicago, Leeds Electro Comps. 312-625-3800
IL Elgin, Allied Elctrns. 312-697-8200
IL Geneva, Melvin Elctrns., Inc. 312-232-8050
IL Villa Park, Melvin Elctrns., Inc. 312-279-5015
IL Wheeling, Hawk Elctrns., Inc. 312-459-4030
IN Indianapolis, MAR Elctrns. 317-633-6699
IA Cedar Rapids, L-Comp 319-373-1028
KS Great Bend, RSC Elctrns., Inc. 316-793-3507
KS Salina, RSC Elctrns., Inc. 913-823-6353
KS Wichita, Airtechnics, Inc. 316-267-2849
KS Wichita, L-Comp 316-265-5100
KS Wichita, Radio Inc. 316-264-2798
KS Wichita, RSC Elctrns., Inc. 316-267-5213
KY Florence, URI Elctrns., Inc. 606-371-4423
LA New Orleans, Southern Radio Supp. Co. 504-524-2343
MD Columbia, Allied Elctrns. 301-381-1560
MD Columbia, Powell Elctrns. 301-995-6410
MD Gaithersburg, Axis Elctrns., Inc. 301-840-9640
MD Kensington, Marine Air Supply Co. 301-949-9560
MD Marlow Hgts., Allied Elctrns. 301-423-0161
MA Avon, Controller Svc. & Sls. 617-584-9010
MA Billerica, A. W. Mayer Co., Inc. 617-229-2255
MA Boston, Controller Svc. & Sls. 617-269-1375
MA Westborough, Powell Elctrns. 617-366-6100
MA Wilmington, Allied Elctrns. 617-942-0150
MI Ann Arbor, Wedemeyer Elctrn. Supp. 313-665-8611
MI Grand Rapids, RM Elctrns. 616-531-9300
MI Lansing, Wedemeyer Elctrn. Supp. 517-484-9009
MI St. Clair Shores, Spemco 313-771-2700
MN Burnsville, Cassidy Elctrns. 612-895-9026
MN Eden Prairie, Allied Elctrns. 612-829-7554
MN Minneapolis, Stark Elctrns. Supp., Inc. 612-332-1325
MS Columbus, Bluff City Elctrns. 601-328-6212
MS Tupelo, Bluff City Elctrns. 601-842-6832
MO Kansas City, L Comp., Inc. 816-221-2400
MO Maryland Hgts., L Comp., Inc. 314-291-6200
MO St. Louis, Franklin Elctrns. Co. 314-993-5333
NH Manchester, Controller Svc. & Sls. 603-623-7225
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NJ Englewood, Powell Elctrns. 201-894-0800
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Mt. Laurel, Allied Elctrns. 609-234-7769
NM Albuquerque, Dalis Elctrns., Inc. 505-888-4525
NY Bohemia, Key Components 516-567-7500
NY Hempstead, Electronic Equip. Co. 516-538-5510
NY Mineola, Allied Elctrns. 516-248-2360
NY Mt. Vernon, QAR Industrial Elctrn. Sls., Inc. 914-699-2224
NY Rochester, Allied Elctrns. 716-244-9440
NY Rochester, Masline Elctrns., Inc. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NY Troy, Trojan Elctrn. Supp. Co. 518-274-4481
NY Yonkers, Kin-Tronics Inc. 914-968-7736
NC Cary, Powell Elctrns. 919-467-1212
NC Charlotte, Dixie Elctrns., Inc. 704-377-5413
NC Pineville, Resco 704-588-1530
NC Raleigh, Allied Elctrns. 919-876-5845
NC Raleigh, Resco 919-781-5700
NC Winston-Salem, Dixie Elctrns., Inc. 919-724-5961
OH Canton, Whitehead Elctrns. 216-477-9576
OH Cincinnati, Schuster Elctrns. 513-489-1400
OH Cincinnati, URI Elctrns. 513-761-4030
OH Columbus, Wedemeyer Elctrn. Supp. Co., Inc. 614-436-9600
OH Columbus, Whitehead Elctrns. 614-224-1186
OH Twinsburg, Schuster Elctrns. 216-425-8134
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Oklahoma City, RSC Elctrns. 405-631-7729
OK Tulsa, Radio, Inc. 918-587-9123
OR Beaverton, Comp. Resources 503-641-8488
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Beaverton, Rose Elctrn. Distr. 503-629-9288
OR Eugene, Norvac Elctrns. 503-345-2905
OR Portland, URS Elctrns. 503-233-7151
OR Tigard, Priebe Elctrns. 206-881-2363
PA Allentown, Federated Purchaser 215-437-4481
PA Philadelphia, H & R Elctrns. 215-426-1700
PA Philadelphia, Powell Elctrns. 215-365-1900
PA Pittsburgh, Allied Elctrns. 412-367-4124
PA Wayne, Peak Elctrns. 215-293-9000
RI Providence, Controller Svc. & Sls. 401-781-7100
SC Columbia, Dixie Elctrns. 803-779-5332
SC Greenville, Dixie Elctrns. 803-297-1430
SC N. Charleston, Dixie Elctrns. 803-552-2671
SC Taylors, Cantrell Whlse. Prods. 803-268-1194
TN Gray, Dixie Elctrns. 615-477-3838
TN Jackson, Bluff City Elctrns. 901-424-0236
TN Knoxville, Dixie Elctrns. 615-938-4131
TN Memphis, Bluff City Elctrns. 901-345-9500
TN Nashville, Bluff City Elctrns. 615-242-8000
TX Austin, Southwest Elctrns. 512-837-8971
TX Austin, Wofford Elctrns. 512-339-1131
TX Brownsville, Carden Indl. Grp. 512-541-3660
TX Dallas, Allied Elctrns. 214-553-4370
TX Dallas, Off The Shelf Comps., Inc. 214-247-0052
TX Dallas, Southwest Elctrns. 214-234-3050
TX Dallas, Wallace Elctrns. 214-340-0400
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Swieco, Inc. 817-335-6521
TX Houston, Wofford Elctrns. 713-847-3583
TX Humble, Allied Elctrns. 713-446-8005
TX Irving, Powell Elctrns. 214-550-0547
TX Richardson, Off the Shelf Comps., Inc. 214-238-0808
TX Richardson, RSC Elctrns. 214-644-3444
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Ballard Supp. Corp. 801-972-2430
UT Salt Lake City, Kimball Elctrns. 801-328-2075
UT Salt Lake City, Salt Lake Beta 801-966-0236
UT Salt Lake City, Std. Supp. Co. 801-486-3371
WA Bellevue, Powell Elctrns. 206-641-4446
WA Kent, Comp. Resources 206-251-9771
WA Redmond, Priebe Elctrns. 206-881-2363
WA Seattle, Allied Elctrns. 206-547-2827
WA Seattle, URS Elctrns. 206-451-9393
WI Mequon, Taylor Elec. Co. 414-241-4321
WI New Berlin, NEP Elctrns, Inc. 414-785-9100
WI Oconomowoc, GW Elctrns., Ltd 414-367-6003
WI Waukesha, Hawk Elctrns. 414-547-4457
Can Burnaby, BC, ITT Multicomps. 604-291-8866
Can Calgary, Alberta, ITT Multicomps. 403-253-8575
Can Concord, Ont, Trade Elctrns. 416-661-7111
Can Concord, Ont., ITT Multicomps. 416-736-1144
Can Dartmouth, NS, ITT Multicomps. 902-465-2350
Can Edmonton, Alberta, ITT Multicomps. 403-451-4001
Can Monkton, NB, ITT Multicomps. 506-857-8011
Can Nepean, Ont., ITT Multicomps. 613-226-7406
Can Saskatoon, SK, ITT Multicomps. 306-373-7138
Can St. Laurent, PQ, ITT Multicomps. 514-335-7697
Can Winnipeg, Manitoba, ITT Multicomps. 204-786-8401

NKR PRECISION MANUFACTURING, Rte. 17M, Box 333, Harriman, NY 10926, Tel: 914-782-8562; Empl.: 17

NMB TECHNOLOGIES INCORPORATED

FAX: 818-341-8207

NMB TECHNOLOGIES, 9730 Independence Avenue, Chatsworth, CA 91311, Tel: 818-341-3355 ..... **A•1750-1751; B•1242, 1829; C•1690**

NOBEX DIV., Griffith Plastics Corp., 1027 California Dr., Box 4365, Burlingame, CA 94010, Tel: 415-342-8170; FSC No.: 32767; Empl.: 35

NOBLE U.S.A., INC., 5450 Meadowbrook Ct., Rolling Meadows, IL 60008, Tel: 312-364-6038, TELEX: 206745, FAX: 1-312-364-6045; *Sls. Mgr.:* Robert K. Burdick; *Dist. Mgr.:* Vyto Omilijonas

NOHAU CORPORATION, 51 E. Campbell Ave., Ste. 107E, Campbell, CA 95008, Tel: 408-866-1820, 408-866-4493, FAX: 408-370-3155 ..... **D•1304**

Local Sales Offices & Reps

CA Long Bch., Softwired Sys. 213-434-9409
CA San Diego, Microware Technlg. Inc. 619-693-4280

NOKIA-MOBIRA, Sub. of the Nokia Corp.-Helsinki, 2300 Tall Pines Drive, Largo, FL 34641, Tel: 813-536-5553; Empl.: 4,000; *Sls. Mgr.:* P. Chelgren

NOLATRON, P.O. Box 4042, Harrisburg, PA 17111, Tel: 717-564-3398, FAX: 717-939-5831; Empl.: 5

NOLL, J. A. CO., P.O. Box 312, Monroeville, PA 15146, Tel: 412-733-1089; *Sls. Mgr.:* P. Carson; *Dist. Mgr.:* P. Carson

NON-LINEAR SYSTEMS/DIV. OF KAYPRO CORP., 533 Stevens Ave., Solana Bch., CA 92075, Tel: 619-481-3953, TWX: 910-322-1132; Empl.: 55; *Sls. Mgr.:* Ben W. Fisher; *Dist. Mgr.:* Jeanne Simmons

NORELCOM INDS., 63 Marine St., Farmingdale, NY 11735, Tel: 516-249-7245, FAX: 516-249-3745; Empl.: 30

NOREN PRODUCTS INC., 1010 O'Brien Blvd., Menlo Pk., CA 94025, Tel: 415-322-9500, TELEX: 17-1410 Noren MNPK, FAX: 415-324-1348

NORGREN, 5400 South Delaware, Littleton, CO 80120-1663, Tel: 303-794-2611, TELEX: 45541; Empl.: 661; *Sls. Mgr.:* Patrick Maley

NORITAKE CO., INC., Noritake Co., Limited (Japan), 23820 Hawthorne Blvd., Ste. 100, Torrance, CA 90505, Tel: 213-373-6704; FSC No.: 213-772-3918; Empl.: 7; *Sls. Mgr.:* Y. Tatsuta

NORLAND CORPORATION, Norland Dr., Ft. Atkinson, WI 53538, Tel: 414-563-8456, TELEX: 26-5448; Empl.: 250; *Sls. Mgr.:* Jay Singer

NORPLEX/OAK INC., Allied-Signal Inc., P.O. Box 1448, La Crosse, WI 54602-1448, Tel: 608-784-6070, TELEX: 59-2257; Empl.: 2,200; *Sls. Mgr.:* George Gabuzda

NORSAL INDUSTRIES, 85 D Hoffman Lane S., Central Islip, NY 11722, Tel: 516-234-1200, TWX: 510-234-1200, FAX: 516-234-1589; Empl.: 45; *Sls. Mgr.:* Marc Spector

NORTH AMERICAN PHILIPS CONTROLS CORP., See Airpax Corporation, Cheshire Div.

NORTH AMERICAN PHILIPS LIGHTING, Bank St., Hightstown, NJ 08520, Tel: 609-448-4000, TWX: 510-685-5651; Empl.: 600; *Sls. Mgr.:* C. J. Lehmann

NORTH AMERICAN PRINTED CIRCUIT DIV., Tyco Labs., Inc., Box 145, Stafford, CT 06075, Tel: 203-684-2703; Empl.: 230

NORTH ATLANTIC INDUSTRIES, 60 Plant Ave., Hauppauge, NY 11788, Tel: 516-582-6060, TWX: 510-227-9660, FAX: 516-582-8079; FSC No.: 07342; Empl.: 320; *Sls. Mgr.:* K. Salz ..... **D•1305, 1391**

Local Sales Offices & Reps

AL	Huntsville, Periphix-Teqspec	205-721-1701
AZ	Phoenix, Aztec Entprs.	602-944-9185
CA	Cupertino, T. Louis Snitzer Co.	408-257-8333
CA	Los Angeles, T. Louis Snitzer Co.	213-836-6170
CO	Denver, Aztec Entprs.	303-779-5285
CT	Middletown, Intersell	203-528-5357
FL	Cocoa Beach, TeqSpec	305-783-3444
FL	Palm Harbor, Teqspec	813-785-2276
GA	Shellville, Periphex-Teqspec	404-972-7955
IL	Chicago, Pat Lind Elctrns.	312-726-3513
IN	Indianapolis, Pat Lind Elctrns.	317-632-7444
KS	Lenexa, Ramsey Assocs.	913-541-1007
MD	Wheaton, Brimberg Sls. Co.	301-946-2670
MA	Burlington, Intersell	617-273-3844
MN	Circle Pines, P. Lind	612-786-5770
MO	Chesterfield, Ramsey Assocs.	314-532-9386
NJ	Teaneck, Sci. Dvcs.-East	201-837-1004
NM	Albuquerque, Aztec Entprs.	505-262-1688
NC	Winston-Salem, Teqspec III	919-723-8102
PA	Horsham, Pennsylvania Sci. Dvcs.	215-956-0700
TX	Houston, Scientific Sls.	713-460-9170
TX	Richardson, Sci. Sls.	214-231-6541
UT	Ogden, Aztec Entprs.	801-621-1655
WA	Kirkland, Syntek	206-488-0394
WI	Milwaukee, Pat Lind Elctrns.	414-224-0146
Can	Scarborough, Ont., John DeGroot Assocs.	416-431-9331

NORTHEAST INNOVATIONS, INC., International Science Technology, P.O. Box 120, Concord, NH 03302, Tel: 603-736-8260; *Sls. Mgr.:* James P. Diggins

NORTHEAST SCIENTIFIC CORP., 30 Wetherbee St., Acton, MA 01720, Tel: 508-263-2711; Empl.: 10; *Sls. Mgr.:* C. Moritz

NORTHERN AMPOWER CORPORATION, 47087 Grand River Avenue, Novi, MI 48050, Tel: 313-349-4860, FAX: 313-344-2575; Empl.: 35; *Sls. Mgr.:* Ronald E. Kirsch

NORTHERN PRECISION LABS., 11 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-4800, TWX: 710-734-4301; Empl.: 95; *Sls. Mgr.:* P. Pytal

NORTHERN TECHNOLOGIES, 747 Main St., Ste. 207, Concord, MA 01742, Tel: 617-371-0915, TELEX: 948337, FAX: 617-371-2580; Empl.: 400

North Hills Electronics, Inc.

FAX: 516-759-3327

NORTH HILLS ELECTRONICS, 1 Alexander Pl., Glen Cove, NY 11542, Tel: 516-671-5700, TELEX: 46-6886; FSC No.: 98821; Empl.: 125; *Sls. Mgr.:* Herb Marx ..... **A•1247, 2300-2302**

Local Sales Offices & Reps

CA	Palo Alto, Tri Rep	415-965-1822
CT	Wethersfield, Underwood Sls. Corp.	203-563-3046
MA	Lowell, Underwood Sls. Corp.	617-256-8191
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
NJ	Glen Gardner, F & M Tech. Sls.	201-832-7216
OR	Portland, Evergreen Mktg. Grp.	503-643-8020
TX	Dallas, Milestek, Inc.	817-455-7444
TX	Houston, Milestek, Inc.	713-376-6776
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160
Can	Montreal, Componetics Ltd.	514-331-9930

NORTHLAKE ENGINEERING, INC., 999 Anita Ave., Antioch, IL 60002, Tel: 312-395-5710, FAX: 312-395-9101; FSC No.: 50638; Empl.: 120; *Sls. Mgr.:* W. A. Hardt

NORTHWEST MICROCIRCUITS, INC., 5464SW Philomath Blvd., Corvallis, OR 97333, Tel: 503-753-8242; Empl.: 12; *Sls. Mgr.:* Wm. H. Ferwalt

Local Sales Offices & Reps

MN	Minneapolis, E.P.M. Inc.	612-434-9446

NORTON ASSOCIATES, INC., 10 Di Tomas Ct., Copiague, NY 11726, Tel: 516-842-4666; FSC No.: 08739

NOVA ELECTRIC INC., 263 Hillside Ave., Nutley, NJ 07110, Tel: 201-661-3434, TELEX: 427386, FAX: 201-661-3926; FSC No.: 29019; Empl.: 50; *Sls. Mgr.:* Kenneth Niovitch ..... **D•2130-2131**

Local Sales Offices & Reps

AL	Huntsville, VESCO	205-881-1494
AZ	Phoenix, Aspen Power, Inc.	602-931-9287
FL	Orlando, Data Rep	305-682-6548
GA	Macon, VESCO	912-745-5200
HI	Honolulu, Victor Kim Elctrns.	808-841-6266
IN	Indianapolis, CMP	317-244-1685
MD	Lanham, Sel-Tronics	301-731-8080
MI	Farmington Hills, CMP	313-477-7700
MO	St. Louis, P.E.M. Sls. Co.	314-427-7200
NJ	Nutley, Nova Elec. Sls.	201-661-3434
NY	Buffalo, J & M Schaefer, Inc.	716-825-8050
NY	E. Syracuse, J & M Schaefer, Inc.	315-463-5223
NY	Rochester, J & M Schaefer, Inc.	716-586-9300
NC	Raleigh, VESCO	919-859-1550
OH	Berea (Cleveland), CMP	216-826-0400
OH	Englewood, CMP	513-836-0951
PA	Washington, Battery Sys., Inc.	412-228-7500
TX	Ft. Worth, ATM/Qualified Power	817-572-3788
UT	Salt Lake City, Computer Environments	801-466-6002
Can	N. Vancouver, B.C., Interworld Elctrns.	604-984-4471

NOVATEK CORPORATION, 900 East Atlantic Blvd., Pompano Beach, FL 33060, Tel: 305-782-4397, TELEX: 522600 AAA EXECT, FAX: 305-971-0316; Empl.: 5; *Sls. Mgr.:* Joe DiBrigida

NOVATRONICS, Box 878, Pompano Beach, FL 33061, Tel: 305-942-5200, TWX: 510-956-9878, FAX: 305-776-7147; Empl.: 460; *Sls. Mgr.:* Joseph P. Muni

NOVATRONICS OF CANADA LTD., 677 Erie St., P.O. Box 610, Stratford, Ontario, Canada N5A 6V6, Tel: 519-271-3880, TELEX: 06-955394, FAX: 519-271-9781; Empl.: 100; *Sls. Mgr.:* Laraine Murray ..... **B•1243**

Local Sales Offices & Reps

WA	Seattle, Bill Knorr Sls.	206-643-4330

NOVOTECHNIK U.S., INC., Village Plaza, 488 Boston Post Rd., Rte. 20 E., Marlborough, MA 01752, Tel: 617-485-2244, FAX: 617-485-2430; FSC No.: MULTIPLE; Empl.: 5 ..... **B•1900**

NRD INC., Mark IV Ind., Inc., 2937 Alt Blvd. N., Grand Island, NY 14072, Tel: 716-773-7634, TELEX: 91578 NRD GRDI, FAX: 716-773-7744; Empl.: 100; *Sls. Mgr.:* James R. Curtis; *Dist. Mgr.:* Larry Keating ..... **D•2170**

Local Sales Offices & Reps

AZ	Phoenix, Pam Hopkins Assoc.	602-253-7888
CA	San Jose, Tech-Ser, Inc.	408-496-1004
CA	Torrance, Tech-Ser, Inc.	213-370-7200
FL	Tampa, SRT Mktg.	813-884-4805
GA	Atlanta, Electro-Rep Assocs.	404-320-1134
IL	Chicago, M. Gottlieb Assocs., Inc.	312-775-1151
IN	Kokomo, M. Gottlieb Assocs., Inc.	317-455-0444
MA	Clinton, Devaney Assocs., Inc.	617-368-1436
MI	Southfield, Comp. Assocs., Inc.	313-355-4110
MN	Edina, Omni-Tec	612-881-4447
MO	Liberty, Lectro-Reps	816-781-2522
NY	Rochester, TCS	716-342-2406
NC	Charlotte, Electro-Rep Assocs.	704-527-2530
PA	Langhorne, AMS Assocs.	215-364-1050
TX	Dallas, Scalon, Hughes & Assocs.	214-739-2888
Can	Toronto, Ont., Sigma Mktg.	416-757-5757

Local Distributors

CT	Wallingford, Astech, Inc.	203-265-4241
CT	West Hartford, Signal Ind. Elec.	203-236-6005
IA	Cedar Rapids, Storage Engrg. Co., Inc.	319-363-7775
KS	Witchita, R.S.C. Elctrns.	316-267-5213
MD	Gaithersburg, R. S. Willard Co., Inc.	703-948-7700
MI	Grand Rapids, S.F. Elctrns.	616-459-0216
MI	Pontiac, Techno Inds., Inc.	313-628-4090
MO	Kansas City, Elctrns. Supp.	816-931-0250
MO	St. Louis, Van Sickle Elctrns.	314-621-5000
NY	Cortland, Monroe-Metz	1-800-424-2442
NY	Rochester, Batty Hoyt	716-647-9400
OH	Dayton, Griffith Dist. Co.	513-224-9102
TN	Johnson City, Tri-Citys Ind. Supp. Co.	615-929-8106
VA	Arlington, Arlington Elctrns. Whlsrs.	703-524-6256
PR	Rio Piedras, Rubber & Gasket Co. of P.R.	809-763-8787
Can	Mississauga, Ont., Prelco Elctrns.	416-678-0401
Can	Montreal, Que., Prelco Elctrns.	514-389-8051
Can	Nepean, Prelco Elctrns.	613-726-1800

NTE ELECTRONICS, INC., 44 Farrand St., Bloomfield, NJ 07003, Tel: 201-748-5089, FAX: 201-748-6224; FSC No.: 7T184; Empl.: 60; *Sls. Mgr.:* Annette Fuchs; *Dist. Mgr.:* Mary Damiano

NTK

FAX: 201-467-5794

NTK TECHNICAL CERAMICS, NGK Spark Plugs (USA), Inc., 99 Morris Ave., Springfield, NJ 07081, Tel: 201-376-6070, TELEX: 95-246-1286; FSC No.: 95-246-1286; *Sls. Mgr.:* Mark Ota; *Dist. Mgr.:* Earl Hanson ..... **A•1438, 1772; B•1901; D•1044-1045, 2171**

Local Sales Offices & Reps

AL	Huntsville, L&D, Inc.	205-837-1469
CA	Culver City, DeAngelo Rothman and Co. Inc.	213-827-2202
CT	Brookfield, M & M Assocs.	203-775-6888
FL	Longwood, D-Assocs.	305-830-8976
FL	Maitland, D. J. Ellis & Assocs., Inc.	305-645-1101
FL	Maitland, D. J. Ellis Assocs.	305-645-1101
FL	Maitland, D.J. Ellis & Assocs. Inc.	305-645-1101
GA	Atlanta, L&D Inc.	404-455-3483
IL	Chicago, Greenslade Sls.	312-593-3450
IN	Ft. Wayne, T.X. Sls.	219-489-4447
IA	Chanhassen, Barnes Sls. Assocs.	612-934-2907
MA	Framingham, G/M Assocs., Inc.	617-380-0785
MI	Ann Arbor, Jordan-Elliott Sls. Inc.	313-662-4087
MI	Jackson, Jordan-Elliottt Inc.	517-788-8353
MN	Chanhassen, Barnes Sales Assocs.	612-934-2907
NC	Raleigh, L&D Inc.	919-876-5301
PA	Rydal, Espy Sls. Assocs.	215-576-0780
PA	Rydal, ESPY Sls.	215-576-0780
TN	Seymour, L & D, Inc.	315-573-6511
VA	Richmond, L & D, Inc.	804-257-7717
WA	Seattle, Northmar Inc.	206-524-5170

NT.T/WAVECONN, State Rd. Hill, Meadville, PA 16335, Tel: 800-535-3162, 914-591-4173, FAX: 914-591-7783; Empl.: 100; *Sls. Mgr.:* Sigmund Jay Silberstein

NUCLEAR RESEARCH CORP., 125 Titus Ave., Box H, Warrington, PA 18976, Tel: 215-343-5900, TELEX: 510-665-8525 NRC WNTN; FSC No.: 96696; Empl.: 85; *Sls. Mgr.:* James R. Lee

NUCLEONIC PRODS., See Thomson-CSF Comps. Corp., Passive Comps. Div.

NU-CONCEPT SYSTEMS, 2725 Advance La.P. O. Box 587, Colmar, PA 18915, Tel: 215-822-8400, FAX: 215-822-1427; FSC No.: 58561; Empl.: 17; *Sls. Mgr.:* Robert F. Scheuerle

Local Sales Offices & Reps

CA	Glendale, Tooltronics	818-240-4000,
CO	Denver, Prod. Equip. Sls.	303-650-0344,
CT	Lyme, Art Meyers	203-767-0555,
FL	Altamonte Springs, PFI of Florida, Inc.	305-365-4781,
GA	Woodstock, Protech Sys.	404-926-0342,
IL	Downers Grove, Physics Equip.	312-960-4054,
MD	Baltimore, Art Meyers	301-574-7054,
MO	Raytown, Versatech	816-353-9303,
NH	Hampton, Matrix Sls.	603-926-1965,
NJ	Camden, Arch Mfg. & Sls.	609-966-3835
OH	Heath, Howden Co.	614-928-6666,

TX Dallas, Torenko & Assocs. 214-340-6565,
WA Mukilteo, Systems Specialists 206-355-0404,

NU DATA, 32 Fairview Ave., Little Silver, NJ 07739, Tel: 201-842-5757, TELEX: 271139, TWX: 710-722-5754; Empl.: 20; *Sls. Mgr.:* Richard A. Previte

NU-MEDIA, 1075 Featherstone, Pontiac, MI 48057, Tel: 313-373-1165; FSC No.: 2450; Empl.: 26; *Sls. Mgr.:* Brett W. Lincoln

NUMERIX CORP., 20 Ossipee Rd., Newton, MA 02164, Tel: 617-964-2500, TELEX: 948032, FAX: 617-969-4380

NU-METRICS INC., Cedar Valley Bldg., Box 471, Vanderbilt, PA 15486, Tel: 412-628-6370, 800-346-2025, FAX: 412-628-8875; Empl.: 12; *Sls. Mgr.:* Bernie Ames

NWL CAPACITORS, NWL Transformers, 8050 Monetary Dr., Riviera Bch., FL 33404, Tel: 305-848-9009, FAX: 305-848-9011; Empl.: 20

NWL TRANSFORMERS

FAX: 609-298-1982

NWL TRANSFORMERS, Rising Sun Rd., P.O. Box 358, Bordentown, NJ 08505, Tel: 609-298-7300, TWX: 510-685-3645; Empl.: 225; *Sls. Mgr.:* C. W. Harrison ..... **A•2303; D•1857**

NYE, WILLIAM F. CO., Div. of New Bedford Thread Co., Inc., P.O. Box G-927, New Bedford, MA 02742-0927, Tel: 617-996-6721, TELEX: 940807; Empl.: 22; *Sls. Mgr.:* Donald R. Fairbanks

NYLTITE, 3451 S. Clinton Ave., S. Plainfield, NJ 07080, Tel: 201-561-1300; *Sls. Mgr.:* Frances Gould

Nytronics Components Group

FAX: 803-393-5421 (x362)

NYTRONICS COMPONENTS GRP., INC., 700 Orange St., Darlington, SC 29532, Tel: 803-393-5421, TWX: 810-665-2182; FSC No.: 83125; Empl.: 502; *Sls. Mgr.:* Mack W. Windham .... **A•1144-1157, 1192, 1248-1269, 1594-1600, 1979; B•1019**

Local Sales Offices & Reps

AL Huntsville, B.C.I. 205-529-4411
AZ Tucson, Clemick & Assocs. 602-749-4003
CA Los Angeles, MG Sls. 213-476-3113
CA Sunnyvale, W.W. Posey 408-746-0771
CO Englewood, Component Sls. 303-779-8060
CT Bloomfield, Astrorep of New England 203-243-3122
FL Longwood, Beacon 305-332-1940
GA Chamblee, B.C.I. 404-455-0405
IL Glendale Hgts., Beta 312-790-9886
IN Indianapolis, EMCI 317-253-1668
KS Lenexa, Mid-Tec Assoc. 913-541-0505
MA Lowell, Astrorep of New England 617-459-7399
MI Ann Arbor, Kahsar Sls., Inc. 313-769-0131
MN Minneapolis, Dunlop Consits. 612-544-1070
MO St. Louis, Mid-Tec Assoc. 314-275-8666
NJ West Orange, National Atlantic 201-731-0730
NY Pittsford, W.A. Franklin Sls. 716-248-8251
NY Valley Cottage, LRC Assocs. 914-268-4435
OH Cincinnati, Kahsar Sls., Inc. 513-922-3133
OH Columbus, Kahsar Sls., Inc. 614-252-4009
OR Tigard, Eltech, Inc. 503-684-3458
PA Narberth, Bresson Assocs. 215-664-6460
TX Dallas, Texoma 214-324-8097
TX Houston, Texoma 713-462-1432
UT Salt Lake City, Component Sls. 801-268-8440
VA Lynchburg, Bresson Assocs. 703-237-1304
WA Bellevue, Eltec 206-643-4330
WI Milwaukee, Beta 414-543-6609
Can Ottawa,Ont., Dynasty Elctrns. 613-738-1200

Local Distributors

CA Garden Grove, Inductive Prods. 714-891-2572
CA Gardena, Bell Inds. 213-515-1800
CA San Diego, Mock III 619-560-0515
CA San Diego, Neumann Elctrns. 619-695-3005
CA Santa Clara, Cypress 408-980-2500
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell 805-499-6821
CA Walnut, A. C. I. 818-331-0735
CO Englewood, Industrial Elctrns. 303-694-9444
CO Wheatridge, Bell Inds. 303-424-1985
IL Chicago, Bell Inds. 312-982-9210
IL Chicago, Newark Elect. 312-638-4411
IN Indianapolis, Bell Inds. 317-634-8202
MD Beltsville, Newark Elec. 301-937-5085
MD White Marsh, RESCO/Baltimore 301-529-0500
MA Needham, Cronin Elctrns. 617-449-5000
MA Woburn, Sterling Elec. 617-938-6200
MN Minneapolis, Joel Co. 612-545-5669
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hauppauge, Jaco Elect. 516-273-5500
NY Plainview, ACI Elect. 516-293-6630
NY Rome, Rome Elect. 315-337-5400
NC Raleigh, Radio Elec. Svc. 919-781-5700
OH Centerville, C.V. Clark 513-435-3000
OR Lake Oswego, Bell Inds. 503-241-4115
PA Montgomeryville, Pyttronic Inds. 215-643-2850
PA Philadelphia, Herback Rademan 215-426-1700
PA Philadelphia, PEI 215-568-7400
PA York, E. C. I. 717-843-8971
TX Dallas, Wholesale Elect. 214-824-3001
WA Bellevue, Bell Inds. 206-747-1515

OAK MATERIALS GROUP INC., Laminates Div., 1 Mechanic Street, Hoosick Falls, NY 12090, Tel: 518-686-4379, TELEX: 710-965-9721; FSC No.: 53240; *Sls. Mgr.:* Robert L. Fidrych; *Dist. Mgr.:* Richard Spiak

OAK Switch Systems Inc.

FAX: 815-459-5000 (x2218)

OAK SWITCH SYSTEMS, 100 S. Main St., Crystal Lake, IL 60014, Tel: 815-459-5000, TWX: 910-634-3353; FSC No.: 76854; Empl.: 500; *Dist. Mgr.:* Gary LeMaire ..... **B•1778, 1830**

Local Sales Offices & Reps

AL Huntsville, Electramark, Inc. 205-539-7040
AZ Scottsdale, Harris & Croy 602-951-9121
AZ Tucson, Harris & Croy Inc. 602-575-5109
CA Granada Hills, C & N & Assocs., Inc. .. 818-895-2431
CA San Mateo, Stewart/Fullerton & Assocs. 415-570-7666
CO Broomfield, Technet Sls. & Svcs. 303-466-7777
FL Winter Springs, Oak Switch Sys., Inc. 305-699-4010
GA Norcross, Electramark, Inc. 404-446-7915
IL Crystal Lake, Oak Switch Sys. Inc. 815-459-5000
IL Palatine, Golbeck/Milota 312-705-0602
IA Cedar Rapids, Pattison Sls. 319-395-9866
KS Olathe, C-Tron, Inc. 913-829-0073
MA Acton, Boston Elctrns. Assocs. 617-264-4456
MI White Pigeon, Oak Switch Sys. Inc. ... 616-483-7179
MN Maplewood, Ziegenbein Assoc., Inc. ... 612-772-1324
MO St. Charles, C-Tron 314-928-8078
NE Omaha, IO Neb 402-895-4431
NJ Cherry Hill, Eastern Elctrns. 609-662-2113
NJ Mountainside, Henry G. Richter 201-233-4615
NY Fayetteville, Henry G. Richter 315-637-6713
NC Raleigh, Eastern Elctrns. 919-876-7591
OH Cincinnati, JMK Elctrns. 513-271-3860
OH Cleveland, JMK Elctrns. 216-886-7100
OH Dayton, JMK Elctrns. 513-435-6228
OR Tigard, Matrix Sls. & Mktg. 503-639-0325
PA Phoenixville, Henry G. Richter 215-495-6176
TX Dallas, Dal/Tex Rep., Inc. 214-991-7799
UT Sandy, Technet-Utah 801-572-3107
WI Brookfield, Ziegenbein Assocs., Inc. ... 414-785-1350
Can Don Mills, Ont., R. D. Assocs. 416-444-0959

Local Distributors

AL Huntsville, Component Distr. 205-883-7501
AL Huntsville, Marshall Elctrns. 205-881-9235
AZ Phoenix, Marshall Elctrns. 602-496-0290
AZ Tempe, Harper SID 602-967-1464
AR Little Rock, Component Distr. 501-277-6278
CA Chatsworth, Marshall Elctrns. 818-407-4100
CA Compton, Harper SID 213-979-5090
CA Inglewood, Newark Elctrns. 213-671-7066
CA Irvine, Marshall Elctrns. 714-859-5050
CA Milpitas, Marshall Elctrns. 408-943-4600
CA Mountain View, I/O Sls. Inc. 415-968-1080
CA Palo Alto, Zack Elctrns. 415-326-5432
CA Rancho Cordova, Marshall Elctrns. 916-635-9700
CA San Diego, Harper SID 619-578-2500
CA San Diego, Marshall Elctrns. 619-578-9600
CA San Francisco, Zack Elctrns. 415-626-1444
CA Sunnyvale, Harper SID 408-747-0333
CO Denver, CSID 303-292-9594
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Component Distrs. 303-799-4916
CO Thornton, Marshall Elctrns. 303-451-8383
CT Wallingford, Marshall Elctrns. 203-265-3822
FL Ft. Lauderdale, Marshall Elctrns. 305-977-4880
FL Melbourne, Component Distr. 305-724-9910
FL Orlando, Marshall Elctrns. 305-841-1878
FL W. Palm Bch., Wings Electro Sls. Co. 305-798-6606
GA Norcross, Component Distr. 404-441-3320
GA Norcross, Marshall Elctrns. 404-923-5750
IL Chicago, Newark Elctrns. 312-784-5100
IL Crystal Lake, Sub-Sem, Inc. 815-459-4139
IL Palatine, Ohm/Elctrns. 312-359-5500
IL Rosemont, Advent Elctrns. 312-297-6200
IL Schaumburg, Marshall Elctrns. 312-490-0155
IN Indianapolis, Advent Elctrns. 317-874-2190
IN Indianapolis, Graham Elctrns. 317-634-8202
IN Indianapolis, Marshall Elctrns. 317-297-0483
KS Edwardsville, C. Tennant Co. 913-441-1801
KS Lenexa, Marshall Elctrns. 913-492-3121
MD Gaithersburg, Marshall Elctrns. 301-840-9450
MA Canton, Impact Sls. 617-821-1500
MA Westborough, In-Stock Prods. 617-870-5750
MA Wilmington, Marshall Elctrns. 617-658-0810
MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, Marshall Elctrns. 313-525-5850
MI Oak Park, Newark Elctrns. 313-967-0600
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Northern, Inc. 612-944-1167
MN Plymouth, Marshall Elctrns. 612-559-2211
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Fairfield, Marshall Elctrns. 201-882-0320
NJ Mt. Laurel, Marshall Elctrns. 609-234-9100
NJ Springfield, Route Elctrns. 201-379-7710
NM Albuquerque, Walker Radio 505-883-2992
NY East Syracuse, Modutex Corp. 315-437-7052
NY Hauppauge, Fairmont Elec. 516-231-3313
NY Hauppauge, Marshall Elctrns. 516-273-2424
NY Jamaica, Calson Co. 718-525-5900
NY Johnson City, Marshall Elctrns. 607-798-1611
NY Northport, Coke-el Aerospace Co. 516-754-2233
NY Rochester, Marshall Elctrns. 716-235-7620
NC Raleigh, Component Distr. 919-787-7311
NC Raleigh, Marshall Elctrns. 919-878-9882
OH Centerville, IPD 513-435-2086
OH Dayton, Marshall Elctrns. 513-236-8088
OH Solon, Marshall Elctrns. 216-248-1788
OH Westerville, Marshall Elctrns. 614-891-7580
OR Beaverton, Marshall Elctrns. 503-644-5050
OR Portland, Radar Elec. 503-232-3404
PA Pittsburgh, Marshall Elctrns. 412-963-0441
TN Nashville, Graham Elctrns. 615-367-4400
TX Austin, Marshall Elctrns. 512-837-1991
TX Carrollton, Marshall Elctrns. 214-233-5200
TX Dallas, Component Distr. 214-644-0373
TX El Paso, Ideal Indl. Elect. 915-779-6647
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Marshall Elctrns. 713-895-9200
TX Irving, Harper S. I. D. 214-621-0500
UT Salt Lake City, Marshall Elctrns. 801-485-1551
WA Bellevue, Marshall Elctrns. 206-747-9100
WA Seattle, Radar Elec. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Brookfield, Marshall Elctrns. 414-797-8400
Can Burlington, Ont., White Radio 416-632-6894
Can Burnaby, B.C., Semad Elctrn. Dist. 604-438-2515
Can Calgary, Alberta, Semad Elctrn. Dist. .. 403-252-5664
Can Downsview, Ont., Westburne Elctrns. 416-635-2980
Can Markham, Ont., Semad Elctrn. Dist. 416-475-3922
Can Ottawa, Ont., Semad Elctrn. Dist. 613-727-8325
Can Ottawa, Ont., Westburne Elctrns. 613-737-5570
Can Pointe Claire, Semad Elctrn. Dist. 514-694-0860

OAKTRON INDUSTRIES, INC., 704 30th St., Monroe, WI 53566, Tel: 608-328-5560, TELEX: 260-266; FSC No.: 07109; Empl.: 250; *Sls. Mgr.:* J. F. Disch; *Dist. Mgr.:* Jim Hendrickson

OAL ASSOCIATES, P.O. Box J, Escondido, CA 92025, Tel: 619-743-7143, FAX: 619-743-2460; Empl.: 18; *Sls. Mgr.:* Mark Lohkemper

OAS INC., See Optimum Applied Systems

OCEAN MARINE INSTRUMENT, P. O. Box 3963, Tustin, CA 92680, Tel: 714-832-4627 ..... **D•2140**

OCTAGON SYSTEMS, 6510 W. 91st Ave., Westminster, CO 80030, Tel: 303-426-8540, TELEX: 4931919

ODELL, M. P., CO., 1620 Chesapeake Dr., Hoffman Estates, IL 60195, Tel: 312-991-2828; *Sls. Mgr.:* Maria McClurkin

OECO CORP., 4607 S.E. International Way, Milwaukie, OR 97222, Tel: 503-659-7932, TELEX: 36-0350; FSC No.: 95266; *Sls. Mgr.:* Dave Fuller

OGALLALA ELCTRNS., Div. Arnold Engrg. Co., Box 59, Ogallala, NE 69153, Tel: 308-284-4093, FAX: 308-284-4093 (ext 29); Empl.: 37; *Sls. Mgr.:* H. L. Harrington

OSI

FAX: 614-486-0743

OHIO SEMITRONICS, INC., 1205 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-9561; FSC No.: 12066; Empl.: 36; *Sls. Mgr.:* G. Clagett ..... **B•1902-1917; D•1306-1309**

Local Sales Offices & Reps

AZ	Tucson, Sheldon Equip.	602-722-1452
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Hayward, FLW, Inc.	415-786-9070
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	Orlando, Datarep	305-843-5224
GA	Marietta, FLW	404-424-1731
IL	Columbia, R. L. Weisheimer & Assocs.	618-281-4148
IL	Park Ridge, Elctrn. Instr. Assocs.	312-298-2290
MD	Baltimore, Electra-Tech, Inc.	301-877-8344
MA	Danvers, Pat Jenks Assocs.	617-777-5600
MI	Milford, TMS	313-360-1514
MN	Minneapolis, The Mark Co.	612-933-3026
NJ	Garwood, E. R. Mertz, Inc.	201-272-0687
NY	Latham, L-Tron Corp.	518-785-5032
NC	Charlotte, Zelco Assocs.	704-541-6122
OH	Dayton, Mohawk Intronics	513-434-8873
OH	No. Ridgeville, TMS, Inc.	216-327-3527
OR	Portland, Topp Engrg. Sls. Corp.	503-244-7265
PA	Carnegie, Flow Media	412-276-8055
PA	Frazier, FLW, PA, Inc.	215-251-9700
TN	Memphis, Jordan/Marlar/Hale, Inc.	901-452-7441
TX	Houston, Scientific Sls. Co.	713-460-9170
TX	Richardson, Scientific Sls. Co.	214-231-6541
UT	Salt Lake City, MC Squared, Inc.	801-298-3388
WA	Bellevue, Topp Engrg. Sls. Corp.	206-747-5400

FAX: 312-675-1505

OHMITE MANUFACTURING CO., 3601 W. Howard St., Skokie, IL 60076, Tel: 312-675-2600, TELEX: 72-4433, TWX: 910-223-0805; FSC No.: 44655 ..... **A•1980-1994, 2094-2095**

OHMTEK SFERNICE, INC.

FAX: 716-283-5932

OHMTEK INC., Sfernice Group Company, 2160 Liberty Dr., Niagara Falls, NY 14304, Tel: 716-283-4025; FSC No.: 57489; Empl.: 175; *Sls. Mgr.:* William Cuviello ..... **A•1848, 2020-2025**

Local Sales Offices & Reps

AZ	Scottsdale, Semper Fi Sls., Inc.	602-991-4601
CA	Chatsworth, Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Santa Clara, I Square, Inc.	408-988-3400
CO	Denver, West, Inc.	303-477-8180
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
IL	Downers Grove, Richmar Elctrns.	312-968-0118
IN	Ft. Wayne, John F. Kilfoil Co.	219-436-7233
IA	Hiawatha, Ard Sls.	319-393-6392
MA	Sterling, Compatible Comps., Inc.	617-422-7641
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Minneapolis, Dunlop Consits.	612-544-1070
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
OR	Beaverton, Eclipse Mktg. Grp.	503-642-1661
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TX	Richardson, Pro-Comp Sls. Co.	214-669-1500
UT	Salt Lake City, West, Inc.	801-466-5739
WA	Redmond, Eclipse Mktg. Grp.	206-885-6991
Can	Rexdale, Ont., Source Elctrns.	416-675-6235

Local Distributors

MA	Sterling, Compatible Comps. Dvcs.	617-422-7356

OK INDUSTRIES, INC., 4 Executive Plaza, Yonkers, NY 10701, Tel: 914-969-6800, TELEX: 12-5091; Empl.: 200; *Sls. Mgr.:* John Malboeuf

OKONITE CO., Box 340, Ramsey, NJ 07446, Tel: 201-825-0300, TWX: 710-988-1017; Empl.: 1700; *Sls. Mgr.:* F. R. Postma

OLEKTRON CORP., Signal Technology Corp., 61 Sutton Road, Webster, MA 01570, Tel: 617-943-7440, TELEX: 710-347-1602, FAX: 617-949-1804; FSC No.: 32252

OLFLEX WIRE & CABLE, INC., 30 Plymouth Street, Fairfield, NJ 07006, Tel: 201-575-1101, TELEX: 130-327, ESYLNK: 201-575-7178; Empl.: 25; *Sls. Mgr.:* Michael R. Picone

OLIVER ADVANCED ENGINEERING, 320 W. Arden St., Glendale, CA 91203, Tel: 818-240-0080, TWX: 510-600-8099, FAX: 818-240-6131; Empl.: 28; *Sls. Mgr.:* J. Gilberts

OLYMPIC WIRE & CABLE, 1 Madison Rd., Fairfield, NJ 07006, Tel: 201-227-7996, FAX: 201-227-1606; FSC No.: 63830; Empl.: 35; *Dist. Mgr.:* Yvette Archer

OMEGA ENGINEERING, Box 4047, Stamford, CT 06907, Tel: 203-359-1660, TELEX: 99-6404; Empl.: 500; *Sls. Mgr.:* Peter Casiraghi & Nelson Hart ..... **B•1779, 1860-1861, 1932-1933; C•1891; D•1013, 1099, 1138, 1177, 1312, 1392-1393, 1420**

OMEGA PRECISION CORP., 1384 Pompton Ave., Cedar Grove, NJ 07009, Tel: 201-256-3422; FSC No.: 9Y506; Empl.: 16; *Sls. Mgr.:* Leon Komsa

Local Sales Offices & Reps

CA	Mountain View, Lindsay Assocs.	415-965-3307
CO	Littleton, TMC	303-773-0643
MD	Baltimore, Bernard White & Co., Inc.	301-484-5400
OH	Hudson, J. A. Chluda & Assocs.	216-650-1638
PA	Westfield, Roberson Assocs.	201-256-3422

OMNIBYTE CORP., 245 W. Roosevelt Rd., Bldg. 1-5, W. Chicago, IL 60185, Tel: 312-231-6880, 1-800-638-5022, FAX: 1-312-231-7042; Empl.: 38; *Sls. Mgr.:* Mike Hansen

OMNIPrint

FAX: 408-747-0358

OMNIPRINT, INC., 1188 Elko Drive, Sunnyvale, CA 94089, Tel: 408-745-6400; Empl.: 12 ..... **D•1100**

Local Sales Offices & Reps

CA	Irvine, OBI Distrs.	714-250-9003
CA	Mountain View, I/O Sls. Inc.	415-968-1080
IL	Arlington Heights, Coombs Assoc., Inc.	312-439-9810
NJ	Fords, Marlin Data	201-738-7200
TX	Austin, The Thorson Co.	512-345-1985
TX	Dallas, The Thorson Co.	214-233-5744
TX	Houston, The Thorson Co.	713-771-3504
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

OMNI SPECTRA, INC., Microwave Subsystems Div., 2626 So. Hardy Dr., Tempe, AZ 85282, Tel: 602-966-1471, TWX: 910-950-1296; *Sls. Mgr.:* Carl Seburn; *Dist. Mgr.:* Carl Seburn

OMNI SWITCH USA, INC., 21630 N. 19th Ave., Ste. B-16, Phoenix, AZ 85027, Tel: 602-582-0629, FAX: 602-582-0665; Empl.: 100; *Sls. Mgr.:* Laurie Ball

OMNITEK, INC., P.O. Box 102, 820 Pennsylvania Blvd., Feasterville, PA 19047, Tel: 215-355-4443, TWX: 510-667-1730; FSC No.: 54316; *Sls. Mgr.:* Frank Shandelman

OMRON ELCTRNS., INC., Control Comps. Div., One E. Commerce Dr., Schaumburg, IL 60173, Tel: 312-843-7900, TWX: 910-291-2494, FAX: 312-843-7787 (ext. 8568); Empl.: 209; *Sls. Mgr.:* F. Newburn ..... **B•1550-1554, 1780-1781**

Local Sales Offices & Reps

CA	Anaheim	714-978-6008,
CA	Cupertino	408-255-9231
IL	Schaumburg	312-843-7900
KS	Kansas City	913-262-0560
MA	Danvers	617-774-6501
MI	Detroit	313-357-6666,
PA	Wayne	215-964-9376

OMUTEC, Odetics, Inc., 1515 S. Manchester Ave., Anaheim, CA 92802, Tel: 714-758-0200, TWX: 910-594-1461; *Sls. Mgr.:* Stan Tomlinson

ONAN POWER/ELECTRONICS, 4801 W. 81st St., Minneapolis, MN 55437, Tel: 612-921-5600, FAX: 612-921-5627; FSC No.: 3Z577; *Sls. Mgr.:* John R. Michael

ONEAC CORPORATION, 27944 N. Bradley Rd., Libertyville, IL 60048, Tel: 312-816-6000, 800-243-4543; *Sls. Mgr.:* Frank Brletich

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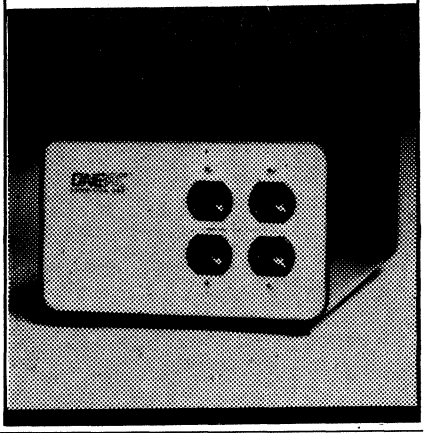

ONSET COMPUTER CORP., 199 Main St, PO Box 1030, N. Falmouth, MA 02556, Tel: 617-563-2267, TELEX: 469915; Empl.: 8; *Sls. Mgr.:* Lon Hocker

OPAMP LABS, INC., 1033 N. Sycamore Ave., Los Angeles, CA 90038, Tel: 213-934-3566; FSC No.: 24699; Empl.: 18 ..... **D•1015**

OPTEK

FAX: 214-542-1739

OPTEK TECHNOLOGY, INC., 345 Industrial Blvd., McKinney, TX 75069, Tel: 214-542-9461, TWX: 910-860-5625; Empl.: 610; *Sls. Mgr.:* James Trautwein; *Dist. Mgr.:* Betty Renfro ..... **B•1278**

Local Sales Offices & Reps

AZ	Scottsdale, Earl & Haas Assoc.	602-994-3813
CA	Escondido, Uni Rep	714-746-5131
CA	Santa Clara, Criterion	408-988-6300
CA	Thousand Oaks, Sc Cubed	805-496-7307
CA	Tustin, Sc Cubed	714-731-9206
CO	Wheatridge, Waugaman Assocs.	303-423-1020
CT	Madison, Conti-Younger Assocs.	203-245-1136
FL	Coral Springs, H A I	305-752-7520
FL	Melborne, H A I	305-676-1639
FL	Tampa, HAI	813-963-0743
IL	Rolling Meadows, KMA Sales	312-398-5300
IN	Indianapolis, J & W Sales	317-842-3740
MA	Burlington, Conti-Younger Assocs.	617-273-1582
MI	Grosse Pointe Pk., Greiner Assocs.	313-499-0188
MN	Eden Praire, Elctrn. Innovators	612-941-0830
MO	St. Louis, Engineering Services	314-997-1515
NY	Clark Mills, KLM/Garner	315-853-6126
NY	Manhasset, Win-Cor Elec.	516-627-9474
NY	Pittsford, KLM/Garner	716-381-8350
NY	Syracuse, KLM/Garner	315-458-6214

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PA	Prospect Park, Elf Sls. Co.	215-534-3340
TX	Austin, ProSales	512-467-9947
TX	Dallas, Prosales	214-492-8870
TX	Houston, Prosales	713-495-8130
UT	Salt Lake City, Waugaman Assocs.	801-261-0802
WA	Bellevue, Vantage Corp.	206-455-3460
WA	Spokane, Vantage Corp.	509-924-4410
WI	Milwaukee, KMA	414-259-1771

Local Distributors

AZ	Tempe, Anthem	602-968-3888
CA	Chatsworth, Anthem	818-700-1000
CA	East Irvine, Anthem	714-768-4444
CA	San Diego, Anthem	619-453-9005
CA	San Jose, Anthem	408-295-4000
CA	Tustin, AVED	714-259-8258
CO	Englewood, Anthem	303-790-4500
IL	Elk Grove Village, RM Elctrns.	312-364-6622
IL	Palatine, Ohm Elctrns.	312-359-5500
IN	Indianapolis, RM Elctrns.	317-291-7110
MA	Andover, R2 Elctrns.	617-470-3777
MA	Newton, Greene Shaw	617-969-8900
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Fridley, Voyager	612-571-7766
NJ	West Berlin, General Comps., Inc.	609-768-6767
NY	New York, Moneloa Elctrns.	212-764-3028
NC	Greensboro, Golden Elctrns.	919-294-4653
WA	Belleview, Bell Inds.	206-747-1515
WI	Milwaukee, Taylor	414-241-4321

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OPTICAL ELECTRONICS, INC., 2700 E. Bisby Rd., Tucson, AZ 85706, Tel: 602-889-8811, TELEX: 283347 (via RCA); FSC No.: 5962; Empl.: 16; *Sls. Mgr.:* Victoria Acosta

OPTICS FOR RESEARCH, INC., P.O. Box 82, Caldwell, NJ 07006, Tel: 201-228-4480, TELEX: 130-224, FAX: 201-228-0905; Empl.: 21; *Sls. Mgr.:* Donald K. Wilson

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Local Sales Offices & Reps

AZ	Scottsdale, Arcom Sls.	602-947-5745
CA	Brea, Masco Elctrns.	714-529-0866
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Oviedo, Conley & Assocs., Inc.	305-365-3283
GA	Atlanta, Optima Enclosures	404-496-4000
IL	Itasca, Janus, Inc.	312-250-9650
KS	Kansas City, BC Elctrn. Sls.	913-342-1211
MD	Randallstown, Beacon North	703-478-2480
MA	Millis, Selmark Assocs., Inc.	617-376-2914
MN	Minneapolis, Holgren Assocs.	612-786-7641
MO	Ferguson, BC Elctrn. Sls.	314-521-6683
NJ	Berkeley, Cambridge Allen	201-464-0203
NJ	Marlton, Beacon North Inc.	609-596-9456
NY	Binghamton, Empire Tech. Assoc.	607-772-0651
OH	Cleveland, C. A. Robinson Co.	216-473-6044
OH	Dayton, C. A. Robinson Co.	513-278-7969
TX	Austin, Matthews & Assocs.	512-346-2969
TX	Dallas, Matthews & Assocs.	214-248-7881
VA	Sterling, Beacon North	703-478-2480
WI	Waukesha, Janus, Inc.	414-542-7575

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CO	Lakewood, Candal, Inc.	303-935-7218
CT	Clinton, Selmark Assocn.	203-573-9088
IN	Indianapolis, STB & Assocs.	317-844-9227

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OPTIMIZED DEVICES, INC., 220 Marble Ave., Pleasantville, NY 10570, Tel: 914-769-6100; Empl.: 30

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CA	San Clemente, Sigwell Entprs.	714-492-6127
IL	Des Plaines, Coombs Assocs.	312-298-4830
IA	Cedar Rapids, Omni-Tec, Inc.	612-881-4447
MD	Baltimore, Stitzer Assocs.	301-823-2600
MI	Bloomfield Hills, Enco Mktg.	313-642-0203
MN	Edina, Omni-Tec, Inc.	612-881-4447
NJ	Springfield, F. F. Sylvester Assocs.	201-376-3324
NJ	Springfield, F. F. Sylvester Assocs.	212-344-3155
NY	Rochester, A-J Electromarketing	716-426-3598
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Plano, Vielock & Assocs.	214-881-1940

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AR	Little Rock, Carlton Bates	501-562-9100
CA	Brea, John Henberger Co.	714-671-0841
CA	Huntington Beach, Opto 22 Distibutor Sls.	714-891-5861
CA	San Diego, John Henberger co.	619-292-5772
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GA	Atlanta, Indl. Elec.	404-578-0300
IL	Elk Grove Village, GBL Goold Elctrns.	312-593-3220
IL	Moline, Jim Otis	309-762-9311
IN	Indianapolis, Neff Engrg.	317-841-9244
MA	N. Redding, Martindale Assocs.	617-664-0355
MI	Brighton, Fox Sys.	313-227-4497
MI	Grand Rapids, Smith Instrs.	616-245-1195
MN	St. Paul, Kim Controls	612-780-2991
NE	Omaha, Jim Otis & Assocs.	800-447-1417
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NC	Charlotte, Mill Power	704-527-8632
OH	Centerville, I. P. D.	513-435-2086
OH	Columbus, Great Lakes Controls Corp.	614-451-7872
OH	North Royalton, Great Lakes Controls Corp.	216-582-0020
OK	Tulsa, Carlton Bates	918-250-1178
OR	Portland, Pacific Control Supply	503-249-2033
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PA	Pittsburgh, Great Lakes Control Corp.	412-341-8922
TX	Dallas, Inotek	214-243-7000
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ORBIT INSTRUMENT CORP., 80 Cabot Ct, Hauppauge, NY 11788, Tel: 516-435-8300, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Carl Frommeyer ..... **B•1831; D•1139**

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CA San Diego, Orbit Instr. Corp. 619-566-3437

ORBIT INSTRUMENT OF CAL., 6431 Global Dr., Cypress, CA 90630, Tel: 714-527-0561, TWX: 510-221-2122; FSC No.: 11263; *Sls. Mgr.:* Graham Vernon ..... **B•1831; D•1139**

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CA San Diego, D. Cary 619-222-8839
CA San Diego, Orbit Instr. Corp. 619-566-3437
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ORCUS, Box 16022, Kansas City, MO 64112, Tel: 913-782-9781, TELEX: 4994037, FAX: 913-782-3894; *Sls. Mgr.:* Manford Eaton

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IL Rolling Meadows, Oriental Motor U.S.A. Corp. 312-577-0310
NJ Fairfield, Oriental Motor U.S.A. Corp. .. 201-882-0480

ORION INSTRUMENTS, INC., 702 Marshall St, Redwood City, CA 94063, Tel: 415-361-8883, TELEX: 530942; *Sls. Mgr.:* Bob Reynolds

ORMEC SYSTEMS CORP., 19 Linden Park, Rochester, NY 14625, Tel: 716-385-3520, TELEX: 510-601-5941; Empl.: 50; *Sls. Mgr.:* Richard Morgan

ORTEL CORP., 2015 W. Chestnut St, Alhambra, CA 91803, Tel: 818-281-3636, TELEX: 752434; *Sls. Mgr.:* Brent J. Ware

OSBORNE TRANSFORMER, 19636 Derby St, Detroit, MI 48203, Tel: 313-368-4136; Empl.: 20; *Sls. Mgr.:* J. R. Osborne

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AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Scottsdale, Thorson Desert States 602-998-2444
CA Carlsbad, Martronix 619-729-2656
CA El Toro, Martronix 714-858-0632
CA Newbury Pk, Martronix 805-499-6385
CA Palo Alto, Horne Electro Sls. 415-494-6777
CO Aurora, Thorson Desert States 303-671-7344
FL Boca Raton, Beacon Elctrns. 305-997-4518
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Longwood, Beacon Elctrns. 305-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Barrington, R-Tek 312-382-4600
IN Ft. Wayne, R-Tek 219-432-8783
IA Cedar Rapids, Midwest Tech. Sls. 319-365-4011
KS Gooddard, Midwest Tech. Sls. 316-794-8565
KS Lenexa, Midwest Tech. Sls. 913-888-5100
MD Burtonsville, Eastern Instrmn. 301-384-8500
MA Needham, Addelco Corp. 617-444-4754
NM Albuquerque, Thorson Desert States 505-293-8555
NY Fairport, bbd Elctrns., Inc. 716-425-1112
NY Huntington, C. R. Mayer Co. Inc. 516-692-4221
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Miamisburg (Dayton), Elctrn. Comps. Inc. 513-866-3340
OR Beaverton, Thorson Co. Northwest ... 503-644-5900
PA Southampton, Eastern Instrmn. of PA 215-355-7700
TX Dallas, McDonald Assocs. 214-239-7236
WA Bellevue, Thorson Co. Northwest 206-455-9180

OSCILLOQUARTZ, B & J Marketing, 17074 Dearborn St., Northridge, CA 91325, Tel: 818-993-0048, TELEX: 650 2068183, FAX: 818-993-5758; Empl.: 125; *Sls. Mgr.:* Alain Jendly

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MD Silver Spring, L. G. White & Co. 301-434-1555
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, Jos-Co/Melius, Inc. 612-861-3343
NJ Caldwell, Grimm, Siegal Assocs., Inc. 201-575-9300
NY Syracuse, Canavan-Scanlon Assocs., Inc. 315-437-1271
OH Cincinnati, O. H. Bromberg & Assocs. 513-771-9333
OH Cleveland, KT/DEPCO 216-442-6200
PA Edgemont, White/Whiddett Co. 215-353-6343
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WA Mercer Island, J. H. Andersen & Assocs. 206-232-0484
Can Scarborough, Ont., Banke Elctrns. 416-477-7722

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CA Los Angeles, Master Distrs. 213-452-1229
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CA San Diego, Deco Elctrns., Inc. 619-693-1595
CA San Jose, Cypress Elctrns. 1-800-538-5112
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CT West Hartford, Wes Garde Components 203-527-7705
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FL Lakeland, Wes Garde Components ... 813-644-7564
IL Carol Stream, Wes Garde Components 1-800-323-9431
IL Crystal Lake, Sub Sem 815-459-4139
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
MA Canton, Impact Sls. Co., Inc. 617-821-1500
MI St. Clair Shores, SPEMCO, Inc. 313-771-2700
MN Minneapolis, Elctrn. Center, Inc. 612-371-5200
MO Maryland Hgts., LCOMP, Inc. 800-325-1393
NJ Mt. Laurel, Wes Garde Components .. 609-778-8190
NJ Oakland, Relay Specialties, Inc. 201-337-1000
NY Bohemia, Key Comps. 516-567-7500
NY Woodside, Switches Unltd., Inc. 718-478-5000
OH Shandon, Cartessa Corp. 513-738-4477
OH Westerville, Wes Garde Components 614-885-0319
TX Dallas, GEECO Sls. Co. 214-341-0610
TX Dallas, Wes Garde Components 214-357-1768
Can Downsview, Ont., Westburne Elctrns. 416-635-2950

OSTBY & BARTON, 487 Jefferson Blvd., Warwick, RI 02886, Tel: 401-739-7310, TELEX: 927573; *Sls. Mgr.:* Jos. E. Burns

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FAX: 312-428-1956

OTTO CONTROLS, Otto Engineering, 2 E. Main St., Carpentersville, IL 60110, Tel: 312-428-7171, TELEX: 722426; FSC No.: 21649; Empl.: 200; *Sls. Mgr.:* R. E. Sparks ..... **B•1784-1785**

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NY Great Neck, Tylinski Co. 516-466-9070
NY Guilderland, Nu-Tekneex Mktg. 518-355-1829
NC Kernersville, CCI South, Inc. 919-996-4814
OH Kettering, Electro-Com 513-299-0864
TN Chattanooga, Electro Sls. 615-267-4260
TX Dallas, Control Comps. Corp. 214-458-8877
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Bellevue, James Findlay Co. 206-455-9597

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AZ Tempe, Harper S.I.D. 602-967-1464
CA Gardena, Cal Switch 213-770-2330
CA Los Angeles, Electric Switches, Inc. ... 213-660-1310
MD Kensington, Marine Air Supp. 301-949-9560
MA Hingham, Sager Elec. Supp. 617-749-6700
NM Albuquerque, International Elctrns. 505-345-8127
NY Lynbrook, Peerless Radio Corp. 516-593-2121
NC Greenville, Womack Elctrns. 919-758-5047
TX Dallas, Associated Aircraft Supp. 214-331-4381

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OVENAIRE, Electronic Technologies Inc., 706 Forrest St., Charlottesville, VA 22901, Tel: 804-977-8050, TWX: 910-997-8053; FSC No.: 12020; Empl.: 165; *Sls. Mgr.:* Andy Bell ..... **A•1442-1445, 1996-1997**

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AL Huntsville, L & D, Inc. 205-837-1469
CA San Mateo, Melvin Sls. 415-349-7445
CA Van Nuys, R.L. Assocs. 213-782-7826
FL Longwood, D. Assocs. 305-830-8976
FL Maitland, Ellis & Assocs. 305-645-1101
GA Atlanta, L & D Inc. 404-395-7079
IL Des Plaines, Janus Inc. 312-298-9330
MD Towson, Dickison Sls. Co. 301-823-0923
MA Milton, Naton Assocs. 617-698-0670
MN St. Paul, Countryman 612-645-9151
NJ Cherry Hill, H. J. White Co. 609-428-4544
NJ Paramus, Eltech Sls. 201-967-1309
NY Buffalo, Quality Comps. 716-837-5430
NC Greensboro, L & D, Inc. 919-292-3201
NC Raleigh, L&D Inc. 919-876-5301
TN Seymour, L&D Inc. 615-577-1549
TX Bedford, W. Pat Fralia Co. 817-354-1144
WA Seattle, Interconnect Tech. 206-462-9508
WI Milwaukee, Janus Inc. 414-476-9104

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CA San Jose, J. T. McFarland Assocs. 408-286-9333
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IL Lincolnwood, Electro-Tech Mktg. Assocs. 312-676-3151
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PA Paoli, Stitzer Assocs. 215-644-5500
TX Richardson, Eagle Marketing 214-238-5383

OYSTER TERMINALS, 1640 5th St., Suite 224, Santa Monica, CA 90401, Tel: 213-395-4774, TELEX: 65-2337 (BT Smedley SNM); *Sls. Mgr.:* Eric Sheppard; *Dist. Mgr.:* Christopher E. Thomson

PACCOM, 3928 148th NE, Redmond, WA 98052, Tel: 206-883-9200, 800-426-6254, TWX: 910-449-2973, FAX: 206-881-0508; Empl.: 16; *Sls. Mgr.:* B. Rudd

PACE INC., 9893 Brewers Ct., Laurel, MD 20707, Tel: 301-490-9860, TELEX: 198296, FAX: 301-498-3252; *Sls. Mgr.:* James K. Bausell

PACER INDUSTRIES, INC., 1450 First Ave., Chippewa Falls, WI 54729, Tel: 715-723-1141, TELEX: 284755; FSC No.: 60162; *Sls. Mgr.:* Olen Nantz

PACIFIC ATLANTIC ELCTRNS., Box 754, El Cerrito, CA 94530, Tel: 415-237-5837, TWX: 510-100-9120, FAX: 415-524-9267; Empl.: 4; *Sls. Mgr.:* P. Yen; *Dist. Mgr.:* P. Yen

PACIFIC COAST CIRCUITS, INC., 189 Granada Dr., San Luis Obispo, CA 93401, Tel: 805-544-4881; FSC No.: 66107; Empl.: 18; *Sls. Mgr.:* Chris Cofer

PACIFIC COMMUNICATIONS, 2041 S. Grand Ave., Santa Ana, CA 92705, Tel: 714-546-0147; Empl.: 60

PACIFIC ELECTRICORD, 747 W. Redondo Bch. Blvd., Gardena, CA 90247, Tel: 213-532-6600, TWX: 910-346-7619; Empl.: 850; *Sls. Mgr.:* W. A. Fiechtner; *Dist. Mgr.:* Robert Huffman

PACIFIC ELECTRO DYNAMICS, INC., 11465 Willows Rd. N.E., Redmond, WA 98073-9745, Tel: 206-881-1700, TWX: 910-449-2977; Empl.: 350

PACIFIC INSTRUMENTS INC., 215 Mason Circle, Concord, CA 94520, Tel: 415-827-9010, TWX: 910-481-9977; Empl.: 60; *Sls. Mgr.:* Bill Wagner

PACIFIC MAGNETICS CORP., 2602 Transportation Ave., Ste. G, National City, CA 92050, Tel: 619-474-8216, FAX: 619-474-3979; *Sls. Mgr.:* Mary Hill

PACIFIC MICROCOMPUTERS, Signal Technology, 6730 Mesa Ridge Rd., San Diego, CA 92121, Tel: 619-453-8649, TELEX: 701-578; FSC No.: 701-578;;;408-433-1337; Empl.: 30; *Sls. Mgr.:* Walter Snell

PACIFIC
POWER SOURCE CORP.

FAX: 714-891-1928

PACIFIC POWER SOURCE CORP., 15122 Bolsa Chica St., Huntington Bch., CA 92649, Tel: 714-898-2691, 800-854-2433; FSC No.: 57148; Empl.: 80; *Sls. Mgr.:* Russ Engle ..... **D•2134-2139**

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CA Sunnyvale, Amasco Corp. 408-773-8690
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FL W. Palm Bch., Ram-Z Assocs. 305-641-4574
IL Chicago, Comtel Midwest 312-539-4838
IN Indianapolis, Loren Green Assocs. 317-923-9827
IA Cedar Rapids, Comtel Midwest Co. ... 319-377-9434
KS Shawnee Mission, Comtel Midwest Co. 913-268-0762
MA Burlington, Intersell, Inc. 617-273-3844
MI Pontiac, EQS Sys. 313-338-2280
MN Minneapolis, Loren Green Assocs. 612-571-6666
MO St. Louis, Comtel Midwest Co. 314-991-5363
NY DeWitt, D. B. Assocs. Inc. 315-446-0220
NY Wantagh, Bytec Reps. 516-781-7400
OH Chesterfield, EQS Sys. 313-338-2280
OH Dayton, EQS Sys. 513-236-7676
OK Tulsa, J. Wisdom & Assocs. 918-665-8899
PA Mechanicsville, John Bell Assocs. 215-794-7075
PA Pittsburgh, EQS Sys. 412-261-2604
TX Richardson, J. Wisdom & Assocs. 214-470-9093
VA Fairfax, Scientific Assocs. 703-385-0600
WA Bellevue, Al Smith 206-746-6770
WI New Berlin, Comtel Midwest Co. 414-544-6042

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EXP Los Angeles, CA, Trans World Trade 213-476-8406

PACIFIC RESISTOR CO., 18300 Oxnard St., Tarzana, CA 91356, Tel: 818-345-7811, TELEX: 06416; FSC No.: 06416; *Sls. Mgr.:* Douglas Trewhitt ..... **A•1998-1999**

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CA San Jose, Comtech Mktg. 408-293-0894
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PACIFIC SCIENTIFIC CO., 4301 Kishwaukee, Rockford, IL 61105, Tel: 815-226-3100, TELEX: 386743, FAX: 815-226-3122; Empl.: 400

PACIFIC SCIENTIFIC, Electro Kinetics Division, 402 E. Gutierrez St., Santa Barbara, CA 93101, Tel: 805-963-2055, TWX: 910-334-1177; Empl.: 210; *Sls. Mgr.:* Robert E. Lynch

PACIFIC TRANSDUCER CORP., 2301 Federal, Los Angeles, CA 90064, Tel: 213-478-1134, TELEX: 3781834 PTC, FAX: 213-312-0826; Empl.: 22; *Sls. Mgr.:* Thomas Lopez

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CA San Diego, English/Damco Sls. Co., Inc. 619-942-8282
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CO Englewood, Omega Ltd. 303-762-1921
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WI Appleton, Ed Sabish 414-731-7212

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AZ Tempe, Circut Specialists, Inc. 602-966-0764
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CA Cucamonga, Abletronics 714-987-7606
CA El Segundo, Force Elctrns. 213-772-1324

CA El Toro, R-Vac 714-586-1210
CA Gardena, California Switch & Signal .. 213-538-9830
CA Goleta, Elctrn. Resources 805-967-8280
CA Milpitas, Zack Elctrns. 408-942-8257
CA Monterey, Zackit (Monterey) 408-375-3144
CA Redding, North Valley Elec. Distr. 916-222-1500
CA Sacramento, Zackit/Sacramento 916-446-3131
CA San Diego, Southland Comps. 619-578-6630
CA San Francisco, Zack Elctrns. 415-626-1444
CA San Jose, Force Elctrns. 408-435-1324
CA San Jose, Quement Elctrns. 408-998-5355
CA San Jose, Rose Elctrns. 408-943-0200
CA Sunnyvale, Fry's Elctrns. 408-733-1770
CA Thousand Oaks, Sandy's Elctrns. 818-889-1209
CA Vallejo, Zackit (Vallejo) 707-644-6676
CO Aurora, Jet Elctrn. Supp. 303-364-1000
CO Englewood, Indelco 303-694-9444
CT Stratford, Utronics 203-378-4201
CT Wallingford, Midstate Elctrns. 203-265-9900
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DE Wilmington, Wholesale Elctrns. Inc. ... 302-656-9988
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FL Longwood, Intertec Comps. 305-834-7777
FL St. Petersburg, Knapp of Florida 813-392-0406
FL Tampa, Sunex Elctrns. 813-885-4074
FL West Palm Beach, Nurmi Elctrns. 305-686-8553
GA Atlanta, Ack Radio 404-351-6340
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HI Honolulu, Precision Radio, Ltd. 808-537-5291
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IL Peoria, Klaus Radio 309-691-4840
IL Rosemont, Advent Elctrns. 312-298-4210
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IN Indianapolis, Advent Elctrns. 317-872-4910
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OH Cincinnati, R. S. Elctrns. 513-793-2450
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OH Columbus, Hughes-Peters 614-294-5351
OK Oklahoma City, She Elctrns. 405-843-5941
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OR Beaverton, Rose Elctrns 503-629-9288
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PA York, Rosen Elctrns. 717-843-7881
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TN Nashville, Bluff City 615-242-8000
TN Nashville, Randolph & Rice 615-255-5602
TX Austin, Galtronics 512-837-7470
TX Austin, Wofford Elctrns. 512-339-1131
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Wholesale Elctrns. Supp. 214-824-3001
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Houston, Ace Elctrns. 713-688-8114
TX Houston, Force Elctrns. 713-561-8644
TX Houston, Wofford Elctrns. 713-847-3583
TX Richardson, Off-the-Shelf Comps. 214-238-0808
TX San Antonio, Altex Elctrns. 512-828-0503
UT Salt Lake City, Standard Supp. 801-486-3371
VA Charlottesville, Virginia Elctrn. Comps. 804-296-4184
WA Bellevue, Almac Elctrns. DKM Co. 206-643-9992
WA Seattle, Radar Elec. 206-282-2511
WI Milwaukee, Industrial Elctrns., Inc. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp., Inc. 414-786-5300
WI Oshkosh, Electronic Inds., Inc. 414-235-8930
Can Burnaby, BC, Intek Elctrns. 604-294-8100
Can Mississauga, Ont., Rush Elctrns. 416-677-7280
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, BC, Future Elctrns. 604-294-1206
Can Victoria, BC, Queale Elctrns., Ltd. 604-388-6111

PAINE CORPORATION, 2401 S. Bayview St., Seattle, WA 98144, Tel: 206-329-8600, 800-426-0366, ESYLNK: 6294-5057, FAX: 206-329-1615; FSC No.: 13624; Empl.: 93; *Sls. Mgr.:* R. E. Helmick

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PALOMAR ENGINEERS, Box 455, Escondido, CA 92025, Tel: 619-747-3343; Empl.: 9

PAMRAN INC., 1900 Williams St., Young Ind. Pk., Racine, WI 53404, Tel: 414-637-7999; Empl.: 28; *Sls. Mgr.:* R. C. Pfeil

PANAMETRICS, 221 Cresent St., Waltham, MA 02254, Tel: 617-899-2740, TELEX: 6817337, TWX: 951006, FAX: 617-899-1552; Empl.: 200; *Sls. Mgr.:* Bob Mel

Panasonic

FAX: 201-392-4782

PANASONIC INDUSTRIAL CO., Battery Sls. Div., Box 1511, Secaucus, NJ 07096-1511, Tel: 201-348-5266; Empl.: 25 ..... **D•1470-1477**

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AZ Scottsdale, Dar-C 602-948-2240
CA Glendale, Halbar Assocs. Inc. 818-246-8263
CA Pleasanton, Moulthrop Sls. Inc. 415-463-0450
CA San Diego, Tauber & Assocs. 619-274-7242
FL Deerfield Bch., S.E.C. 305-426-4601
IN Indianapolis, Marketing Engs. Inc. 317-872-5665
KS Overland Pk., Spectrum Sls. 913-648-6811
MA Burlington, Conti-Younger Assocs. Inc. 617-273-1582
MN Eden Prairie, Electro Mark Inc. 612-944-5850
OH Beachwood, Elctrn. Salesmasters Inc. 216-831-9555
OR Beaverton, Advanced Power Prods. 503-646-0994
TX Dallas, Dunbar Assocs. 214-239-7151

Local Distributors

AL Huntsville, Resistacap Inc. 205-883-4270
AZ Scottsdale, Electro Mktg. 602-991-0110
CA Chatsworth, Mil-Comm 818-998-3111
CA San Diego, Tauber Elctrns. Inc. 619-274-7242
CA San Jose, Rose Elec. Distrbg. Co. 408-263-2934
CA Santa Clara, Cypress Elctrns. Inc. 408-980-2500
CA Van Nuys, NESCO 818-781-0505
CO Arvada, Denver/Wintronics 303-431-7161
CO Englewood, Colorado Indl. Elec. Ind. .. 303-694-9444
CT Woodbury, Cell Technlg. 203-266-4105
FL St. Petersburg, Micro Precision 813-821-5504
GA Norcross, Applied Power, Inc. 404-263-0421
IL Morton Grove, Power Pak Inc. 312-966-6000
IL Palatine, Ohm Elctrns. 312-359-5500
IN Indianapolis, Bell Inds. 317-634-8202
MD Aberdeen, Harco Elctrns. 301-575-6885
MD Beltsville, Mark Elctrns. 301-792-0072
MA Canton, Impact Sls. Co. Inc. 617-821-1500
MA Danvers, Generation Elctrns. Inc. 617-777-4866
MI Brighton, Applied Power Inc. 313-227-3604
MN Thief River Falls, Digi-Key 800-346-5144
MO St. Louis, Indl. Battery Prod. Inc. 314-423-7005
NJ Camden, Gen. Radio 609-964-8560
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Panasonic

FAX: 201-392-4441

PANASONIC INDUSTRIAL COMPANY, Electronic Components Division, 1 Panasonic Way, Secaucus, NJ 07094, Tel: 201-392-4290/4264; *Sls. Mgr.:* J. Ambrose/E. Budenieks/K. Sasaki; *Dist. Mgr.:* Liz Morgan ..... **D•1860-1861**

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AL Huntsville, Rep, Inc. 205-830-0470
AZ Phoenix, O'Donnell Assts. 602-944-9542
CA Los Alamitos, Power Specialists 213-594-9418
CA Pleasanton, Moulthrop Sls., Inc. 415-463-0450
CO Englewood, Comp. Sls., Inc. 303-779-8060
FL Coral Springs, HAI Elctrns. Inc. 305-752-7520
GA Tucker, Rep, Inc. 404-938-4358
IL Palatine, Technlg. Sls. 312-991-6600
IN Indianapolis, Mktg. Engrs., Inc. 317-872-5665
MI Brighton, Elctrn. Sources, Inc. 313-227-3598
MN Eden Prairie, Electro-Mark, Inc. 612-944-5850
MO St. Louis, KKB & Co. 314-647-2400
NJ Fair Lawn, March Inds. 201-794-0088
NJ Medford, Jack McCoy, Inc. 609-953-0770
NJ Secaucus, Panasonic 201-392-4290
NM Albuquerque, O'Donnell Assts. 505-883-1030
NY Mendon, Tech-Mark, Inc. 716-624-3840
NC Morrisville, Rep., Inc. 919-469-9997
NC Raleigh, Rep, Inc. 919-851-3007
OH Dayton, Del Steffan & Assocs. 513-293-3145
OH Lexington, Del Steffan & Assocs. 419-884-2313
OR Tigard, Elctrn. Engrg. Sls. 503-639-3978
PA Carnegie, Del Steffan & Assocs. 412-276-7366
PA Exton, Jack McCoy, Inc. 215-363-0350
TN Jefferson City, Rep., Inc. 615-475-4105
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UT Salt Lake City, Comp. Sls., Inc. 801-268-8440
WA Redmond, Elctrn. Engrg. Sls. 206-883-3374
Can Concord, Ont., Astec Comps., Ltd. 416-669-4022

Local Distributors

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CA Santa Clara, Cypress Elctrns., Inc. 408-980-2500
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MI Livonia, RS Elctrns. 313-525-1155
MN Minneapolis, Indl. Comps., Inc. 612-831-2666
TX Dallas, Computer Comps. Corp. 214-239-0271
WI Milwaukee, Taylor Elec. Co. 414-241-4321

PANATECH SEMICONDUCTOR, 3375 Scott Blvd., Suite 314, Santa Clara, CA 95054, Tel: 408-727-7700, TWX: 910-380-3973, FAX: 408-727-8144; Empl.: 12; *Sls. Mgr.:* Rebecca Gutierrez; *Dist. Mgr.:* Rebecca Gutierrez

PANAVISE PRODS., 2850 E. 29th St., Long Beach, CA 90806, Tel: 213-595-7621, TELEX: 18-2135, FAX: 213-595-9539; Empl.: 25; *Sls. Mgr.:* Gary Richter; *Dist. Mgr.:* Kathy DePorter

PANDUIT CORP., 17301 Ridgeland Ave., Tinley Park, IL 60477-0981, Tel: 312-532-1800, TELEX: 25-4560; FSC No.: ;06383; Empl.: 1200 .... **C•1476-1478, 1892-1893**

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AL Birmingham, Frank Parker & Assocs. 205-655-4801
AL Mobile, Frank Parker & Assocs. 205-457-3896
AK Anchorage, Bar Elec. Agt. 907-345-7281
AZ Tucson, Clemick & Assocs. 602-749-4003
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CA Anaheim, Panduit Corp. 714-978-2299
CA Los Altos, Ewing-Foley 415-941-4525
CA Sacramento, Ewing-Foley, Inc. 916-786-0796
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FL	Orlando, Panduit Corp.	800-282-9209
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LA	New Orleans, Wells-Keown & Assocs.	504-244-0330
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MO	St. Louis, Panduit Corp.	314-894-7800
NE	Omaha, Panduit Corp.	402-391-0452
NV	Las Vegas, G & F Sls. Co.	702-367-0885
NH	Salem, Sales Eng. Co.	603-893-5521
NJ	Leonia, Panduit Corp.	201-461-7790
NM	Albuquerque, F P Sls.	505-345-5553
NY	Buffalo, Panduit Corp.	800-777-3300
NY	Rochester, Panduit Corp.	800-777-3300
NY	Schenectady, Panduit Corp.	800-777-3300
NY	Syracuse, Panduit Corp.	800-777-3300
NC	Raleigh, L. G. White Southern	919-872-6049
NC	Winston-Salem, L. G. White Southern	919-725-3612
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OH	Cleveland, Panduit Corp.	800-777-3300
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OK	Oklahoma City, Elctrl. Prods. of Okla.	405-235-8041
OR	Portland, Panduit Corp.	503-654-9455
PA	Philadelphia, Kunz, Powell & Assoc.	215-296-9490
PA	Pittsburgh, Cody Assocs., Inc.	412-787-5336
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Datatronics
A DIVISION OF DATAMAX ELECTRONICS

PR	Santurce, L. Gandia & Assocs.	809-725-3473
Can	Markham, Ont., Panduit Canada Ltd.	416-475-6922

PANEL COMPONENTS CORPORATION

FAX: 707-578-5478

PANEL COMPONENTS CORP., P.O. Box 6626M, Santa Rosa, CA 95406, Tel: 707-523-0600, TELEX: 176-747; Empl.: 18 ..... **B•1344-1345; C•1480-1484, 1894-1898; D•2141**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg. Inc.	205-533-5165
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CA	Tustin, Schoenbachler-Dobson Co.	714-544-1888
CO	Englewood, Omega Ltd.	303-762-1921
FL	Deerfield Beach, Newell-Hynes Assoc., Inc.	305-429-3207
GA	Atlanta, DHR Mktg., Inc.	404-451-9848
IL	Northbrook, Raines & Assocs.	312-498-0890
IA	Marion, M-S-B Assocs., Inc.	319-377-6261
KS	Shawnee Mission, M-S-B Assocs., Inc.	913-432-2131
MA	Scituate, Olsen Tech. Sls.	617-878-9386
MN	St. Paul, Arkco Sls.	612-777-7454
MO	St. Charles, M-S-B Assocs., Inc.	314-946-5577
NC	Raleigh, DHR Mktg., Inc.	919-781-1961
OH	Cleveland, K-T Depco	216-442-6200
PA	Philadelphia, Eastern Sci. Mktg.	215-368-4570
PA	Pittsburgh, K-T Depco	412-367-1011
SC	Greenville, DHR Mktg. Inc.	803-235-3594
TX	Lewisville, Jim Hughes Co.	214-221-1536
EXP	Burnaby, B. C., Darmac Agencies, Ltd.	604-438-3523
Can	Ottawa, Ont., Lloyd Ellam Assocs.	613-727-3892

PAN-MAGNETICS, See Tamura Corp. of America

PAPST

FAX: 401-849-4640

PAPST MECHATRONIC CORP., Aquidneck Indl. Pk., Newport, RI 02840, Tel: 401-849-8810 ... **C•1692-1694**

Local Sales Offices & Reps

AL	Huntsville, Robert O. Whitesell & Assocs.	205-883-5110
AZ	Phoenix, Jr. Engrg. Sls., Inc.	602-956-4670
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	Campbell, Papst Mechatronic Corp.	408-377-4842
CA	Pasadena, Luscombe Engrg. Co.	213-684-2000
CA	San Diego, Luscombe Engrg. Co.	619-549-9699
CO	Denver, Quorum 3	3030-750-3267
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Oviedo, Conley & Assocs.	305-365-3283
GA	Norcross, Robert O. Whitesell & Assocs.	404-449-9190
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Indianapolis, Elctrn. Mktg. Consits.	317-253-1668
IA	Marion, MSB Assocs. Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MA	Needham, Sturgeon Co.	617-444-6603
MN	Edina, Mel Foster Tech. Sls., Inc.	612-941-9790
MO	St. Charles, MSB Assocs.	314-946-5577
NJ	Cherry Hill, Trinkle Sls., Inc.	609-795-4200
NJ	Englewood, Harold Gray Assocs., Inc.	201-894-0894,215-922-2080
NY	Johnson City, Tech-Mark, Inc.	607-729-
NY	Mendon, Tech-Mark, Inc.	716-624-3840
NY	Utica, Tech-Mark, Inc.	315-733-0575
NC	Greensboro, Robert O. Whitesell & Assocs.	919-273-1945
OH	Beachwood, Elctrn. Salesmasters, Inc.	216-831-9555
OR	Beaverton, Venture Elctrns.	503-626-7418
TN	Knoxville, Robert O. Whitesell & Assocs.	615-694-9476
TX	Dallas, JYSCO/Comps., Inc.	214-349-1650
WA	Bellevue, Venture Elctrns.	206-454-4594
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pickering, Ont., A.C. Simmonds & Sons, Ltd.	416-839-8041

PARAGON ELECTRIC CO., INC., 606 Parkway Blvd., Two Rivers, WI 54241, Tel: 414-793-1161, TELEX: 26-3450, FAX: 414-793-3736; Empl.: 500; *Sls. Mgr.:* Don Karman

PARALINE

FAX: 818-281-5867

PARA-LINE TRANSFORMER CO., INC., 511 South Palm Ave., Alhambra, CA 91803, Tel: 818-281-0222; FSC No.: 59465; Empl.: 52 ..... **A•2318**

PARK ELECTRONICS, 16 Xenia Court, Mine Hill, NJ 07801, Tel: 201-328-9299; Empl.: 60; *Sls. Mgr.:* Kelly Faulkenham

PARKER HANNIFIN CORP., 17325 Euclid Ave., Cleveland, OH 44112, Tel: 216-531-3000, TELEX: 980636

PARKER HANNIFIN CORPORATION, Compumotor Division, 1179 N. McDowell Blvd., Petaluma, CA 94952, Tel: 707-778-1244, 800-358-9068, TWX: 510-744-2155

PARKER MCCRORY MFG. CO., 2000 Forest Ave., Kansas City, MO 64108, Tel: 816-221-2000; *Sls. Mgr.:* Ken Turner; *Dist. Mgr.:* Ken Turner

PARKER SEAL GRP., P.O. Box 11751, Lexington, KY 40512, Tel: 606-269-2351, TELEX: 218-442; Empl.: 2,200; *Sls. Mgr.:* Frank Chesnik; *Dist. Mgr.:* John Dutton

PARLEX CORP., 145 Milk St., Methuen, MA 01844, Tel: 617-685-4341, Ext. 265, TWX: 710-342-1528; Empl.: 650; *Sls. Mgr.:* Gary Marraccini

PAR-METAL

FAX: 718-439-3930

PAR METAL PRODUCTS, INC., 1260 Atlantic Ave., Brooklyn, NY 11216, Tel: 718-774-5900, TELEX: 424 823 SNDS UI Attn: Par; Empl.: 100; *Sls. Mgr.:* J. Troiano ..... **C•1072**

PARSONS MANUFACTURING, 1055 O'Brien Dr., Menlo Park, CA 94025-1476, Tel: 415-324-4726, FAX: 415-324-3051; Empl.: 45; *Sls. Mgr.:* C. E. Plummer

PARVEX DIVISION, Alsthom International, Inc., Two Ram Ridge Road, Spring Valley, NY 10977, Tel: 914-425-6908, FAX: 914-425-8108

PASO SOUND PRODUCTS, 14 First St, Pelham, NY 10803, Tel: 914-738-4800, FAX: 914-738-3954; Empl.: 50; *Sls. Mgr.:* David Moore

PASTERNACK ENTERPRISES, P.O. Box 16759, Irvine, CA 92713, Tel: 714-261-1920; FSC No.: 53919; Empl.: 26; *Sls. Mgr.:* Heather Marshall

PATTON-MACGUYER INC., 17 Virginia Ave., Providence, RI 02905, Tel: 401-941-6000, FAX: 401-941-5290; FSC No.: 77147; Empl.: 55; *Sls. Mgr.:* J. Allen

PAYNE ENGINEERING, Box 70, Scott Depot, WV 25560, Tel: 304-757-7353, TELEX: 88-5452; Empl.: 40; *Sls. Mgr.:* Matthew J. Gilberto

PCA ELECTRONICS INC

FAX: 818-894-5791

PCA ELECTRONICS, 16799 Schoenborn St., Sepulveda, CA 91343, Tel: 818-892-0761, TWX: 910-496-1525; FSC No.: 97722; Empl.: 45; *Sls. Mgr.:* Ben Weinberg ..... **A•1602-1611, 2305-2307**

Local Sales Offices & Reps

AZ	Phoenix, Toward Engrg. Assocs.	602-955-3193
CA	Folsom, Fahrner-Miller Assocs., Inc.	916-985-6382
CA	San Diego, Ramsey & Assocs.	619-546-9277
CA	Santa Clara, Fahrner-Miller Assocs.	408-727-9800
FL	Boca Raton, Sunland Assoc.	305-365-1533
FL	Goldenrod, Sunland Assocs.	305-365-9533
IL	Westchester, W. G. Brouillette & Assocs.	312-345-6500
IN	Carmel, W. G. Brouillette & Assocs., Inc.	317-848-2016
MA	Sudbury, KSA of New England	617-443-5881
MN	Minneapolis, Bill Deming and Assocs.	612-888-5000
NJ	Springfield, F. F. Sylvester	201-376-3324
NJ	Wayne, Howard Kagan Assocs.	201-694-1115
OH	Dayton, Electro-Com	513-898-5140
OR	Portland, Elctrn. Comp. Sls.	503-245-2342
PA	King of Prussia, Eltron Comp. Sls.	215-783-5350
TX	Richardson, Blackburn Assocs.	214-783-2200
UT	Salt Lake City, Sage Sls.	801-467-2401
WA	Mercer Island, Elctrn. Comp. Sls.	206-232-9301
WA	Seattle, Elctrn. Comp. Sls.	206-232-9301

Local Distributors

CA	Buena Pk., Cypress Elctrns. Inc.	714-521-5230
CA	San Diego, Cypress Elctrns. Inc.	619-535-0011
CA	San Jose, Cypress Elctrns.	408-980-2500
CA	Santa Clara, Cypress Elctrns. Inc.	408-980-2500
CO	Wheatridge, Cypress Elctrns. Inc.	303-431-2622
MA	Sudbury, ASK Elctrns.	617-443-5881
NJ	Parsippany, Fabe Electro-Sales	201-299-1123
OR	Beaverton, Cypress Elctrns.	503-641-2233
WA	Bothwell, Cypress Elctrns.	206-483-1144

PCB PIEZOTRONICS, 3425 Walden Ave., Depew, NY 14043-2495, Tel: 716-684-0001, TWX: 710-263-1371; Empl.: 150; *Sls. Mgr.:* Roy Maines

Local Sales Offices & Reps

CA	Alhambra, Dale-Dahl Assocs.	213-682-3417
FL	Orlando, Microspec, Inc.	305-898-3504
IL	Woodstock, TMI Inc.	815-385-2212

PCD, 5 Lowell Avenue, Winchester, MA 01890, Tel: 617-721-1280, FAX: 617-729-1898; FSC No.: 58982; *Sls. Mgr.:* A. Arcisz

PCK ELASTOMERICS, INC., 2940 Turnpike Dr., Hatboro, PA 19040, Tel: 215-672-0787, 215-672-4741, TWX: 510-387-236, FAX: 215-672-4633; FSC No.: 64914; *Sls. Mgr.:* John H. Seibert; *Dist. Mgr.:* George Glatts **C•1485-1487**

Local Sales Offices & Reps

AZ	Scottsdale, TC Elctrn. Sls., Inc.	602-994-5153
CA	Fullerton, Libratronix	714-871-1513
CA	San Jose, Western Indl. Network	408-559-8118
CO	Denver, Sunbird Inds.	719-481-2900
CT	S. Dartmouth, Remtron	617-444-5256
FL	Melbourne, Southern Elctrns. Sls.	305-242-9661
IL	Barrington, Fisk Mktg.	219-478-1057
IN	Ft. Wayne, R. L. Bontempo & Assocs.	219-478-1057
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Needham Hgts., Remtron	617-444-9566
MI	Troy, C. B. Jensen & Assocs.	313-643-0506
MN	Brooklyn Center, Willman Assocs.	612-566-5010
NJ	Madison, Livera-Polk Assocs., Inc.	201-377-3220
NY	E. Rochester, L-Mar Assocs.	716-381-9100
NY	Glen Head, Livera-Polk Assocs., Inc.	516-759-9300
NC	Raleigh, KZJ Comp. Sls.	919-782-8100
OH	Cincinnati, G & H Sls.	513-272-0580
OH	Grove City, G & H Sls.	614-878-1128
OH	Richmond Hgts., G & H Sls.	216-248-8490
OR	Beaverton, L. D. Elctrns.	503-684-8221
PA	Hatboro, J. S. Wurts	215-674-3562
TX	Dallas, Marcom	214-351-4532
TX	Houston, Marcom	713-271-5635
UT	Salt Lake City, Sunbird Inds.	801-943-5609
WA	Snohomish, L. D. Elctrns.	206-568-0511
WA	Spokane, LD Elctrns.	509-922-4883

PCK TECHNOLOGY DIV., Kollmorgen Corp., 322 South Service Rd., Melville, NY 11747, Tel: 516-454-4400, TELEX: 6852163, FAX: 516-454-0317; Empl.: 180; *Sls. Mgr.:* J. F. Dennis-Browne

PC TRANSFORMER CORP., 64 D Nancy St., West Babylon, NY 11704, Tel: 516-491-3300, FAX: 516-491-3689; FSC No.: 62281; Empl.: 11; *Sls. Mgr.:* Stanley L. Goldstein **A•2308-2315**

PEARSON ELECTRONICS, INC., 1860 Embarcadero Rd., Palo Alto, CA 94303, Tel: 415-494-6444, TELEX: 171-412, FAX: 415-494-6716; FSC No.: 05280; Empl.: 23; *Sls. Mgr.:* Patricia L. Pearson **A•2316**

PECA, INC., 592 Winks Lane, Bensalem, PA 19020, Tel: 215-245-1550; Empl.: 30; *Sls. Mgr.:* Jean Douglass

PENFIELD, INC., 8 West St., Plantsville, CT 06479, Tel: 203-621-9141, TWX: 5101003285, ESYLNK: 6287757, FAX: 203-621-2380; Empl.: 77

PENN AIRBORNE PRODS., 950 Industrial Hwy., Southampton, PA 18966, Tel: 215-355-3400, TELEX: 834-759, FAX: 215-322-2194; FSC No.: 25805; Empl.: 41; *Sls. Mgr.:* Claude Mercier

PENN ENGINEERING & MANUFACTURING CORP., P.O. Box 1000, Danboro, PA 18916, Tel: 215-766-8853, FAX: 215-766-0143; FSC No.: 46384; Empl.: 480; *Sls. Mgr.:* John E. O'Brien

PENN KEYSTONE CORP., Div. of C & K Components, Ives Road, Wallingford, CT 06492, Tel: 203-269-8701, TELEX: 96-3485, TWX: 710-476-1397, FAX: 203-265-5398; FSC No.: 03034; *Sls. Mgr.:* Martin Wakefield

The New PENN-TRAN

FAX: 814-355-1524

PENN-TRAN CORP., Box 1321, Rte. 144N, Wingate, PA 16880, Tel: 814-355-1521, TELEX: 706473; FSC No.: 50783; Empl.: 87; *Sls. Mgr.:* William Holt **A•1280; D•1862**

Local Sales Offices & Reps

AZ	Tempe, Systems Sls. of Arizona	602-829-9338
CA	Los Altos, Cain-White & Co.	415-948-6533
CA	Pasadena, A-F Sls. Engrg., Inc.	213-681-5631
CA	San Diego, AF Sls. Engrg. Inc.	619-581-1206
CO	Englewood, Dynatech, Inc.	303-773-2830
CT	Madison, United Comp.	203-245-4810
IL	Lake Bluff, R & R Mktg. Assoc.	312-295-6660
IN	Ft. Wayne, Aktron	219-747-3650
MA	Bourne, United Comps.	617-759-3556
MN	Minneapolis, International Sls. Co.	612-831-8423
NY	Johnson City, Teckmark, Inc.	607-729-6340
NY	Mendon, Tech-Mark, Inc.	716-624-3840
OH	Sharon Center, Merit Elctrns., Inc.	216-725-1460
OR	Portland, Intertech Sls.	503-775-7885
PA	Glenside, Koebert Assocs., Inc.	215-887-2310
TX	Dallas, Seaton Corp.	214-380-0414
UT	Layton, Dynatech, Inc.	801-546-4837
WV	Inwood, Koebert Assoc.	304-229-8401

PENN VIDEO INC., 929 Sweitzer Ave., Akron, OH 44311, Tel: 216-762-4840, TELEX: 98-6327 PVI-AKR, FAX: 216-762-4840 (ext. 34); Empl: 66; *Sls. Mgr.:* Sandra Donaldson; *Dist. Mgr.:* Gary Wagner

PENNWALT CORP., Three Pkwy., Philadelphia, PA 19102, Tel: 215-587-7520, TELEX: 84-5234, FAX: 215-587-7497

PENNY & GILES, 1640 Fifth Street, Suite 224, Santa Monica, CA 90401, Tel: 213-393-1497, TELEX: 65-2337

PENRIL DATACOMM, Penril Corp., 207 Perry Parkway, Gaithersburg, MD 20877, Tel: 301-921-8600, TWX: 710-828-0522; Empl.: 250; *Sls. Mgr.:* Bob Maranzani

PENSTOCK ENGINEERING LABS., Penstock, Inc., 520 Mercury Dr., Sunnyvale, CA 94086-4018, Tel: 408-730-0300, TWX: 910-370-7450, FAX: 408-730-4782; Empl.: 24; *Sls. Mgr.:* Steve Ulett; *Dist. Mgr.:* Jerry Quinnell **A•1844**

Local Sales Offices & Reps

AZ	Phoenix, Penstock Desert States	800-255-6788
CA	Sunnyvale, Penstock Intl.	408-730-0300
CA	Sunnyvale, Penstock, Inc.	408-730-0300
IL	Palatine, Penstock Midwest	312-934-3700
NJ	Teterboro, Penstock East	201-288-7313
OR	Portland, Penstock Northwest	206-454-2371
WA	Bellevue, Penstock Northwest	206-454-2371
EXP	CA/Sunnyvale, Penstock Intl.	408-730-0300
Can	Vancouver, BC, Penstock Canada	604-662-3475

Local Distributors

AZ	Phoenix, Penstock Desert Sls.	800-255-6788
CA	Sunnyvale, Penstock Intl.	408-730-0300
CA	Sunnyvale, Penstock, Inc.	408-730-0300
IL	Palatine, Penstonck Midwest	312-934-3700
NJ	Teterboro, Penstock East	201-288-7313
OR	Portland, Penstock Northwest	206-454-2371
WA	Bellevue, Penstock Northwest	206-454-2371
EXP	CA/Sunnyvale, Penstock Intl.	408-730-0300
Can	Vancouver, BC, Penstock Canada	604-662-3475

PERCON (PERIPHERAL CONNECTIONS, INC.), 2190 W. 11th, Eugene, OR 97402, Tel: 503-344-1189, FAX: 503-344-1399; Empl.: 15; *Sls. Mgr.:* Palmer Parker

PERFECT GEAR & INSTRUMENT, Designatronics, Inc., 2101 Jericho Tpk., New Hyde Park, NY 11040, Tel: 516-328-3300, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 210; *Sls. Mgr.:* Murray Ores

PERFECTION MICA CO., See Magnetic Shield Corp.

PERFORMANCE CONTROLS, INC., 433 Caredean Drive, Horsham, PA 19044, Tel: 215-675-6500, TELEX: 88-1478; FSC No.: 61773; Empl.: 35

PERIPHERALS, 1363 Logan Ave., Costa Mesa, CA 92626, Tel: 714-540-4925, 800-468-6888, TELEX: 4996258 Berlan; Empl.: 20; *Sls. Mgr.:* Elizabeth O'Rouke

PERKIN-ELMER CORP., Elctrn. Prods. Dept., 761 Main Ave., Norwalk, CT 06859-0132, Tel: 203-762-4786, TWX: 710-468-3213; Empl.: 70; *Sls. Mgr.:* D. P. Duggan **A•2317**

Local Sales Offices & Reps

CA	Agoura Hills, C.D.H. Assocs.	818-707-1970

PERMAG, 400 Karin La., Hicksville, NY 11801, Tel: 516-822-3311, TWX: 710-581-5264; Empl.: 50

PERMALUSTER, INC., 1844 N. Keystone St., Burbank, CA 91504, Tel: 213-849-4543, 213-849-6454; Empl.: 6; *Sls. Mgr.:* J. Ross

THE PERMANENT MAGNET CO., INC., 4437 Bragdon St., P. O. Box 26226, Indianapolis, IN 46226, Tel: 317-547-1336; Empl.: 70; *Sls. Mgr.:* Jack Amigh

PERMA POWER ELCTRNS., 5601 W. Howard Ave., Chicago, IL 60648, Tel: 312-647-9414; Empl.: 80/100; *Sls. Mgr.:* Michael Shatz; *Dist. Mgr.:* Michael Shatz **B•1346; C•1706-1707**

Local Sales Offices & Reps

AL	Birmingham, Adams & Assocs.	205-781-6467
CA	Hayward, Techn. Sls.	415-887-6616
CA	Sun Valley, Teqni-Rep.	818-768-4223
CO	Denver, KC Mktg.	800-733-5561
CT	Hartford, The Smith Co.	203-523-0512
MA	Woburn, W & D Mktg.	617-935-5610
GA	Atlanta, Adams & Assocs.	404-973-0853
IL	Buffalo Grove, GB Mktg. Inc.	312-520-4008
IN	Indianapolis, Green-Wissler	317-872-9981
LA	Slidell, Dick Bellew Sls.	214-644-7881
MI	Plymouth, J. Malcolm Flora	313-453-4296
MN	St. Paul, R. W. Sls.	612-646-2710
MO	Jefferson City, C. A. Vignola	314-636-3121
NH	Manchester, W&D Mktg.	603-622-5097
NJ	Medford, Fahy Mktg.	609-654-1022
NY	Phelps, L. S. M. Assocs.	315-548-4891
NY	Plainview, Landau & Mack	516-293-3310
NC	Greensboro, Adams & Assocs.	919-272-6838
OH	Stow, J. Lehner Co.	216-686-1985
TX	Dallas, Berthold Sls.	214-328-0067
WA	Seattle, Northmar, Inc.	206-524-5170
WI	Milwaukee, Voss-Dent & Assocs.	414-781-0555
EXP	N.Y., Plainview, Morhan Export	516-293-5582

Local Distributors

AL	Birmingham, Forbes Distrbg.	205-251-4104
CA	Los Angeles, ITC Corp.	213-388-0621
CO	Denver, Fistells Elctrn. Supp.	303-623-7864
FL	Orlando, Hammond Elctrns.	305-849-6060
GA	Atlanta, Specialty Distrbg.	404-458-6341
IL	Chicago, Newark Elctrns.	312-784-5100
IL	Palatine, OHM Elctrns.	312-359-5500
IN	Lafayette, CWY Elctrns.	317-448-1611
IA	Des Moines, Mid-State Distrbg.	515-244-7231
KY	Louisville, Peerless Elctrns.	502-637-7674
LA	New Orleans, Wm. B. Allen	800-535-9593
MA	N. Wilbraham, Indl. Comps.	413-596-3854
MN	Minneapolis, Acme Elctrns.	612-338-4754
MO	Kansas City, Elctrns. Supp. Co., Inc.	816-931-0250
NY	Hauppauge, Broadline Elctrns.	516-231-4100
NC	Raleigh, Southeastern Elctrns.	919-828-2311
OH	Columbus, Whitehead Elctrns.	614-224-1186
TN	Nashville, Electra	615-256-0800
TX	Dallas, Wallace Elctrns.	214-340-0400
TX	Ft. Worth, Allied Elctrns.	800-433-5700
UT	Ogden, Carter Supp. Co.	801-393-8603
WA	Tumwater, JW Elctrns.	206-943-1071
EXP	Plainview, NY, Morhan Exporting	516-293-5582

PERRY AMPLIFIER, 138 Fuller St., Brookline, MA 02146, Tel: 617-734-0844; Empl.: 18; *Sls. Mgr.:* N. Geskos

PERSONAL TOUCH CORPORATION, 4320-290 Stevens Creek Blvd., San Jose, CA 95129, Tel: 408-246-8822, TELEX: 499-4986ABC UI, FAX: 408-246-8822

PERTEC PERIPHERALS CORP., Digital Development Corp., P.O. Box 2198, Chatsworth, CA 91311, Tel: 818-882-0300, 800-821-4126, 800-443-9577 (outside CA), TWX: 910-494-2093; Empl.: 300; *Sls. Mgr.:* Wm. Greenfield

PERX, 1730 S. Amphlett Blvd., Ste. 222, San Mateo, CA 94402, Tel: 415-573-0801; Empl.: 4; *Sls. Mgr.:* Bob Croshaw

PFC, See Southern Elctrns. Co. Inc.

PFT INC. PRECISION FABRICATION TECHNOLOGIES, INC.

FAX: 219-253-6570

PFT, INC., State Road 16 W., Monon, IN 47959, Tel: 1-800-558-7297, 219-253-6666; Empl.: 62; *Sls. Mgr.:* Joseph Rogers; *Dist. Mgr.:* Duane Nagel ..... **C•1073-1077**

Local Sales Offices & Reps

CA	Saratoga, Edward King & Assocs.	408-867-2111
CA	Valencia, Lessing & Assocs.	805-295-0225
FL	Tampa, SRT Mktg.	813-884-4805
IN	Indianapolis, Elctrn. Reps.	317-894-1414
MI	Warren, Burcaw Co.	313-573-4605
NJ	Medford, Champion Elctrn. Sls.	609-983-0932
NY	Islandia, Schmitt Mktg. Corp.	516-582-5888
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
OR	Portland, James J. Backer Co.	503-297-8744
TX	Dallas, S.W. Mktg. Assocs.	214-341-8631
TX	Houston, S.W. Mktg. Assocs.	713-537-8166
WA	Seattle, James J. Backer Co.	206-285-1300
WI	Colgate, Rep One & Assocs.	414-628-4016

PHALO CORP., Transitron Corp., 900 Holt Ave., Manchester, NH 03103, Tel: 603-669-4347, TELEX: 710-220-9878; Empl.: 150

PHASE CONTROL ELECTRONICS, 87-27 Myrtle Ave., Glendale, NY 11385, Tel: 718-441-4728; Empl.: 16; *Sls. Mgr.:* Jack Stanley ..... **D•1140**

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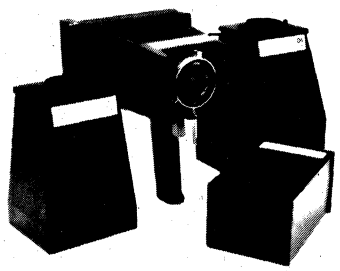

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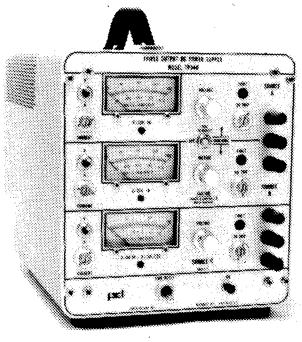

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NJ Bordentown, Eva-Tec Mktg. 609-298-4307
NY Commack, Eva-Tec Mktg. 516-462-5791
NC Greensboro, S.E. Power Comps. 919-275-4711
NC Matthews, S.E. Power Comps. 704-846-8536
OK Tulsa, Nova Mktg. 918-660-5105
TX Austin, Nova Mktg. 512-343-2321
TX Dallas, Nova Mktg. 214-750-6082
TX Houston, Nova Mktg. 713-988-6082
WV Charleston, Burl Burgess & Assocs. ... 304-465-0742
WI Milwaukee, L & W Power Corp. 414-782-0799

POWER DYNAMICS INC., 59 Lakeside Ave., P.O. Box 539, West Orange, NJ 07052, Tel: 201-736-5722, TELEX: 666173 (PDI); FSC No.: 60046; *Sls. Mgr.:* James Papianni; *Dist. Mgr.:* Lyle Scott ..... **A•1679; C•1519-1522, 1900**

Local Sales Offices & Reps

AL Huntsville, Electro Sls., Inc. 205-883-9648
AZ Tempe, Allegro Assocs., Inc. 602-967-1337
CA Laguna Niguel, David Budge & Assoc. 714-582-8720
CA Mountain View, Bart Budge Assocs. .. 415-961-0940
CA San Diego, David Budge Assocs. 619-471-2554
CO Broomfield, SummitWest Mktg. 303-460-9600
GA Atlanta, Electro Sls., Inc. 404-394-1122
IL Palatine, Golbeck & Milota Assocs., Inc. 312-705-0602
KS Shawnee Mission, Microtronics, Inc. ... 913-262-1444
MD Baltimore, Muncy-Semless Assocs. ... 301-484-6376
MN Minneapolis, RK Sls. 612-571-1001
MO St. Charles, Microtronics, Inc. 314-946-8500
NH Amherst, D.A. Crowley & Assocs 603-673-7050
NY Fayetteville, C. W. Floring Assocs., Inc. 315-637-4552
NY Port Washington, Ashtec, Inc. 516-767-0336
NY Scottsville, C. W. Floring Assocs., Inc. 716-889-4614
NC Raleigh, Barker Assocs. 919-876-0282
OH Hudson, Electro-Com 216-656-3273
OH Kettering, Electro-Com 513-299-0864
OR Tigard, Electronic Comp. Sls. 503-245-2342
PA W. Berlin, Muncy-Semless Assocs. 609-346-4402
TX Dallas, Rem-Air Comp. 214-234-1069
UT Salt Lake City, Aspen Sls., Inc. 801-467-2401
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301
PR Old San Juan Stn., Casanova Indl. Sls. Corp. 809-753-8674
Can Toronto, Tienkay, Inc. 416-736-1221

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Chatsworth, Fuses Unltd. 818-882-1515
CA El Segundo, Force Elctrns. 714-522-1324
CA Livermore, Fuse-Com 415-449-1313
CA Mountainview, Energy Sls. 415-969-0800
CA San Diego, Sigma Elctrns. 619-565-2000
CA San Jose, Force Elctrns. 408-435-1324
CA San Jose, Rose Elctrns. 408-263-9700
CA So. San Francisco, Peters-DeLaet, Inc. 415-873-9595
CO Arvada, Denver Wintronics 303-431-7161
CT Wallingford, Sager Elect. Supp. Co. 203-265-4600
FL Ft. Lauderdale, KSM Elctrns. 305-971-5900
FL Ft. Lauderdale, Stock Elctrns. 305-978-9875
GA Atlanta, KSM Elctrns. 404-458-2013
IL Crystal Lake, Sub-Sem 312-782-3954
MA Canton, Impact Sls. 617-821-1500
MA Framingham, Now Elctrns. 617-872-5876
MA Hingham, Sager Elect. Supp. Co. 617-749-6700
MA Westborough, In-Stock Products Co. .. 617-870-5750
MI Troy, Empire Elctrns 313-585-8130
MN New Brighton, Parts I 612-633-8079
MO St. Louis, Beckwith Elctrns. 314-343-6463
NJ Englewood Cliffs, Castle Inds. 201-592-0200
NY Hauppauge, Sager Elctrns 516-348-1300
NY Johnson City, Help Elctrns. 607-729-3528
NC Raleigh, Sager Svc. Plus Elctrns. 919-850-9550
OH Cincinnati, Schuster Elctrns 513-489-1400
OH Twinsburg, Schuster Elctrns 216-425-8134
OK Oklahoma City, Radio, Inc. 405-789-0741
OK Tulsa, Radio, Inc 918-587-9123
OR Beaverton, Micro Power Elctrns. 503-626-7086
TX Austin, Southwest Elctrns. 512-837-8971
TX Dallas, Off The Shelf Comps. 214-247-0052
TX Dallas, Southwest Elctrns. 214-234-3050
TX Farmers Branch, Force Elctrns. 214-247-9955
TX Houston, Force Elctrns. 713-561-8644
TX Richardson, Off The Shelf Comps. 214-238-0808
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Standard Supp. Co. 801-486-3371
UT W. Valley City, Wintronics 801-966-0236
WA Redmond, Energy Sls. 206-883-2343
WA Redmond, Fuse-Com 206-881-2442
Can Downsview, Ont., PS Comps. 416-665-9546

POWER ELECTRONICS CORPORATION, 30 Industrial Dr., Londonderry, NH 03053, Tel: 603-623-8888; Empl.: 100; *Sls. Mgr.:* Matthew W. Pierson

FAX: 412-925-4393

POWEREX, Westinghouse, GE, Mitsubishi, Hillis St., Youngwood, PA 15697, Tel: 412-925-7272, TWX: 510-468-2840; Empl.: 600; *Sls. Mgr.:* John Johanson/John Siefken; *Dist. Mgr.:* Dick Levitre ..... **A•2136**

Local Sales Offices & Reps

CA Agoura, Westpower Co. 818-706-2550
CA Campbell, Powerex 408-379-1542
CA Del Mar, Westpower Assocs. 619-481-3721
CA Laguna Hills, Westpower Co. 714-582-6716
CA Santa Clara, Engineering Assoc. Corp. 408-988-5001
CO Denver, Lindberg Co. 303-758-9033
CT Cheshire, Eva-Tec Mktg. 203-272-4234
FL Maitland, EIR 305-660-9600
GA Norcross, Southeast Power Comps. .. 404-448-2458
IL Chicago, L & W Power Corp. 312-852-6464
IN Carmel, Giesting & Assocs. 317-844-5222
IA Cedar Rapids, Dy-Tronix 319-377-8275
KS Wichita, Dy-Tronix, Inc. 316-838-0884
MA Boston, Powerex 617-620-3446
MI Plymouth, L & W Power Corp. 313-451-1150
MN Minneapolis, PSI 612-944-8545
MO Bridgeton, Dy-Tronix 314-291-4777
MO Raytown, Dy-Tronix 816-356-6340
NH Amherst, Eva-Tec 603-673-4830
NJ Bordentown, Eva-Tec 609-298-4307
NM Albuquerque, Lindberg Co. 505-881-1006
NY Commack, Eva-Tec 516-462-5791
NY Ithaca, Bob Dean, Inc. 607-257-1111
NY Wappingers Falls, Bob Dean, Inc. 914-297-6406
NC Greensboro, Southeast Power Comps. 919-275-4711
NC Matthews, Southeast Power Comps. .. 704-846-8532
OH Cincinnati, Giesting & Assocs. 513-385-1105
OH Cleveland, Giesting & Assocs. 216-261-9705
OK Tulsa, NOVA Mktg. 918-660-5105
OR Tigard, Vantage Corp. 503-620-3280
PA Pittsburgh, Bear Mktg., Inc. 412-531-2002
PA Youngwood, Powerex 412-925-4358
TX Austin, NOVA Mktg. 512-343-2321
TX Dallas, NOVA Mktg. 214-750-6082
TX Houston, NOVA Mktg. 713-988-6082
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Bellevue, Vantage Corp. 206-455-3460
WA Spokane, Vantage Corp. 509-924-4410
WI Milwaukee, L & W Power Corp. 414-782-0799
Can Burnaby, BC, Davetek Mktg., Inc. 604-430-3680
Can Montreal, Que., Gidden-Morton 514-335-9572
Can Ottawa, Ont., Gidden-Morton 613-726-0844
Can Toronto, Ont., Gidden-Morton 416-671-8111

Local Distributors

AL Birmingham, Indl. Elec. Supp. Co. 205-956-8504
AL Huntsville, Hamilton/Avnet 205-837-7210
AZ Tempe, Hamilton/Avnet 602-231-5100
CA Anaheim, Pacesetter Elctrns. 714-777-4711
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Hamilton/Avnet 818-700-6565
CA Chatsworth, Time Elctrns. 818-998-7200
CA Costa Mesa, Avnet Elctrns. 714-754-6111
CA Costa Mesa, Hamilton Electro Sls. 714-641-4100
CA Gardena, Hamilton/Avnet 213-217-6700
CA Ontario, Hamilton/Avnet 714-989-8816
CA Sacramento, Hamilton/Avnet 916-920-2216
CA San Carlos, WESCO 415-591-9674
CA San Diego, Hamilton/Avnet 619-571-7510
CA San Diego, Time Elctrns. 619-586-1331
CA Sunnyvale, Hamilton/Avnet 408-743-3355
CA Sunnyvale, Pacesetter Elctrns. 408-734-5470
CA Sunnyvale, Time Elctrns. 408-734-9888
CA Torrance, Time Elctrns. 213-320-0880
CO Englewood, Hamilton/Avnet 303-740-1000
CO Englewood, Time Elctrns. 303-799-8851
CT Cheshire, Time Elctrns. 203-271-3200
CT Danbury, Hamilton/Avnet 203-797-2800
CT E. Hartford, R&S Elctrn. Dists. 203-528-9901
CT E. Haven, J.V. Elctrns. 203-469-2321
FL Ft. Lauderdale, Hamilton/Avnet 305-971-2900
FL St. Petersburg, Hamilton/Avnet 813-576-3930
FL Winter Pk., Hamilton/Avnet 305-628-3888
GA Norcross, Hamilton/Avnet 404-447-7507
IL Bensenville, Hamilton/Avnet 312-860-7700
IL Chicago, Newark Elctrns. 312-784-5100
IL Elmhurst, Semiconductor Specialists 312-279-1000
IL Wooddale, Time Elctrns. 312-350-0610
IN Carmel, Hamilton/Avnet 317-844-9333
IN Ft. Wayne, Graham Elctrns. 219-423-3422
IN Hammond, WESCO 312-454-6970
IN Indianapolis, Graham Elctrns. 317-634-8202
IA Cedar Rapids, Advent Elctrns. 319-363-0221
IA Cedar Rapids, Hamilton/Avnet 319-362-4757
KS Overland Pk., Hamilton/Avnet 913-888-8900
KY Lexington, Hamilton/Avnet 606-259-1475
MD Columbia, GRS Elctrns. 301-995-6744
MD Columbia, Hamilton/Avnet 301-995-3500
MA Norwood, Gerber Elctrns. 617-769-6000
MA Peabody, Hamilton/Avnet 617-531-7430
MA Peabody, Time Elctrns. 617-532-6200
MI Grand Rapids, Hamilton/Avnet 616-243-8805
MI Livonia, Hamilton/Avnet 313-522-4700
MI Madison Hgts., Galco Elctrns. 313-542-9090
MN Bloomington, Semiconductor Specialists, Inc. 612-854-8841
MN Edina, Time Elctrns. 612-835-1250
MN Minnetonka, Hamilton/Avnet 612-932-0600
MO Earth City, Hamilton/Avnet 314-344-1200
MO St. Louis, Time Elctrns. 314-391-6444
NH Manchester, Hamilton/Avnet 603-624-9400
NJ Camden, GRS Elctrns. 609-964-8560
NJ Cherry Hill, Hamilton/Avnet 609-424-0100
NJ E. Hanover, Delburn Elctrns., Inc. 201-884-0800
NJ Fairfield, Hamilton/Avnet 201-575-3390
NM Albuquerque, Hamilton/Avnet 505-765-1500
NY Freeport, Semtex Indl. Corp. 516-223-0200
NY Hauppauge, Hamilton/Avnet 516-231-9800
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Hamilton/Avnet 716-475-9130
NY Rome, Rome Elctrns. 315-337-5400
NY Syracuse, Hamilton/Avnet 315-437-2641
NC Charlotte, Elctrns. Mktg. Corp. 704-394-6195

NC Raleigh, Hamilton/Avnet 919-878-0810
OH Centerville, Hamilton/Avnet 513-439-6700
OH Cincinnati, Hughes Peters 513-351-2000
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Darrah Elec. 216-631-0912
OH Cleveland, Hamilton/Avnet 216-349-5100
OH Columbus, Elctrns. Mktg. Corp. 614-299-4161
OH Columbus, Hughes Peters 614-294-5351
OH Dayton, Elctrns. Mktg. Corp. 513-439-4711
OH Highland Hgts., Elctrns. Mktg. Corp. ... 216-442-3441
OH Westerville, Hamilton/Avnet 614-882-7004
OK Tulsa, Altair Co. 918-252-5781
OK Tulsa, Hamilton/Avnet 918-252-7297
OR Beaverton, Almac Elctrns. 503-629-8090
OR Lake Oswego, Hamilton/Avnet 503-635-8157
OR Portland, Dunn Elctrns. 503-285-0214
PA Mars, Almo Elctrns. 412-931-5990
PA Philadelphia, Almo Elctrns. 215-698-4003
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Hamilton/Avnet 412-281-4150
TX Austin, Hamilton/Avnet 512-837-8911
TX Austin, Time Elctrns. 512-339-3051
TX Carrollton, Time Elctrns. 214-241-7441
TX El Paso, Intl. Elctrns. 915-598-3406
TX Houston, Altair Co. 713-462-3029
TX Houston, Time Elctrns. 713-530-0800
TX Irving, Hamilton/Avnet 214-550-7755
TX Richardson, Altair Co. 214-231-5166
TX Stafford, Hamilton/Avnet 713-240-7733
UT Salt Lake City, Hamilton/Avnet 801-972-2800
UT Salt Lake City, Time Elctrns. 801-973-8181
VA Charlottesville, Virginia Elctrn. Comps. 804-296-4184
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Hamilton/Avnet 206-643-3950
WA Spokane, Almac Elctrns. Corp. 509-924-9500
WV Charleston, McJunkin Corp. 304-348-5211
WI Mequon, Taylor Elec. Co. 414-241-4321
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Hamilton/Avnet 414-784-4510
WY Gillette, WESCO 307-687-0014
Can Burnaby, B.C., Hamilton/Avnet 604-437-6667
Can Burnaby, B.C., ITT/RAE Elctrns. 604-291-8866
Can Calgary, Alberta, Hamilton/Avnet 403-250-9380
Can Calgary, Alberta, ITT/RAE Elctrns. 403-251-5888
Can Concord, Ont., ITT/RAE Elctrns. 416-736-1144
Can Dartmouth, Nova Scotia, ITT/RAE Elctrns. 902-465-2350
Can Edmonton, Alberta, ITT/RAE Elctrns. 403-451-4001
Can Hamilton, Ont., Westinghouse Canada, Inc. 416-664-3300
Can Mississauga, Ont., Hamilton/Avnet 416-677-7432
Can Moncton, New Brunswick, ITT/RAE Elctrns. 506-857-8011
Can Nepean, Ont., Hamilton/Avnet 613-266-1700
Can Nepean, Ont., ITT/RAE Elctrns. 613-266-7406
Can Saskatoon, Saskatchewan, ITT/RAE Elctrns. 306-933-2888
Can St. Laurent, Que., Hamilton/Avnet 514-335-1000
Can St. Laurent, Que., ITT/RAE Elctrns. 514-335-7697
Can Willowdale, Ont., Electro Sonic, Inc. ... 416-494-1666
Can Winnepeg, Manitoba, ITT/RAE Elctrns. 204-786-8401

POWER FUNCTIONS ENGINEERING, 3831 Cavalier Dr., Garland, TX 75042, Tel: 214-278-0996; Empl.: 9

POWER GENERAL, Unitrode Corp., 152 Will Dr., Canton, MA 02021, Tel: 617-828-6216, TWX: 710-348-0200; Empl.: 300; *Sls. Mgr.:* Steve Dutton, Natl. Sls. Mgr. ..... **D•1900**

Local Sales Offices & Reps

CA Anaheim, Westrep 714-527-2822
CA San Diego, Westrep 619-566-6580
CA San Jose, Pro Assoc. 408-248-5300
CO Boulder, Front Range Mktg. 303-443-4780
CT Wallingford, APEX Assocs. 203-269-8401
FL Margate, EPM Corp. 305-977-0331
FL Orlando, EPM Corp. 305-425-6149
IL Glendale Heights, Beta Technlg. Sls. .. 312-790-9886
KS Overland Pk., SPECTRUM Sls. 913-648-6811
MD Randallstown, Beacon North Inc. 301-655-2265
MA Canton, Power Gen. 617-828-6216
MA Westwood, APEX Assocs. 617-326-5042
MI Plymouth, Leading Edge Sls. Corp. 313-420-3344
MN Minneapolis, Comtek Sls. 612-941-7181
NJ Clifton, R.O.I. Sls. Co. 201-340-1515
NJ Clifton Parks, Net Sls. 518-371-6864
NY Cortland, Net Sls. Co. 607-756-6592
NY Fairport, Net Sls. 716-223-1030
NY Webster, Net Sls. Co. 716-671-0022
OH Columbus, McFadden Sls. 614-761-3177
OR Beaverton, Venture Elctrns. 503-626-7418
PA Norristown, R.J.I. 215-631-1414
SC Greenville, EMA, Inc. 803-233-4637
TX Austin, Beacon Elctrns. 512-345-3543
TX Dallas, Beacon Elctrns. 214-437-1505
OK Tulsa, Beacon Elctrns. 918-622-1494
VA Sterling, Beacon North .. 800-336-3747,703-478-2480
WA Bellevue, Venture Elctrns. 206-454-4594
WI Milwaukee, Beta Technlg. Sls., Inc. 414-543-6609
Can Montreal, Que., Kaytronics 514-745-5800

POWERIGHT PRODUCTS, INC., 2739 Oakland Avenue, Garland, TX 75041, Tel: 214-840-0575, TWX: 510-601-2543

POWER INSTRUMENTATION DIV., Datapower, Inc., 3545 Cadillac Ave., Costa Mesa, CA 92626, Tel: 714-754-4400, TWX: 910-595-1560, FAX: 714-754-5407

POWER INTEGRITY CORP., 1840 Pembroke Rd., P.O. Box 9682, Greensboro, NC 27429-0682, Tel: 919-379-9773, 800-237-6260; *Sls. Mgr.:* James T. Fesmire

POWER LABS, INC., 5 Towle Ave., Dover, NH 03820, Tel: 603-742-4613; Empl.: 9

POWERLINE, INC., 10 Cochituate St., Natick, MA 01760, Tel: 617-655-7987, TELEX: 5161003630, FAX: 617-655-7984

Local Sales Offices & Reps

AL Huntsville, Over & Over 205-837-7105
CA Santa Clara, Sourcetronics 206-743-6641
CO Ogden, Taylor Mktg. 801-546-9570
GA Norcross, Over & Over 404-449-6205
IL Arlington, Phoenix Elctrns. Sls. 312-394-4422
IA Des Moines, The Beams Co. 515-255-1148
MD Hunt Valley, Eagle Sls. Corp. 301-666-3930
MA Whitinsville, Power Factor Assocs. 617-234-6415
NJ Englewood, Technimat 201-569-4200
NC Charlotte, Over & Over 704-542-9111
OH Cincinnati, KCH Co. 513-931-1686
PA Horsham, TMI 215-441-4300
UT Ogden, Taylor Mktg. 801-546-9570

POWER MAGNE-TECH CORPORATION, 441 High Street, Perth Amboy, NJ 08861, Tel: 201-826-4700, TELEX: 284401PMCQ, FAX: 201-826-4706; Empl.: 65; *Sls. Mgr.:* Arthur Zuckerman; *Dist. Mgr.:* Arthur Zuckerman ..... **A•1281, 2352-2353**

POWERMARK, See Topaz, Inc., 9192 Topaz Way, San Diego, CA 92123

POWER/MATE, See RTE Power/Mate

Power-one

FAX: 805-388-0476

POWER-ONE D.C. POWER SUPPLIES, 740 Calle Plano, Camarillo, CA 93010, Tel: 805-987-8741, TWX: 910-336-1297; FSC No.: 54407; Empl.: 480; *Dist. Mgr.:* Julius Hirsch, Dir. of Distrbn. ..... **D•1902-1907**

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, System Sls. of AZ 602-829-9338
CA Orange County, A-F Sls. Engrg. 714-641-2903
CA Pasadena, A-F Sls. Engrg. 213-681-5631
CA San Diego, A-F Sls. Engrg. 619-226-8424
CA Santa Clara, Nova-Tronix, Inc. 408-727-9530
CO Denver, Quorum 3 303-696-8480
CT Hamden, Datcom 203-288-7005
FL Clearwater, Electrocraft 813-578-2233
FL Coral Springs, Electrocraft 305-753-8666
GA Norcross, Montgomery Mktg. Inc. 404-447-6124
IL Chicago, M. Gottlieb & Assocs. 312-775-1151
IN Carmel, Technlg. Mktg. Corp. 317-844-8462
IN Ft. Wayne, Technlg. Mktg. Corp. 219-432-5553
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
KS Olathe, ATS 913-782-8702
KY Louisville, Technlg. Mktg. Corp. 502-893-1377
MA Waltham, Datcom, Inc. 617-891-4600
MI Southfield, Rathsburg Assocs. Inc. 313-559-9700
MN Minneapolis, George Russell & Assocs. 612-854-1166
MO St. Louis, ATS 314-878-2921
NM Albuquerque, Sys. Sls. of Arizona 505-899-2901
NY Great Neck, Trionic Assocs. 516-466-2300
NY Syracuse, Nycom, Inc. 315-437-8343
NC Cary, Montgomery Mktg. Inc. 919-467-6319
NC Raleigh, Montgomery Mktg. Inc. 919-851-0010
OH Chagrin Falls, Tom Mulligan Co. 216-831-9448
OH Columbus, Tom Mulligan Co. 614-457-2242
OK Tulsa, Advance Tech. Sls. 918-664-0482
OR Portland, W3 503-629-9871
PA Murrysville, Pittsburgh Sls. 412-327-6268
PA W. Conshohocken, Eastern Comp. Sls. 215-825-8610
TX Austin, Advance Tech. Sls. 512-331-9979
TX Dallas, Advance Tech. Sls. 214-340-1300
TX Houston, Advance Tech. Sls. 713-440-3888
TX Spring, Advance Tech. Sls. 713-440-3888
UT Salt Lake City, Quorum 3 801-943-9227
WA Seattle, W3 206-285-0210
WI Milwaukee, M. Gottlieb & Assocs. 414-546-4466

Local Distributors

AL Huntsville, Arrow Elctrns. 205-837-6955
AL Huntsville, Pioneer Elctrns. 205-837-9300
AZ Phoenix, Sterling Elctrns. 602-268-2121
AZ Phoenix, Wyle Labs. 602-866-2888
AZ Tempe, Arrow Elctrns. 602-968-4800
AZ Tempe, Bell Inds. 602-966-7800
CA Calabasas, Wyle Labs. 818-880-9000
CA Canoga Pk., FLW 818-719-0037
CA Chatsworth, Arrow Elctrns. 818-701-7500
CA Costa Mesa, FLW 714-751-7512
CA Garden Grove, Bell Inds. 714-895-7801
CA Gardena, Bell Inds. 213-515-1800
CA Hayward, FLW 415-786-9070
CA Irvine, Wyle Labs. 714-863-9953
CA Los Alamitos, Compumech Elctrns. ... 714-826-0866
CA Los Angeles, Wyle Labs. 213-322-9953
CA Mtn. View, Bell Inds. 415-960-1440
CA Newport Bch., Arrow Elctrns. 714-838-5422
CA Sacramento, Bell Inds. 916-969-3100
CA Sacramento, Wyle Labs. 916-638-5282
CA San Diego, Arrow Elctrns. 619-565-4800
CA San Diego, Bell Inds. 619-268-1277
CA San Diego, FLW 619-434-5251
CA San Diego, Wyle Labs. 619-565-9171
CA San Jose, Compumech Elctrns. 408-280-6446
CA Santa Clara, Wyle Labs. 408-727-2500
CA Sunnyvale, Arrow Elctrns. 408-745-6600
CA Sunnyvale, Bell Inds. 408-734-8570
CA Thousand Oaks, Bell Inds. 805-499-6821
CO Aurora, Arrow Elctrns. 303-696-1111
CO Denver, Bell Inds. 303-424-1985
CO Denver, Wyle Labs. 303-457-9953
CO Englewood, Sterling Elctrns. 303-796-7338
CT New Haven, Greene-Shaw Co. 203-265-3333
CT Norwalk, Pioneer Elctrns. 203-853-1515
CT Wallingford, Arrow Elctrns. 203-265-7741
CT Wallingford, Sterling Elctrns. 203-265-9535
FL Altamonte Springs, Pioneer Elctrns. ... 305-834-9090
FL Deerfield Bch, Pioneer Elctrns. 305-428-8877
FL Ft. Lauderdale, Arrow Elctrns. 305-429-8200
FL Largo, Bell Inds. 813-541-4434
FL Miami, Elctrn. Equip. Co. 305-871-3500
FL Palm Bay, Arrow Elctrns. 305-725-1480
FL Tampa, Elctrn. Equip. 813-988-0810
GA Norcross, Arrow Elctrns. 404-449-8252
GA Norcross, Bell Inds. 404-662-0923
GA Norcross, Pioneer Elctrns. 404-448-1711
IL Arlington Heights, C. W. Elctrns. 312-439-9880
IL Bensonville, Voyager Elctrns. 312-860-1300
IL Elk Grove Village, Pioneer Elctrns. 312-437-9680
IL Northbrook, Classic Comps. 312-272-9650
IL Schaumburg, Arrow Elctrns. 312-397-3440
IL Urbana, Bell Inds. 217-328-1077
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Arrow Elctrns. 317-243-9353
IN Indianapolis, Pioneer Elctrns. 317-849-7300
IA Cedar Rapids, Arrow Elctrns. 319-395-7230
IA Cedar Rapids, Bell Inds. 319-395-0730
IA Cedar Rapids, Deeco, Inc. 319-365-7551
KS Lenexa, Arrow Elctrns. 913-541-9542
KS Overland Pk., Sterling Elctrns. 913-236-5589
KS Wichita, LCOMP 316-265-5100
LA Westwego, Sterling Elctrns. 504-436-1418
MD Baltimore, Arrow Elctrns. 301-995-6003
MD Gaithersburg, Pioneer Elctrns. 301-921-0660
MA Canton, Impact Sales 617-821-1500
MA Lexington, Pioneer Elctrns. 617-861-9200
MA Newton, Greene-Shaw Co. 617-969-8900
MA Woburn, Arrow Elctrns. 617-933-8130
MA Woburn, Sterling Elctrns. 617-938-6200
MI Ann Arbor, Arrow Elctrns. 313-971-8220
MI Ann Arbor, Bell Inds. 313-971-9093
MI Grand Rapids, Arrow Elec. 616-243-0912
MI Livonia, Chelsea Indl. RS Elctrns. 313-525-1155
MI Livonia, Pioneer Elctrns. 313-525-1800
MN Edina, Arrow Elctrns. 612-830-1800
MN Edina, Pioneer 612-944-3355
MN Fridley, Voyager 612-571-7766
MO Kansas City, LCOMP 816-221-2400
MO St. Louis, Arrow Elctrns. 314-567-6888
MO St. Louis, Chelsea Indl. Olive Elec. 314-997-7709
MO St. Louis, LCOMP 314-291-6200
NE Lincoln, Scott Elctrns. 402-466-8221
NE Omaha, Scott Elctrns. 402-734-6750
NH Hudson, Bell Inds. 603-882-1133

NH Manchester, Arrow Elctrns. 603-668-6968
NJ Fairfield, Arrow Elctrns. 201-575-5300
NJ Marlton, Arrow Elctrns. 609-596-8000
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NJ S. Plainfield, Sterling Elctrns. 201-769-7000
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NM Albuquerque, Arrow Elctrns. 505-243-4566
NM Albuquerque, Bell Inds. 505-292-2700
NM Albuquerque, Sterling Elctrns. 505-884-1900
NY Hauppauge, Arrow Elctrns. 516-231-1000
NY Liverpool, Arrow Elctrns. 315-652-1000
NY Mamaroneck, Logicomp Elctrns. 914-698-9332
NY Melville, Arrow Elctrns. 516-391-1300
NY Rochester, Arrow Elctrns. 716-427-0300
NY Rochester, CAM/RPC Elctrns. 716-334-5600
NY Rochester, Pioneer Elctrns. 716-381-7070
NY Rochester, Zeller Elctrns. 716-254-8840
NY Woodbury, Pioneer Elctrns. 516-921-8700
NC Charlotte, Pioneer Elctrns. 704-527-8188
NC Raleigh, Arrow Elctrns. 919-876-3132
NC Winston-Salem, Arrow Elctrns. 919-725-8711
OH Centerville, Arrow Elctrns. 513-435-5563
OH Cleveland, CAM/RPC Elctrns. 216-461-4700
OH Cleveland, Pioneer Elctrns. 216-587-3600
OH Dayton, Bell Inds. 513-435-8660
OH Dayton, Bell Inds. (Military) 513-434-8231
OH Dayton, Pioneer Elctrns. 513-236-9900
OH Solon, Arrow Elctrns. 216-248-3990
OK Tulsa, Arrow Elctrns. 918-665-7700
OK Tulsa, Sterling Elctrns. 918-663-2410
OR Portland, Bell Inds. 503-241-4115
OR Portland, Radar Elec. 503-232-3404
OR Portland, Wyle Labs. 503-640-6000
OR Tigard, Arrow Elctrns. 503-684-1690
PA Horsham, Pioneer Elctrns. 215-674-4000
PA Monroeville, Arrow Elctrns. 412-856-7000
PA Pittsburgh, CAM/RPC Elctrns. 412-782-3770
PA Pittsburgh, Pioneer Elctrns. 412-782-2300
PA Zelionople, Argent Electra 412-776-4330
RI Warwick, Major Edwards Elctrns. 401-725-7400
TN Nashville, Bell Inds. 615-367-4400
TX Austin, Arrow Elctrns. 512-835-4180
TX Austin, Pioneer Elctrns. 512-835-4000
TX Austin, Sterling 512-836-1341
TX Austin, Wyle Labs. 512-834-9957
TX Dallas, Force Elctrns. 214-247-9955
TX Dallas, Pioneer Elctrns. 214-386-7300
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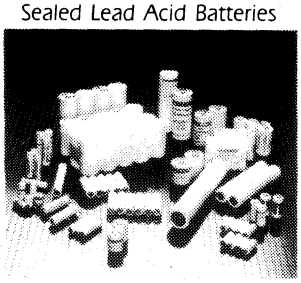

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UT Salt Lake City, Arrow Elctrns. 801-972-0404
UT Salt Lake City, Bell Inds. 801-972-6969
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WA Bellevue, Arrow Elctrns. 206-643-4800
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WA Seattle, Radar Electric 206-282-2511
WA Seattle, Wyle Labs. 206-453-8300
WI Brookfield, Arrow Elctrns. 414-792-0150
WI Madison, Arrow Elctrns. 608-271-7661
WI Milwaukee, Bell Inds. 414-547-8879
WI New Berlin, Classic Comps. 414-786-5300
EXP CA, Los Angeles, Hanex, Inc. 213-556-3807

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FAX: 203-866-4487

POWER PAC, P.O. Box 777, 32 Meadow St, S. Norwalk, CT 06856-0777, Tel: 203-866-4484; FSC No.: 53998; Empl.: 140; *Sls. Mgr.:* Charles Mittel ..... **D•1908-1914**

Local Sales Offices & Reps

AL Huntsville, BC Elctrns. Sls. 205-837-6657
AZ Tempe, Delta Elctrns. 602-252-4222
CA Irvine, QPI 714-552-2849
CA Long Beach, QPI 213-596-1233
CA Simi Valley, QPI 805-522-3060
CA Sunnyvale, Zytronics 408-749-1326
CT Southington, ORION-DSA 203-621-8371
DC Seabrook, W. A. Brown Equip. Co. 301-577-6105
FL Sandford, Mountain Electro Mktg. 305-425-0685
GA Smyrna, BC Elctrn. Sls. 404-436-5169
IL Hillside, CADRE 312-449-3900
LA Plano, GW Products 214-422-1746
MD Seabrook, W. A. Brown-Equip. Co. 301-577-6105
MA Marlborough, Orion DSA 617-480-0516
MI Farmington Hills, Carter McCormic & Peirce 313-477-7700
MN Minneapolis, R.J. Inc. 612-866-3661
NY Great Neck, MOS Mktg. 516-487-3966
NY Syracuse, L. D. Allen 315-437-8387
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OH Englewood, Carter McCormic & Peirce 513-836-0951
PA King of Prussia, KSI 215-783-6400
PA Pittsburgh, Carter McCormic & Peirce 412-733-7490
TX Plano, G.W. Prods. 214-422-1746

POWER-PAK, INC., 6216 Oakton St, Morton Grove, IL 60053, Tel: 312-966-6000, FAX: 312-966-6009; Empl.: 35; *Sls. Mgr.:* Robert Villari

POWER PRODUCTS DIV., Computer Products, Inc., 2981 Gateway Dr., Pompano Bch., FL 33069-4803, Tel: 305-975-7660, TWX: 510-956-3098; FSC No.: 62125; Empl.: 180 ..... **D•1649-1664, 1673-1674**

Refer to Computer Prods., Inc., Pompano Beach, FL, for sales offices & representatives & distributors.

POWER-SCIENCE, 7667 Vickers St., San Diego, CA 92111, Tel: 619-292-4322; Empl.: 10; *Sls. Mgr.:* E. Cooper

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POWER-SONIC, Box 5242, 3106 Spring St, Redwood City, CA 94063, Tel: 415-364-5001, TELEX: 348400; Empl.: 30; *Sls. Mgr.:* Carl E. Fischetti; *Dist. Mgr.:* Carl E. Fischetti ..... **D•1481**

Local Sales Offices & Reps

CA Irvine, English/Damco 714-837-3801
CO Englewood, Don Dennis 303-721-1938
FL Tampa, SRT Mktg. 813-884-4805
ID Sun Valley, Rick Flickinger 208-726-3332
IL River Forest, Pete Collins 312-366-7076
MD Woodbine, DJC Elctrns. 301-795-7020
MA Natick, Assocd. Power Prods. 617-879-5632
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Lowell Kangas 314-821-4050
NY Wantagh, Dony Tech. Sls. 516-816-5550
NC Raleigh, Positive Comps. 919-772-8073
PA Newtown Sq., William Reeves Assocs. 215-566-6709
TX Dallas, Power Connection 214-357-8207

Local Distributors

AK Anchorage, Revl 907-349-8790
CA Chatsworth, Mil-Comm Distrs. 818-998-3111
CA Long Beach, Battery Specialties 213-437-1809
CA Mtn. View, Energy Sls. 415-969-0800
CA San Diego, Alexander Battery West ... 619-480-4806
CO Denver, Hensley Battery 303-455-3643
CT Waterbury, Lighting Svcs., Inc. 203-756-8148
FL Altamonte Springs, TNR Tech. 800-722-7267
FL Tampa, Leader Elctrns. 813-870-3315
GA Atlanta, Arrowhead 404-955-1006
IA Cedar Rapids, Iowa Radio 319-393-4510
LA Lafayette, Ralph's Elctrns. 318-233-0105
LA New Orleans, Wm. B. Allen Supp. Co. 800-462-9528
MA Sharon, Adcour 617-784-3996
MA Wellesley Hills, Target Elctrns. 617-235-2545
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MO Maryland Hgts., Chelsea Inds. 314-997-7709
NE Lincoln, Scott Elctrn. Supp. 402-466-0221
NY Ridgewood, J.A. McDermott Corp. 212-456-3606
OH Cleveland, Security Prods. Co. 216-451-1400
TX Austin, Galtronics 512-837-7470
TX Ft. Worth, Allied Elctrns. 800-433-5700
TX Texas city, Elctrn. Supp. 409-945-4401
VA Arlington, Arlington Elctrns. 703-524-2412
WA Redmond, Energy Sls. 206-883-2343

POWER SOURCES INTERNATIONAL INC., Sources Electronics, 15014 Malachite Ct., Reno, NV 89506, Tel: 702-972-1224, TWX: 510-600-5831, FAX: 702-329-1360

Power Star, Inc.

POWER STAR, INC., 17346 Eastman St., Irvine, CA 92714, Tel: 714-261-5377, 800-854-9420; Empl.: 15; *Sls. Mgr.:* Thomas A. Goreth ..... **D•2142-2145**

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CT North Haven, Power Conversion Sys. 203-281-7270
MA Wellesley, Power Conversion Sys. 617-235-7884
NH Londonberry, Power Conversion Sys. 603-434-2371
NJ Fairfield, SDM Reps. 201-882-5005
NJ Pennsauken, S.C.I. Reps. 609-662-5222
OR Portland, Underwood & Hanify 503-224-0583
TX Dallas, Seaton Corp. 214-380-0414
WA Bellevue, Underwood & Hanify 206-643-1793

POWER SWITCH Corp.

FAX: 201-641-7871

POWER SWITCH CORPORATION, 50 Graphic Place, Moonachie, NJ 07074, Tel: 201-641-4544; Empl.: 27; *Sls. Mgr.:* Danice Donito ..... **D•1915-1917**

Local Sales Offices & Reps

CA Los Gatos, Reptronics 408-429-5997
CA Westlake Vl, The Tricamo Co. 805-496-3177
CO Aurora, High Technlg. Assocs. 303-695-1990
FL Melbourne, VM2 Mktg. 305-984-1918
GA Norcross, Futron, Inc. 404-263-9688
IL Berkeley, ESA Tech. Mktg. 312-544-0120
IN Indianapolis, STB & Assocs. 317-844-9227
MD Middletown, S.T./Woolard Co. 301-371-4500
MA Whitinsville, Lew Smith Assocs. 617-234-2940
MN Minneapolis, Electro-Serv 612-338-3475
MO Clayton, Seltronix 314-862-0100
MO Grandview, R. R. Burton Assocs. 816-763-5385
NJ Franklin Lakes, Hansen & Hughes 201-848-8900
NY Cazenovia, S.T./Woolard Co. 315-655-8145
NY Greenlawn, Hansen & Hughes 516-754-3608
OH Cleveland, Bradcor Elctrns. 216-261-0888
OH Dayton, Bradcor Elctrns. 216-671-1200

PA Hatboro, Electro Rep Engrg. 215-674-4421
RI Providence, ISM 401-351-7348
SC Pickens, S.T./Woolard Co. 803-878-3830
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255

Power Systems, Inc.

FAX: 203-726-1495

POWER SYSTEMS, INC., 45 Griffin Rd., South, Bloomfield, CT 06002, Tel: 203-726-1300, TWX: 710-425-8778; FSC No.: 50463; Empl.: 250; *Sls. Mgr.:* Richard Milne ..... **D•1919**

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AZ Tempe, A5 Co. 602-968-4923
CA Los Gatos, Luscombe Engrg. of San Francisco 408-370-2020
CA Mission Viejo, The Powerhouse, Inc. .. 714-770-9009
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AL Decatur, R. K. Welter & Assocs. 205-350-3441
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GA Dunwoody, R. K. Welter & Assocs., Inc. 404-390-9718
IL Rolling Meadows, Eagle Tech. Sls. 312-991-0700
MD Timonium, Bresson Assocs., Inc. 800-523-5572
MA Tyngsboro, Comptech, Inc. 617-649-3030
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NY N. Syracuse, Marchese, Marsey & Barden, Inc. 315-458-6920
PA Narberth, Bresson Assocs., Inc. 215-664-6460
TX Houston, Barry Sls., Inc. 713-784-5860
TX Richardson, Barry Sls., Inc. 214-234-0255
UT Salt Lake City, A5 Co. 801-483-1034
VA Lynchburg, Bresson Assocs. 800-523-5512
WA Kirkland, Northwest Comps. Sls. 206-828-4838
Can Burnaby, BC, Davetek Mktg., Inc. 604-430-3680

POWER SYSTEMS & CONTROLS, INC., 3206 Lanvale Ave., Richmond, VA 23230, Tel: 804-355-2803, FAX: 804-358-0498; Empl.: 55

POWER SYS. GRP., Rantec Div., Emerson Elec., 9401 Oso Ave., Chatsworth, CA 91311, Tel: 818-885-8223, TWX: 910-493-1247; FSC No.: 04971; Empl.: 265; *Sls. Mgr.:* Fred Silver

POWERTEC, INC.

FAX: 818-998-4225

POWERTEC, INC., 20550 Nordhoff St., Chatsworth, CA 91311-6168, Tel: 818-882-0004, TELEX: 277483, TWX: 910-494-2092; Empl.: 349; *Sls. Mgr.:* Barry A. Chenes ..... **D•1920-1936**

POWERTECH, INC., 0-02 Fairlawn Ave., Fairlawn, NJ 07410, Tel: 201-791-5050, TELEX: 353970; FSC No.: 32953; Empl.: 49; *Sls. Mgr.:* Alan J. Melnyk .... **A•2137**

POWER TECHNOLOGY, INC., P.O. Box 9769, Little Rock, AR 72219, Tel: 501-568-1995, TWX: 910-722-7313, FAX: 501-568-1994; Empl.: 75; *Sls. Mgr.:* John Webb ..... **D•1937**

POWER TEN, INC., 486 Mercury Dr., Sunnyvale, CA 94086, Tel: 408-738-5959, FAX: 408-738-4326; FSC No.: 61987; *Sls. Mgr.:* Vince Mutascio ..... **D•1938**

Local Sales Offices & Reps

AL Huntsville, Reynolds & Assocs. 205-881-9362
AZ Phoenix, Jayson Co., Inc. 602-867-1964
CA Los Alamitos, Power Specialists 213-594-9418
CA San Diego, Power Specialists 619-726-4799
FL Melbourne, Reynolds & Assocs. 800-255-1965
GA Atlanta, Reynolds & Assocs. 404-934-8525
MA Acton, Framar 617-263-2285
NY Fairport, Hi-Tec Sls. 716-223-5922
NC Raleigh, Reynolds & Assocs. 919-872-6668
PA Glenside, Koebert 215-887-2310
TX Austin, Eberts Elctrns. Sls. 512-258-1067
TX Latexo, Eberts Elctrns. Sls. 409-687-4342
WA Bellevue, A. J. Smith Co. 206-746-6770
Can N. Vancouver, BC, Jerome & Francis 604-986-1286

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FAX: 516-883-7155

POWERTRON, See Industrial Test Equipment Co., Inc.

POWERTRON, Contraves Goerz Corp., 3821 Barranger Dr., Charlotte, NC 28210, Tel: 704-525-8962, TELEX: 572-444; *Sls. Mgr.:* Sam LoBue

POWERTRON CORPORATION, Rte. 15, Box 932, Sparta, NJ 07871, Tel: 201-579-5599, TELEX: 136198; *Sls. Mgr.:* William E. Cannon; *Dist. Mgr.:* William E. Cannon ..... **D•1948**

POWR-UPS CORP., Brookhaven R&D Plaza, 1 Roned Rd., Shirley, NY 11967, Tel: 516-345-5700, 1-800-333-POWR; Empl.: 50; *Sls. Mgr.:* Alon Kopstein ..... **B•1250-1251**

Local Sales Offices & Reps

CA Fullerton, ESCO 714-879-7260
CT Ridgefield, E. S. Williams 203-438-7474
IL Oak Brook, A.G. Erickson 312-323-1367
KS Shawnee Mission, LSC, Inc. 913-362-2121
OH Dover, AJ Assocs. 216-343-2224
PA Audubon, Holmes Assocs. 215-666-0636

Local Distributors

NY Long Island City, B & B Motor & Control Corp. 800-638-7808

PPC PRODUCTS CORPORATION, 7516 Central Industrial Dr., Riviera Beach, FL 33404, Tel: 305-848-9606, TWX: 510-952-7611, FAX: 305-848-1607; FSC No.: 33178; Empl.: 90; *Sls. Mgr.:* Nick Ernick

PPD, INC., 6001 Resco Ct., Raleigh, NC 27612, Tel: 919-781-3955, FAX: 919-781-4980 ..... **A•1158-1166**

Local Sales Offices & Reps

NC Raleigh, Godwin Assocs. 919-878-8000

PPM, INC., 5385 Harper Rd., Cleveland, OH 44139, Tel: 216-349-2300; Empl.: 20; *Sls. Mgr.:* A. L. Bletcher ..... **D•1313**

Local Sales Offices & Reps

AL Huntsville, Jim Springer, Inc. 205-883-4163
AZ Phoenix, J. Smith & Assocs. 602-267-0981
CO Denver, J. Smith & Assocs. 303-597-5343
MI Ferndale, Tiby Co. 313-547-3550
NM Albuquerque, J. Smith & Assocs. 505-345-6501
OH Cleveland, Tiby Co. 216-371-5335
OH Dayton, Tiby Co. 513-277-3822

PRACTICAL AUTOMATION, INC., 2 Research Dr., Shelton, CT 06484, Tel: 203-929-5381, TELEX: 6813310, FAX: 203-929-9941; Empl.: 150; *Sls. Mgr.:* R. M. Banzaca

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AL Huntsville, Elctrn. Mfr. Agts., Inc. 205-830-4030
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CT Hamden, JBL Assocs. 203-281-3161
FL Longwood, Elctrn. Mfr. Agts., Inc. 305-682-1202
MI Livonia, Electro Sls. Assocs. 313-421-7500
MN Minneapolis, Chris & Assocs. 612-861-1634
NC Raleigh, Elctrn. Mfg. Agts. 919-846-6888
OH Cleveland, Electro Sls. Assoc. 216-729-0190
OH Dayton, Electro Sls. Assoc. 513-426-5551
WA Bellevue, Tasco Inc. 206-453-1414

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PRECICONTACT, INC., 835 Wheeler Way, Langhorne, PA 19047, Tel: 215-757-1202, TELEX: 37-29448; FSC No.: 60197; *Sls. Mgr.:* Stephen Lawler ..... **C•1524-1525, 1734**

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AZ Phoenix, G.B. Elctrns. Inc. 602-935-3984
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CO Colorado Springs, Peak Sls. 303-574-8700
FL Orlando, C Assocs. 305-831-1717
IL Chicago, Joel Wasserman Assocs. 312-256-3566
IN Greenwood, Valentine & Assocs. 317-888-2260
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NY Port Washington, Ashtec, Inc. 516-767-0336
NY Victor, Integrity Mktg. Co. 716-924-3671
OH Cincinnati, Makin & Assocs. 513-871-2424
OH Cleveland, Makin & Assocs. 216-248-7370
OH Columbus, Makin & Assocs. 614-848-5424
OR Portland, Elctrn. Mktg. Grp. 503-684-5935
TX Dallas, J.Y. Schoonmaker Co. 214-349-1650
TX Houston, J. Y. Schoonmaker Co. 713-738-2427
UT Salt Lake City, Charles Fields & Assocs. 801-531-6177
VA Harrisonburg, Blueridge Prods. 703-433-0990
WA Redmond, Electronic Mktg. Grp. 206-882-0962
Can Ontario, Avotronics 416-475-2024
Can Vancouver, B.C., Davetek Mktg. 604-430-3680

Local Distributors

AZ Litchfield Park, GB Elctrns. 602-935-3984
AZ Phoenix, Future/Cetec 602-272-7951
CA Buena Pk, Cypress/RPS Elctrns. 213-744-0355
CA Chatsworth, Future/Cetec 818-700-0914
CA Irvine, Future/Cetec 714-250-4141
CA Orange, Electronic Connexions Corp. 714-998-2901
CA San Diego, Cypress/RPS Elctrns. 619-292-5611
CA San Diego, Future/Cetec 619-278-5020
CA San Jose, Cypress Elctrns. 408-945-8400
CA San Jose, Future Elctrns. 408-945-9100
CO Denver, CSID, Inc. 303-292-9594
CO Westminster, Future Elctrns. 303-650-0123
CO Wheatridge, Cypress Elctrns. 303-431-2622
CT Bethel, Future Elctrns. 203-743-9594
CT Bridgeport, Park Distrs. 203-366-8414
CT Wallingford, Cronin Elctrns., Inc. 203-265-3134
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FL Altamonte Springs, Future Elctrns. 305-767-8414
FL Clearwater, Electronic Precepts of FL 813-530-9781
FL Clearwater, Future Elctrns. 813-441-4771
FL Orlando, Reptron Elctrns. 305-735-1112
FL Tampa, Reptron Elctrns. 813-855-4656
GA Atlanta, Reptron Elctrns. 404-446-1300
GA Atlanta, Future Elctrns. 404-441-7676
IL Crystal Lake, Subsem 815-459-4139
IL Lisle, Components, Inc. 312-852-7707
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IL Schaumburg, Future Elctrns. 312-882-1255
IL Schaumburg, Reptron Elctrns. 312-882-1700
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MA Andover, Aved Elctrns. 617-688-3800
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MA Norwood, Emtel Elctrns. 617-769-9500
MA Westborough, Future Elctrns. 617-366-2400
MA Wilmington, J.V. Elctrns. 617-273-4300
MI Detroit, Reptron Elctrns. 313-525-2700
MN Minnetonka, Reptron Elctrns. 612-938-0000
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MO St. Charles, Finnegan Elctrns. 314-946-6201
NH Salem, Sager 603-898-1348
NJ Bellmawr, Mid-Atlantic Elctrns. 609-931-5303
NJ Berlin, GCI Corp. 609-768-6767
NJ Mt. Laurel, Future Elctrns. 609-778-7600
NJ Parsippany, Fabe Electro Sls., Inc. 201-299-1123
NM Albuquerque, Connecting Comps. Div. 505-345-8921
NY Brooklyn, Connector Resources 718-383-2208
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Hauppauge, Sager 516-348-1300
NY Liverpool, Future Elctrns. 315-451-2371
OH Dayton, Televox, Inc. 513-294-4499
OH Mansfield, Rush Elctrns. Distrs., Inc. ... 419-756-2322
OH Worthington, Reptron Elctrns., Inc. 614-436-6675
OR Beaverton, Component Resources 503-641-8488
OR Beaverton, Future Elctrns. 503-645-9454
PA Wayne, Peak Elctrns. 215-293-9000
PA York, E.C.I. 717-846-5334
TN Hixon, Techni-Tronics, Inc. 615-842-0514
TX Allen, Prime Distrbg. Co. 214-231-0170
TX Austin, Southwest Elctrns. 512-837-8971
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Jaco Elctrns. 214-235-9575
TX Richardson, Southwest Elctrns. 214-234-3050
TX Stafford, Southwest Elctrns. 713-491-4900
UT Salt Lake City, Future Elctrns. 801-972-8489

WA Bellevue, Future Elctrns. 206-881-8199
WA Seattle, Pacific Elctrns. 206-575-1050
Can Calgary, Alb., Future Elctrns. 403-235-5325
Can Downsview, Ont., Future Elctrns. 416-638-4771
Can Edmonton, Alb., Future Elctrns. 403-438-2858
Can Ottawa, Ont., Future Elctrns. 613-820-8313
Can Pointe Claire, Que., Future Elctrns. 514-694-7710
Can Vancouver, B.C., Future Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Future Elctrns. ... 204-339-0554

PRECISION COMPONENTS, INC., 1110 W. National Ave., Addison, IL 60101, Tel: 312-543-6400, TELEX: 910-221-0158

PRECISION CONTROL MANUFACTURING, INC., 1509 B Queen Anne Ave. N., Seattle, WA 98109, Tel: 206-281-9380; FSC No.: 64782 ..... **A•2097**

Local Sales Offices & Reps
WA Seattle, Precision Control Mfg., Inc. 206-281-9380

Local Distributors
CA Tarzana, Nate Beckerman & Co., Inc. 818-708-0021

PRECISION DIGITAL CORP., 80 Coolidge Hill Rd., Watertown, MA 02172, Tel: 617-924-2256

PRECISION ELECTRONICS, 9101 King Ave., Franklin Park, IL 60131, Tel: 312-678-5350, FAX: 312-678-0511; Empl.: 25; *Sls. Mgr.:* William Stow

PRECISION EXTRUSIONS, INC., Box 120, Bensenville, IL 60106, Tel: 312-766-0340; *Sls. Mgr.:* Richard Ziehm

PRECISION FILTERS, INC.

FAX: 607-227-4466

PRECISION FILTERS, 240 Cherry St., Ithaca, NY 14850, Tel: 607-277-3550, TELEX: 646846; FSC No.: 66-II-F & 66-II-I; Empl.: 82; *Sls. Mgr.:* D. F. Chandler ..... **A•1680-1686; D•1016-1017**

Local Sales Offices & Reps
AL Huntsville, Burnette Techno-Metrics Inc. 205-830-2832
AZ Tempe, Cleveland Entprs. 602-820-1127
CA Laguna Hills, Elotek Sys., Inc. 714-830-4856
CA San Jose, Synergistic Sls. 408-292-6573
CO Broomfield, Hannah-Hill, Inc. 303-460-0602
AZ Phoenix, Western Region Sls. Off. 602-953-0345
DC Arlington, Gans & Pugh 703-527-3262
FL Osprey, Dick Ridgewell Co. 813-484-2020
MD W. Friendship, Gans & Pugh Assocs. 301-442-2189
MA Beverly, Ellis Assocs. 617-922-2015
MO Manchester, Vertec Assocs., Inc. 314-394-6242
NY Saugerties, Beckrep, Inc. 914-246-3031
TX Houston, ABCOR, Inc. 713-486-9251
VA Arlington, Gans & Pugh Assocs. 703-527-3262
WA Bellevue, Topp Engrg. Sls. 206-747-5400
EXP Can./Ottawa, Ont., Rayonics Sci. 613-521-8251
Can Downsview, Ont., Rayonics Scientific 416-736-1600
Can St. Laurent, Que., Rayonics Sci. 514-335-0105

PRECISION INTERCONNECT, 16640 SW 72nd Ave., Portland, OR 97224, Tel: 503-620-9400, TELEX: 36-0963; FSC No.: 60381; Empl.: 150; *Sls. Mgr.:* Walt Harwood ..... **C•1902-1904**

Local Sales Offices & Reps
CA Hayward 415-785-1277
DE Wilmington 302-798-7071
NH Rye, Precision Interconnect 603-964-9322
OR Portland 503-620-9400

PRECISION LAMP, INC., 480 Aaron Dr., Cotati, CA 94928, Tel: 707-792-0333, TELEX: 348498 GOLDLAMP, FAX: 707-792-2738; FSC No.: FSCM 58451; Empl.: 25

PRECISION LEVEL VIAL CO., P.O. Box 320, 760 Edison-Furlong Rd., Furlong, PA 18925, Tel: 215-794-0800, 800-345-7517; Empl.: 12; *Sls. Mgr.:* Susan Mazzanti

PRECISION MECHANISMS, 44 Brooklyn Ave., Westbury, NY 11590, Tel: 516-ED3-5955; FSC No.: 08127; Empl.: 26; *Sls. Mgr.:* Leon N. Canick

PRECISION METAL PRODUCTS CO., Centennial Indl. Pk., Peabody, MA 01961-6026, Tel: 617-532-5500, TWX: 710-347-0123; FSC No.: 86577; Empl.: 54; *Sls. Mgr.:* Robert H. Degnan

PRECISION MONOLITHICS, INC., 1500 Space Park Dr., Santa Clara, CA 95054-3499, Tel: 408-727-9222, TWX: 910-338-0218; FSC No.: 06665; Empl.: 900; *Sls. Mgr.:* Jo Nall; *Dist. Mgr.:* Mike Dennison

Precision Resistive Products, Inc.

FAX: 319-394-9280

PRECISION RESISTIVE PRODUCTS, INC., P.O. Box 189, Highway 61 South, Mediapolis, IA 52637, Tel: 319-394-9131, TWX: 510-100-8039; Empl.: 50; *Sls. Mgr.:* Oscar Cline; *Dist. Mgr.:* Oscar Cline ..... **A•2002-2003**

Local Sales Offices & Reps
AL Huntsville, Hughes & Assocs. 205-533-9108
CA Anaheim, Impact Electrns. Inc. 714-533-1351
CA Los Altos, Frauman Assoc. 415-941-0660
CA San Diego, KCE 619-278-7640
CO Denver, Williams Assocs. 303-373-4730
IL Chicago, Ellinger Sls. 312-763-1570
IN Greenwood, Valentine Assocs. 317-888-2200
MA Waltham, Jesco, Inc. 617-893-0094
MI Warren, DEM Elctrns. Sls. 313-575-9444
MN Minneapolis, Intl. Sls. 617-831-8423
NJ Mountainside, Kevtron Elctrns. 201-654-7600
OH Cincinnati, G & H Sls. Co. 513-272-0580
TX Richardson, Campion Sls. Co. 214-238-8145
WA Seattle, W3 Assocs., Inc. 206-285-2667

PRC

FAX: 813-546-9515

PRECISION RESISTOR CO., INC., 10601 75 St. N., Largo, FL 34647, Tel: 813-541-5771, TELEX: 821788; FSC No.: 48615; Empl.: 45; *Sls. Mgr.:* Arleen Reid ..... **A•2004-2007**

PRECISION SPECIALTIES, INC., 19414 Londelius St., Northridge, CA 91324, Tel: 818-349-9774; FSC No.: 66785; Empl.: 5

PRECISION STANDARD TIME, INC., 105 Fourier Avenue, Fremont, CA 94539, Tel: 415-656-4447, FAX: 415-656-1671; *Sls. Mgr.:* Ken Brandt

PRECISION TECH. SEWING, 921 E. Charleston Rd., Palo Alto, CA 94303, Tel: 415-856-2128

PRECISION TUBE, Church Rd. & Wissahickon, N. Wales, PA 19454, Tel: 215-699-5801, FAX: 215-699-0761; FSC No.: 82413; Empl.: 240; *Sls. Mgr.:* William J. McNeil

PREFERRED ELECTRONICS, INC., Main Line Dr., P.O. Box 248, Westfield, MA 01086, Tel: 413-568-2301, TELEX: 955-339, FAX: 413-562-7275; Empl.: 175; *Sls. Mgr.:* Merton I. Rosenberg

PREH ELECTRONIC INDUSTRIES, INC., 470 E. Main St., Lake Zurich, IL 60047-2578, Tel: 312-438-4000, TELEX: 297-112 PEI, FAX: 312-438-5522; FSC No.: 36-3193682; Empl.: 7; *Sls. Mgr.:* Ken Wood .... **A•2098; B•1786, 1832; C•1526**

Local Sales Offices & Reps
CA Carlsbad, Bart Budge Assocs. 619-471-2554
CA Laguna Niguel, Bart Budge Assocs. ... 714-582-8720
CA Mtn. View, Bart Budge Assocs. 415-961-0940
CO Littleton, Anodyne Tech. Sls. 303-979-2435
CT Cheshire, MacInnis 203-272-8877
FL Miami, Indl. Comps. 305-477-0387
MI Troy, C. B. Jensen & Assocs. 313-643-0506
NJ Haddon Hgts., Eltron Sls. Ltd. 609-546-6171
NJ Woodbridge, John Chirico Assocs. 201-855-9600
OH Cincinnati, Bob Gilbert & Assocs. 513-574-1932
PA Pocopson, Eltron Sls. Ltd. 215-793-1468
SC Greenville, Eltron Sls. Ltd. 803-234-6931
TX Round Rock, Encore Tech. Comps. ... 512-388-7930
VA Front Royal, Eltron Sls. Ltd. 703-635-7201
Can Markham, Ont., Avotronics Ltd. 416-475-2024

Local Distributors
CA Belmont, LoDan Elctrns. Inc. 415-592-4600
CA Gardena, California Switch & Signal .. 213-770-2330
CT Norwalk, Cobra Comps. 203-847-6442
FL Largo, LoDan Elctrns., Inc. 813-586-2851
IL Arlington Hgts., LoDan Elctrns. 312-398-5311
IL Wheeling, Hawk Elctrns. 312-459-4030
MA Hingham, Sager Elctrl. Supp. Co. 617-749-6700
MA Hopedale, Teccon Elctrns. 617-478-8544
MA Westborough, In Stock Prods. Co. 617-870-5750
NJ Camden, Gen. Radio Supp. Co. 609-964-8560
NY Bohemia, Key Comps. 516-567-7500
NY Hauppauge, Broadline Elctrns. 516-231-4100
NY Hempstead, Elctrn. Equip. 516-538-5510
NY Rochester, Whirlwind Music Distrs. ... 716-663-8820
PA Harrisburg, Cumberland Elctrns. 717-232-5999
TX Dallas, Off the Shelf Comps. 214-247-0052
Can London, Ont., C. M. Peterson Co. Ltd. 519-434-3204
Can Montreal, Que., Ferro Technique 514-341-3450
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-9999
Can Toronto, Ont., Atlas Elctrns. Ltd. 416-789-7761
Can Willowdale, Ont., Electrosonic Inc. 416-494-1666

PREMA PRECISION ELECTRONICS, INC., 6290 Sunset Blvd., Suite 1126, Los Angeles, CA 90028-8770, Tel: 213-463-2294, TWX: 910-321-2903, FAX: 213-463-4319

FAX: 212-993-9211

PREMIER METAL PRODS. CO., 381 Canal Pl., Bronx, NY 10451, Tel: 212-993-9200; Empl.: 75; *Sls. Mgr.:* Anthony E. Bozza ..... **C•1084-1085**

Local Sales Offices & Reps
AZ Phoenix, Scientific Dvcs. 602-957-0401
CA Fontana, Premier Metal 714-829-3089
CA Huntington Bch., Scientific Dvcs. 714-840-3501
CA San Jose, Scientific Dvcs. 408-554-0455
CO Denver, AKI Enterprises 303-338-4488
CT East Haven, Eagle Assocs. 203-467-6542
GA Marietta, Adams & Assocs. 404-973-0853
IL Elmhurst, Utronix Sls. 312-834-1100
KS Kansas City, Delltron Co. 816-436-6445
MD Burtonsville, Eastern Instrmn. 301-384-8500
MA Needham, Eagle Assocs. 617-444-3446
MI Brighton, Electronic Sources 313-227-3598
MN Minneapolis, J.E.M. Anderson Co. 612-823-6459
MO Florissant, Delltron Co. 314-839-0033
NM Albuquerque, Scientific Dvcs. 505-293-3494
NY New Hyde Park, Harris & Aldrich Sls. 516-488-2622
NY Syracuse, Lewis-Dunnigan Co. 315-446-5522
NY Yonkers, Sonkin Assocs. 914-968-8282
NC Greenboro, Adams & Assocs. 919-272-6838
OH Sharon Center, Merit Elctrns. 216-725-1460
PA Penndel, Delta Mktg. 215-750-1440
TX Euless, W. Pat Fralia Co. Inc. 817-354-9720
TX Houston, W. Pat Fralia Co. Inc. 713-772-1572
WA Redmond, Scientific Dvcs 206-885-0004
EXP FL, Ft. Lauderdale, GM Intl. 305-434-6617

Local Distributors
AL Huntsville, Mock Elctrns. 205-539-2401
AL Opelika, Southern Elctrns. 205-745-5298
AZ Phoenix, Dalis Elctrns. 602-275-2885
CA Burlingame, Rose Elctrns. 415-348-2740
CA San Jose, Quement Elctrns. 408-998-5900
CT Danbury, Pilgrim Elctrns. 203-792-7274
FL Miami, Electronic Equip. Co. 305-871-3500
IL Elk Grove Village, GBL/Gould Elctrns. 312-593-3220
IN Fort Wayne, Graham Elctrns. 219-423-3422
LA Baton Rouge, Menard Elctrns. 504-355-0323
MD Baltimore, ASI Elctrns. 301-265-5100
MD Baltimore, Resco 301-823-0070
MD Bethesda, Empire Elctrns. 301-656-3300
MA Hingham, Sager Electrical Supp. 617-749-6700
MA Newton, Greene-Shaw Co. 617-969-8900
MI Ann Arbor, Purchase Radio Supp. 313-668-8696
MO St. Louis, Gateway Elctrn. Supp. 314-427-6116
NJ Cranford, Garden State Indl. Elec. 201-272-6400
NJ Hanover, State Elctrns. PTS 201-887-2550
NJ Kenilworth, Federated Purchaser 201-272-0505
NY Buffalo, Summit Distrs. 716-884-3450
NY E. Farmingdale, Ahirter Telewire 516-293-7788
NY Hauppauge, Broadline Elec. Dist. 516-231-4100
NY Hempstead, Davis Elctrn. Corp. 516-483-9200
NY Lynbrook, Peerless Radio Dist. 212-523-3456
NY LIC, H. L. Dalis Inc. 212-361-1100
NY New York, Martin Audio/Video Corp. 212-541-5900

NY	Portchester, Wise Comps.	914-939-8600
NY	Rochester, Simcona Elctrn. Corp.	716-328-3230
NY	Rochester, Summit Elctrns.	716-334-8110
NC	Raleigh, Southeastern Radio	919-828-2311
OH	Dayton, Carver Supp., Inc.	216-666-1185
PA	Allentown, Federated Elctrns.	215-437-4481
PA	Horsham, Toner Cable Equip.	215-675-2053
PA	Pittsburgh, South Hills Elctrns.	412-921-9000
PA	West Chester, West Chester Elec. Supp.	215-696-7500
SC	Charleston, Wholesale Indl. Elec.	803-722-2634
TN	Clarksville, Randolph Hale & Matthews	615-647-2325
TN	Cookeville, Randolph & Parks	615-526-6184
TN	Nashville, Randolph & Rice	615-255-5601
TN	Tullahoma, Randolph Rice & Williams	615-455-4531
TX	Ft. Worth, Swieco Inc.	817-335-6521
TX	Houston, Lenert Co.	713-225-1465
VA	Arlington, Arlington Elctrns.	703-524-2412
WA	Seattle, Radar Elec. Co.	206-282-2511

PREMIER MICROWAVE, 35 New Broad St, Port Chester, NY 10573, Tel: 914-939-8900, TWX: 710-569-1609; FSC No.: 15870; Empl.: 90; *Sls. Mgr.:* Mel Radner

PREM MAGNETICS, INC., 3521 N. Chapel Hill Rd., McHenry, IL 60050, Tel: 815-385-2700, FAX: 815-385-8578; FSC No.: 20462; Empl.: 300; *Sls. Mgr.:* D. Hertel ..... **A•2355-2365**

PRES:AIR:TROL CO.

FAX: 914-698-9456

PRES-AIR-TROL CORP., 1009 Boston Post Rd., Mamaroneck, NY 10543, Tel: 914-698-2026, 800-431-2625 (outside NY) ..... **B•1787**

PRESIDIO COMPONENTS, INC., 7185 Construction Ct., San Diego, CA 92121, Tel: 619-578-9390, TWX: 310-371-6407; FSC No.: 60212

PRESS-ON PRODUCTS, 21 Factory Rd., Addison, IL 60101, Tel: 312-628-2255, FAX: 312-543-4414; Empl.: 20; *Sls. Mgr.:* T. Cummins

PRESSURE CONTROLS, INC., 406 Cortlandt St., Belleville, NJ 07109, Tel: 201-751-5003; Empl.: 15; *Sls. Mgr.:* P. Emmarco

PRESSURE SYSTEMS, INC., 34 Research Dr., Hampton, VA 23666, Tel: 804-865-1243, TELEX: 901406, FAX: 804-766-2644; Empl.: 77; *Sls. Mgr.:* J. S. Yakshe

PRESTON SCIENTIFIC, 805 E. Cerritos Ave., Anaheim, CA 92805, Tel: 714-776-6400, TELEX: 5101004596 ESL UD, FAX: 714-776-3660; Empl.: 60; *Sls. Mgr.:* Charles J. McGuire

PRIMELINE, Soltec Corporation, P. O. Box 670, San Fernando, CA 91341-0670, Tel: 818-365-0101, TELEX: 494-3094 SOLTEC UI, FAX: 818-365-7839; *Sls. Mgr.:* Byron McIntire

PRIME POWER, A Prime Technology Co., Twin Lakes Rd., P.O. Box 185, N. Branford, CT 06471, Tel: 203-481-5721, TWX: 710-452-3092, FAX: 203-481-8937; *Sls. Mgr.:* J. L. Jamieson

PRIME TECHNOLOGY, INC., See General Resistance, A Prime Technology Co.

PRIMO COMPANY LIMITED, 25-1, 6-Chome, Mure, Mitakashi, Tokyo, Japan 181, Tel: 0422-43-3121, TELEX: 2822-326; FSC No.: 0422 49 8865; Empl.: 391; *Sls. Mgr.:* K. Shinai

PRINCETON CASE CO., INC., 667 Lehigh Ave., Union, NJ 07083, Tel: 201-687-1750; Empl.: 60; *Sls. Mgr.:* S. E. Parker

PRINCETON ELECTRONIC PRODUCTS, Box 101, North Brunswick, NJ 08902, Tel: 201-297-4448, TWX: 710-380-3832; Empl.: 29; *Sls. Mgr.:* H. Center; *Dist. Mgr.:* H. Center

PRINCO INSTRUMENTS, INC., 1020 Industrial Hwy., Southampton, PA 18966; FSC No.: 48620; Empl.: 70; *Sls. Mgr.:* G. G. Pfaff

PRINTER PRODUCTS, Capitol Circuits Corporation, 25 Denby Road, Boston, MA 02134, Tel: 617-254-1200; Empl.: 200; *Sls. Mgr.:* Blaine Wotring ..... **D•1101**

Local Sales Offices & Reps

AZ	Scottsdale, Digital Bus. Sys.	602-991-9831
CA	Mountainview, IFM Inc.	415-961-2828
IL	Chicago, Data Elctrns.	312-283-0300
IN	Indianapolis, John Sukup, Inc.	317-253-5501
PA	Ambler, Denco Data Equip. Corp.	215-542-9876
TX	Richardson, Scientific Sls. Co.	214-231-6541
VA	Alexandria, Scott Data Corp.	703-765-7901
Can	Scarborough, Ontario, Technical Logistics Support	416-298-9486

PROBE MASTER, INC., 4898 Ronson Ct., San Diego, CA 92111, Tel: 619-560-9676, 800-854-1519, 800-772-1519; *Sls. Mgr.:* Dick Press

PROBE-RITE, INC., P.O. Box 242, Santa Clara, CA 95052, Tel: 408-727-0100, TWX: 910-338-0260; *Sls. Mgr.:* Frank J. Ardezzone

PRODELIN CORPORATION, P.O. Box 368, Conover, NC 28613, Tel: 704-464-4141, FAX: 704-464-5725; Empl.: 60; *Sls. Mgr.:* Dan Johnson

PRODUCTS FOR RESEARCH, 88 Holten St., Danvers, MA 01923, Tel: 508-774-3250, TELEX: 940-287, FAX: 617-245-1628; Empl.: 21; *Sls. Mgr.:* Harry Martin

PTI PRODUCT TECHNOLOGY INC.

FAX: 714-474-1340

PRODUCT TECHNOLOGY, INC., 2811-B McGaw Avenue, Irvine, CA 92714, Tel: 714-474-8998; FSC No.: 1Z295; Empl.: 20; *Sls. Mgr.:* Gerald F. Hammel ..... **C•1735**

Local Sales Offices & Reps

AZ	Redlands, Lugen Inds.	714-371-5259
CA	Fremont, Sidann Sls.	415-659-1394
CA	Santa Ana, Sidann Sls.	714-850-0280
CO	Broomfield, Ramark Sls.	303-469-1758
WI	Milwaukee, Lugen Inds.	414-671-1047

PROGRAMMABLE DEVICES, INC., 155-T New Boston St., Woburn, MA 01801, Tel: 617-935-9530, FAX: 617-935-3654; Empl.: 10

PTS FREQUENCY SYNTHESIZERS

FAX: 617-486-4495

PROGRAMMED TEST SOURCES, Beaver Brook Rd., P.O. Box 517, Littleton, MA 01460, Tel: 617-486-3008; FSC No.: 66381; Empl.: 20 ..... **D•1314**

PROJECTS UNLIMITED, 3680 Wyse Rd., Dayton, OH 45414, Tel: 513-890-1918, TWX: 810-450-2523, FAX: 513-890-4911; Empl.: 90; *Sls. Mgr.:* Greg Kimpton

PRO-LOG, 2411 Garden Rd., Monterey, CA 93940, Tel: 408-372-4593, TWX: 910-360-7082; Empl.: 200

PROTEON, INC., Two Technology Dr., Westborough, MA 01581-5008, Tel: 617-898-2800, TELEX: 928124; Empl.: 150; *Sls. Mgr.:* Patrick F. Lally

PROTO PC INC., 2424 Territorial Rd., St. Paul, MN 55114, Tel: 612-644-4660, TWX: 910-380-7623; *Sls. Mgr.:* Danie Watson

PROTO STAMPING CORP., 850 Charter St., Redwood City, CA 94063, Tel: 415-365-0498, TELEX: 709241; Empl.: 35; *Sls. Mgr.:* David Duncan

PROTO SYSTEMS OF ATLANTA, 625 Sims Industrial Blvd., Alpharetta, GA 30201, Tel: 404-475-1330, TELEX: 469432; *Sls. Mgr.:* John Gregory

PROTOTEK, INC., 25 Standen Dr., Hamilton, OH 45015, Tel: 513-874-5094, FAX: 513-874-2252; FSC No.: 60813; Empl.: 45; *Sls. Mgr.:* Larry Frank; *Dist. Mgr.:* Earl Rohe

PSG INDS., 1225 Tunnel Road, Perkasie, PA 18944, Tel: 215-257-3621, TELEX: 827361; FSC No.: 18509; Empl.: 150; *Sls. Mgr.:* Robert Banion

PTC TRANSFORMERS, P.O. Box 397, Rising Sun Road, Bordentown, NJ 08505, Tel: 609-298-8200, TELEX: 510-685-3645; Empl.: 25; *Sls. Mgr.:* C. W. Harrison

PTK/RANTEC DIVISION, 1173 Los Olivos Ave., Los Osos, CA 93402, Tel: 805-528-5858, TELEX: 88-8863, TWX: 910-351-5802; FSC No.: 60132; Empl.: 145; *Sls. Mgr.:* Francesca Peterson

PTS CORPORATION, Box 272, Bloomington, IN 47401, Tel: 812-824-9331; Empl.: 350; *Sls. Mgr.:* Jeff Hamilton; *Dist. Mgr.:* David Melwid

PTX-PENTRONIX INC., 1737 Cicotte, Lincoln Park, MI 48146, Tel: 313-388-3100, TELEX: 23-0398; Empl.: 21; *Sls. Mgr.:* J. Schultz

Z-LINE

FAX: 714-641-9062

PULIZZI ENGINEERING, INC., 3260 S. Susan St., Santa Ana, CA 92704-6865, Tel: 714-540-4229; FSC No.: 70513; Empl.: 35; *Sls. Mgr.:* Michael B. Pulizzi; *Dist. Mgr.:* Michael B. Pulizzi ..... **D•2146-2149**

Local Sales Offices & Reps

CA	Los Angeles, Power Partners	213-215-0800, 714-261-9200
CA	Los Gatos, Norwest Elctrns.	408-395-1190
IA	Des Moines, Beams 500 to 528	515-255-1148
MD	Silver Spring, L. G. White & Co., Inc.	301-792-0660
MA	N. Reading, Tech. Instrs., Inc.	617-944-3930

Local Distributors

CA	San Jose, Dansco Comp. Sls., Inc.	408-292-9740

PULNIX AMERICA, INC., 770-A Lucerne Drive, Sunnyvale, CA 94086, Tel: 408-733-1560, TELEX: 172541 PULNIX AMERICA, FAX: 408-737-2966; *Sls. Mgr.:* Richard Hofmeister

PULSAR PRODUCTS DIV., Physics International, 2700 Merced St., San Leandro, CA 94577, Tel: 415-577-7236, TWX: 910-366-7033; Empl.: 360

PULSE ENGINEERING, INC., 7250 Convoy Ct., P.O. Box 12235, San Diego, CA 92112, Tel: 619-268-2400, FAX: 619-268-2515; Empl.: 150; *Sls. Mgr.:* Leonard M. Luner

PULSE INSTRUMENTS CO., 1234 Francisco, Torrance, CA 90502, Tel: 213-515-5330; Empl.: 20; *Sls. Mgr.:* Ron Perry

PULSE TRONIC INC., P.O. Box 5196, Ville St. Laurnet, Que., Canada H4L 4Z8, Tel: 514-747-6028, TELEX: 05-826652, FAX: 514-747-7330; *Sls. Mgr.:* Pamela Hirsh

PURE DATA LTD., 200 W. Beaver Creek, Richmond Hill, Ont., Canada L4B 1B4, Tel: 416-731-6444, TELEX: 06-966707, FAX: 416-731-7016; Empl.: 75; *Sls. Mgr.:* Terrence Hickey; *Dist. Mgr.:* Chris Bergman

PYLE INDUSTRIES, INC., 501 Center St., P.O. Box 620, Huntington, IN 46750, Tel: 219-356-1200, FAX: 219-356-2830; Empl.: 275; *Sls. Mgr.:* Frank Pyle, Jr.; *Dist. Mgr.:* Mark Pyle

PYLE-NATIONAL DIVISION, BRIntec Corp., 1334 N. Kostner Ave., Chicago, IL 60651, Tel: 312-342-6300, TELEX: 25251, TWX: 910-221-0335; FSC No.: 49367; Empl.: 650; *Sls. Mgr.:* Mike Carroccia; *Dist. Mgr.:* Mike Curroccia

PYLON CO., See Augat/Pylon Corp., Inc.

PYLON ELEX DEVELOPMENT CO. LTD., 2300 Victoria, Lachine, PQ, Canada H8S 1Z3, Tel: 514-637-1186, TELEX: 05-821680, FAX: 514-636-1970; Empl.: 50; *Sls. Mgr.:* Sydney Harland

PYROCOM CO., 924 N. 143rd St., Seattle, WA 98133, Tel: 206-365-3535; *Sls. Mgr.:* Bill Kurtz

PYROFERRIC INTERNATIONAL, INC., 200 Madison St., Toledo, IL 62468, Tel: 217-849-3300, TWX: 910-663-0616; Empl.: 50; *Sls. Mgr.:* S. John Horner

Local Sales Offices & Reps

AZ Phoenix, Charles T. Fink & Assocs., Ltd. 602-992-9884
CA Alhambra, Deniston/JDA, Inc. 818-289-2844
CA Santa Clara, C. B. King Assocs. 408-988-7551
OH Shaker Hgts., Don Gype Co. 216-283-5380

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QSI CORPORATION, 1740 North Research Park Way, Logan, UT 84321, Tel: 801-753-3657, TELEX: 887430; Empl.: 10; *Sls. Mgr.:* Dennis R. Durfee

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RAGEN DATA SYSTEMS, INC., 3 Oval Dr., Central Islip, NY 11722, Tel: 516-234-3800, TELEX: 685-2305, TWX: 510-227-4901; FSC No.: 13068; Empl.: 150; *Sls. Mgr.:* Kevin Douglas

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NC	Raleigh, CSR Elctrns	919-878-9200
OH	Cincinnati, Luebbe Sls. Co	513-891-5770
OH	Cleveland, Luebbe Sls. Co	216-333-0425
OH	Columbus, Luebbe Sls. Co	614-431-0474
OH	Dayton, Luebbe Sls. Co	513-294-0426
OR	Portland, James J. Backer Co	503-297-8744
PA	Huntingdon Valley, Inacker Sls., Inc	215-947-5660
PA	Pittsburgh, Luebbe Sls. Co	412-364-0490
TN	Knoxville, CSR Elctrns	615-673-0222
TX	Austin, Allied Comps	512-331-4494
TX	Dallas, Allied Comps	214-238-0408
TX	Hurst, Allied Comps	817-589-0456
WA	Seattle, James J. Backer Co	206-285-1300
Can	Mississauga, Ont, Gidden-Morton Assocs	416-671-8111
Can	Nepean, Ont, Gidden-Morton Assocs	613-726-0844
Can	St. Laurent, Que., Gidden-Morton Assocs	514-335-9572

Local Distributors

AZ	Tempe, Harper/SID	602-967-1464
AZ	Tempe, Shelley-Ragon	602-894-2058
CA	Chatsworth, Shelley-Ragon	818-998-3333
CA	Chatsworth, TTI	818-709-1010
CA	Compton, Harper/SID	213-979-5090
CA	Milipitas, TTI	408-943-9155
CA	San Diego, Harper/SID	619-560-8545
CA	San Diego, Shelley-Ragon	619-453-7133
CA	San Diego, TTI	619-587-4888
CA	San Jose, Shelley-Ragon	408-942-9111
CA	Sunnyvale, Harper/SID	408-747-0333
CO	Englewood, Shelley-Ragon	303-762-0670
CO	Westminster, TTI	303-429-6806
CT	East Haven, J. V. Elctrns	203-469-2321
FL	Orlando, TTI	305-859-1000
FL	Tampa, Impala Elctrns	813-885-4747
FL	Tampa, Shelley-Ragon	813-884-0946
IL	Addison, Belford Elctrns	312-865-2400
IL	Elk Grove Village, Shelley-Ragon	212-595-6633
IL	Northbrook, Classic Comps	312-272-9650
IA	Cedar Rapids, Shelley-Ragon	319-373-0525
MD	Columbia, Aztech Elctrns	301-995-1760
MD	Columbia, TTI	301-995-1331
MA	Woburn, TTI	617-938-8800
MI	Grand Rapids, S-F Elctrns. Supp	616-459-0216
MN	El Prairie, TTI	612-944-5080
MN	Minneapolis, Aerospace Comptr. Supp	612-884-4725
MN	St. Paul, Shelley-Ragon	612-642-2828
MO	Independence, Shelley-Ragon	816-254-3410
MO	St. Louis, Shelley-Ragon	314-454-0480
NH	Hudson, TNT Elctrns	603-880-8300
NY	Bohemia, Shelley-Ragon	516-567-7751
NY	Buffalo, Summit Elctrns	716-887-2862
NY	Farmingdale, Command Elctrns	516-293-1212
NY	Hauppauge, Jaco Elctrns	516-273-5500
NY	Rochester, Simmcona Elctrns	716-328-3230
NY	Rome, Rome Elctrns	315-337-4500
NY	Ronkonkoma, TTI	516-737-2000
NC	Raleigh, Resco-Raleigh	919-781-5700
OH	Dayton, Stotts, Friedman	513-298-5555
OH	Englewood, Argent Electra	513-836-8633
OK	Tulsa, Altair	918-252-5781
OR	Beaverton, Shelley-Ragon	503-682-2929
PA	McKean, Advacom	814-476-7774
PA	Norristown, Century Elctrn. Comps	215-631-5400
PA	Zelienople, Argent Electra	412-776-4330
TX	Austin, Altair	512-837-4970
TX	Fort Worth, TTI	817-429-0441
TX	Houston, Altair	713-462-3029
TX	Richardson, Altair	214-231-5166
WA	Seattle, Shelley-Ragon	206-241-1980
WI	New Berlin, Classic Comps	414-786-5300
Can	Scarborough, Ont., Carsten Elctrns	416-495-9999

RCL-SHALLCROSS, INC., U.S. Hwy. 70 East, Smithfield, NC 27577, Tel: 919-934-5181, TWX: 510-939-1463, FAX: 919-934-5186; FSC No.: 54294; Empl.: 150
..... **A•2012-2017**

See RCL-Shallcross for Local Sales Reps. and Distributors

R-COLUMBIA PRODS. CO., INC., 2008 St. Johns Ave., Highland Park, IL 60035, Tel: 312-432-7915, TWX: 910-692-2160; Empl.: 20

RDF CORPORATION, 23 Elm Ave., Hudson, NH 03051, Tel: 603-882-5195, TWX: 710-228-1882; Empl.: 120; *Sls. Mgr.:* Arthur Di Venuti

REACTEL, INC., 687-D Lofstrand La., Rockville, MD 20850, Tel: 301-279-5535, ESYLNK: 990876, FAX: 301-340-7304; FSC No.: 60458; Empl.: 30; *Sls. Mgr.:* D. E. Claycomb

Local Sales Offices & Reps

CA	Sunnyvale, ESCO Assocs	408-745-1410
FL	Clearwater, Brennan Assocs	813-446-5006
NJ	Keansburg, Reps Five	201-495-2315
VA	Fairfax, Beacon North	703-591-1300

REAL TIME DEVICES, INC., Mattemville Ctr., US 322, Port Matilda, PA 16870, Tel: 814-234-8087, TELEX: 4948141 SEDACOG; Empl.: 15

REAL TIME SYSTEMS, 152 S. MacQuesten Pkwy., Mt. Vernon, NY 10550, Tel: 914-667-0425; *Sls. Mgr.:* A. Citrin

RECOGNITION TECHNOLOGY, INC., 160 E. Main St., Westborough, MA 01581, Tel: 617-366-4800; Empl.: 12; *Sls. Mgr.:* Avi Zimmerman

RECORDER SYS. DIV., See Gulton Instruments Div.

RECORTEC, INC., 275 Santa Ana Ct., Sunnyvale, CA 94086, Tel: 408-737-8441, TWX: 910-379-5022, FAX: 408-737-8448; *Sls. Mgr.:* R. R. Troxell

RECOTON CORP., 46-23 Crane St., Long Island City, NY 11101, Tel: 718-392-6442, TELEX: 236047 RCTN; Empl.: 150; *Sls. Mgr.:* Peter Dayton

REDINGTON COUNTERS, 130 Addison Rd., Windsor, CT 06095, Tel: 203-688-6205, FAX: 203-688-1591; *Sls. Mgr.:* Dennis O'Shea; *Dist. Mgr.:* Dennis O'Shea

REEVE ELECTRONICS, Mellish E. Murray, 1715 W. Carroll Ave., Chicago, IL 60612, Tel: 312-670-0150; Empl.: 25; *Sls. Mgr.:* Ed Martinez

REEVES-HOFFMAN

FAX: 717-243-0079

REEVES-HOFFMAN DIV., Dynamics Corporation of America, 400 W. North St., Carlisle, PA 17013, Tel: 717-243-5929; Empl.: 310; *Sls. Mgr.:* Larry Barbary
..... **A•1454-1456; C•1638-1640**

Local Sales Offices & Reps

AZ	Phoenix, Chaparral Elctrns	602-252-0897
CA	Culver City, Westaironics	213-641-4123
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Boulder, R.G. Entprs	303-447-9211
FL	Tampa, APM Assocs	813-886-2457
GA	Duluth, DTM, Inc	404-381-5592
ID	Boise, N. R. Schultz	208-377-8686
IL	Des Plaines, ESCO Assocs	312-298-5310
MD	Ellicott City, Nelson Elctrns	301-747-7887
MA	Wakefield, H. Jappe Co	617-245-9359
MN	Minneapolis, Intl. Elctrns	612-571-0000
NY	Huntington, Compar N.Y.	516-423-5660
OH	Cincinnati, Tri-State Mktg	513-761-7993
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Hatboro, Electro Rep Engrg	215-674-4421
TX	Irving, Kite Elctrns. Sls	214-438-9336
WA	Bellevue, N. R. Schultz	206-454-0300
Can	Rexdale, Ont., Myelco, Inc	416-674-1636

REGDON SOLENOID, INC., 3713 Grand Blvd., Brookfield, IL 60513, Tel: 312-485-5152, FAX: 312-485-0083; FSC No.: 27190; Empl.: 65 ..... **B•1634-1635**

Local Sales Offices & Reps

AL	Decatur, Tenn Tech	205-350-0630
CA	Los Altos, J. W. Wilhoit	415-961-3660
CA	Valencia, DJM Elctrns	818-362-4309
CT	Woodbury, Mark-Rep Assocs	203-263-3047
FL	Maitland, EIR, Inc	305-660-9600
GA	Atlanta, Tenn Tech	404-622-5784
IL	Downers Grove, Richmar Elect. Corp	312-968-0118
IN	Indianapolis, Richmar Elctrns	317-846-6383
MN	Hopkins, S. J. Collins & Assocs	612-933-7661
NH	Plaistow, Mark-Rep Assocs	603-382-9563
NJ	Florham Park, Varrelman-Gorman Co	201-992-2505
NY	Binghamton, NHA	607-754-3214
NY	Pittsford, NHA	716-586-9002
NC	Raleigh, Tenn Tech	919-266-3610
OH	Cleveland, J. N. Bailey	216-892-1510
OH	New Lebanon, J. N. Bailey	513-687-1325
PA	Huntingdon Valley, Edwin Leiby & Assocs	215-659-8938
TN	Chattanooga, Tenn Tech	615-894-3012
TX	Austin, K & H Sales	512-258-8841
TX	Plano, K & H Sales	214-423-6520
WI	Butler, Richmar Elctrns	414-781-1730

Local Distributors

CA	San Carlos, Logan Elctrn. Supp.	415-594-0700
MA	Lynn, Land Elctrns.	617-592-2220
NJ	Fairlawn, Relay Specialties	201-797-3313

REGENCY LAND MOBILE, INC., 7707 Records St, Indianapolis, IN 46226, Tel: 317-545-4281, FAX: 317-545-2170; Empl.: 500

REGENT CONTROLS, INC., 39 Fanny St, P.O. Box 767, Shelton, CT 06484-0767, Tel: 203-736-2924, FAX: 203-736-2928; Empl.: 35; *Sls. Mgr.:* Lora C. Minor

REHLANDER ASSOCS., 118A Bridge St, Beverly, MA 01915, Tel: 617-922-5961; *Sls. Mgr.:* Michael Rehlander ..... **B•1274**

REICH ASSOCIATES, Rt. 4, Box 4620, Lakehills, TX 78063, Tel: 512-751-3220, TELEX: 358048, ESYLNK: 62705740, FAX: 512-751-3054; FSC No.: 55916; Empl.: 10; *Sls. Mgr.:* W. Reich

RE INSTRUMENTS CORP., 31029 Center Ridge Rd., Westlake, OH 44145, Tel: 216-871-7617; Empl.: 15; *Sls. Mgr.:* Steve Watts

REKCO INCORPORATED

FAX: 414-255-0653

REKCO, INC., N. 114 W. 19225 Clinton Dr., Germantown, WI 53022, Tel: 414-784-3430, TWX: 910-262-3005; *Sls. Mgr.:* Dick Koerber ..... **D•1141**

Local Sales Offices & Reps

CA	Huntington Bch., Brindle Assocs.	714-847-4738
FL	Largo, Burke Assocs.	813-536-4335
IL	Geneva, Applied Comp. Sls.	312-232-2669
NH	Amherst, Eva Tec Mktg.	603-673-4830
NJ	Bordentown, Eva Tec Mktg.	609-298-4307
NY	Ronkonkoma, Eva Tec Mktg.	516-467-5066
TX	Dallas, Titan Reps.	214-241-1398

RELAY SERVICE CO., 1300 N. Pulaski Rd., Chicago, IL 60651, Tel: 312-252-2700; Empl.: 25; *Sls. Mgr.:* Chas. H. Badger

RELAY SPECIALTIES, 17 Raritan Rd., Oakland, NJ 07436, Tel: 201-337-1000, TELEX: 642751, FAX: 201-337-1862; Empl.: 48; *Sls. Mgr.:* S. R. Gershberg

Local Sales Offices & Reps

CA	Los Alamitos, The Rep House	213-598-3379
CT	Manchester, Vin-Tech, Inc.	203-646-3007
MI	Dearborn, Pitcher Poulin Inc.	313-582-5450
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
NJ	Haddon Hgts., Walt Woodward	609-547-5000
NY	Rochester, Clark & Assocs.	716-436-1320
OH	Cincinnati, Annett Indl. Sls. Inc.	513-271-0030

RELCO PRODUCTS, 5594 E. Jefferson Ave., Denver, CO 80237, Tel: 303-756-1143; FSC No.: 14454; Empl.: 7

RELIABILITY, INC., P. O. Box 218370, Houston, TX 77218, Tel: 713-492-0550, TWX: 910-881-1739; FSC No.: 54098; Empl.: 575; *Sls. Mgr.:* J. Marcussen

RELIANCE COMM/TEC, Reliance Electric, P. O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE ELECTRIC CO., Marketing Info Center, P.O. Box 99502, Cleveland, OH 44199, Tel: 800-245-4501

RELIANCE PLASTICS & PACKAGING, 225 Belleville Ave., Bloomfield, NJ 07003, Tel: 201-748-2222, FAX: 201-748-5257; Empl.: 60; *Sls. Mgr.:* Hale Smith

REMEE PRODUCTS CORP., 41 Bridge St., Florida, NY 10921, Tel: 914-651-4431, TELEX: 64-6715, FAX: 914-651-4160; FSC No.: 4R362; Empl.: 135; *Sls. Mgr.:* Ken Pimental; *Dist. Mgr.:* Ken Pimental

REMTEK CORPORATION, 46107 Landing Parkway, Fremont, CA 94538, Tel: 415-490-3999, TELEX: 1171121, FAX: 415-659-1849; Empl.: 40; *Sls. Mgr.:* Robert A. Wold; *Dist. Mgr.:* Robert T. Collins ..... **C•1717**

Local Sales Offices & Reps

AZ	Tempe, Rich Sls. Co.	602-968-7787
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	Fremont, Nicor-II	415-490-5975
CA	Fremont, Remtek Corp.	415-490-3999
CA	Montrose, Signal Entprs.	818-957-0640
CO	Boulder, R. F. Mayo & Assocs.	303-442-2155
FL	Deerfield, Brandel Stephens	305-427-8558
GA	Marietta, Remtek Corp.	404-977-1630
IL	Deerfield, Flaherty-Haines	312-948-7800
IN	Ft. Wayne, Hoyle Assocs.	219-485-6433
KS	Wichita, Baka Corp.	316-682-8411
MA	Clinton, Browning & Naughton	617-365-6365
MI	Birmingham, Forand Sls. Co.	313-644-0087
MN	Eden Prairie, EMT Engrg.	612-934-4147
NJ	Hicksville, J-Square Mktg.	516-935-3200
NY	Rochester, L-Mar Assocs.	716-323-1000
OH	Cleveland, Versatron	216-581-0090
OR	Tualatin, Nicor-I	503-692-0421
PA	Telford, Dalbrook	215-723-3300
TX	Dallas, R. D. Spooner	214-357-6636

RENARD MANUFACTURING COMPANY, INC., 3131 N.W. 79th Avenue, Miami, FL 33122-1011, Tel: 305-592-1500, TELEX: 989326, ESYLNK: 62929141, FAX: 305-593-9990

RENCO, Robbins & Myers, 26 Coromar Dr., Goleta, CA 93117-3094, Tel: 805-968-1525, TWX: 910-334-1180; FSC No.: 34479; Empl.: 170; *Sls. Mgr.:* Sid Russell; *Dist. Mgr.:* Marshal French

RENCO ELECTRONICS, INC.

FAX: 516-586-5562

RENCO ELECTRONICS, INC., 60 Jefryn Blvd., East, Deer Pk., NY 11729, Tel: 516-586-5566, 1-800-645-5828, TELEX: 220-883; Empl.: 200; *Sls. Mgr.:* Edward W. Rensing; *Dist. Mgr.:* Rhonda Rizzo ..... **A•1282-1285, 2367-2369**

Toll-Free Engineering Hot Line 800-645-5828, in NY State 516-586-5566

Local Sales Offices & Reps

AZ	Tempe, Allegro Assocs.	602-967-1337
AR	Ft. Smith, Electra Reps	501-452-7822
CA	San Diego, Coastal Sls.	619-459-4148
CO	Parker, The Remington Grp.	303-841-0523
CT	Norwalk, Northeast Reps.	203-886-6030
FL	Casselberry, S.A. Assocs.	305-695-6010
GA	Tucker, Stephen & Assocs.	404-493-4666
IL	Addison, Baldwin Sls. Assocs.	312-279-0352
IA	Davenport, Rush & West Assocs.	319-388-9494
KS	Olathe, Rush & West Assocs.	913-764-2700
MD	Gaithersburg, Eltron Sls.	301-963-7082
MA	Hingham, Northeast Reps.	617-749-8700
MN	Minneapolis, All Phase	612-835-4940
MO	St. Louis, Rush & West Assocs.	314-965-3322
NH	Nashua, Northeast Reps.	603-880-8199
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Great Neck, Pacent Engrg.	516-482-4678
NC	Raleigh, Eltron Sls.	919-846-6215
OH	Columbus, Baehr Greenleaf & Assocs.	614-486-4046
OH	Westlake, Baehr Greenleaf & Assocs.	216-892-1770
OR	Hillsboro, Temco Northwest	503-649-8375
PA	Evans City, Baehr Greenleaf & Assocs.	412-776-2151
TX	Austin, Electra Reps	512-339-1163
TX	Dallas, Electra Reps	214-248-3852
UT	Parker, The Remington Grp.	303-841-0523
VA	Front Royal, Eltron Sls.	703-635-1933
WA	Kirkland, Temco Nortwest	206-823-6388
WI	Milwaukee, Bert Wartchow Assocs.	414-964-0942
Can	Montreal, Eli Manis, Inc.	514-861-5571

REN ELECTRONICS CORPORATION, C.C.G., An Insico Co., 755 New Ludlow Rd., S. Hadley, MA 01075, Tel: 413-536-1800, TELEX: 315617, FAX: 413-536-8425; FSC No.: 70143; Empl.: 75; *Sls. Mgr.:* S. W. Pai, Div. Mgr.

REPCO, 2421 N. Orange Blossom Trail, Box 7065, Orlando, FL 32854, Tel: 305-843-8484, TELEX: 56-6536

REPRODUCTION TECHNOLOGIES INC., Dept. EM, P.O. Box 790, Bristol, IN 46507-0518, Tel: 219-848-5233, TELEX: 510 600 2378 R T I; Empl.: 15 ..... **D•1043**

Local Sales Offices & Reps

AL	Birmingham, Secom Systems	205-854-5451
CA	Agoura Hills, CDH & Assocs.	818-707-1970
CO	Arvada, BBS Communications	303-422-8810
FL	Palm Coast, Secom Sys.	904-445-4654
GA	Doraville, Secom Sys.	404-455-0672
IL	Arlington Hgts., VLR Comms.	312-520-5208
IN	Indianapolis, R F Mktg.	317-849-8662
MD	Rockville, Joe Then	301-984-3945
MA	Falmouth Heights, R J C Assocs.	617-540-8832
MI	Ferndale, Shalco	313-547-4771
MN	Minneapolis, KODO Assocs.	612-881-1255
MO	Kansas City, Forristal-Young Sls.	816-358-6771
NM	Albuquerque, BBS Comms.	505-877-0277
NC	Raleigh, Secom Sys.	919-846-6013
OH	Columbus, Micronics, Inc.	614-442-6677
OR	West Lynn, Dave Leonard Co.	503-636-2380
TX	Dallas, Dobbs Stanford Inc.	214-358-0800

REPUBLIC ELCTRNS. CORP., 176 E. 7th St., Paterson, NJ 07524, Tel: 201-279-0300, TWX: 710-988-5908, FAX: 201-345-1937; FSC No.: 93958; Empl.: 125; *Sls. Mgr.:* W. Eisenberger

REPUBLIC ELECTRONICS CO., 200 Wireless Blvd., Hauppauge, NY 11788, Tel: 516-273-9800, TELEX: 96-1460; FSC No.: 95750; Empl.: 145; *Sls. Mgr.:* William Shaver

RESDEL ENGRG. CORP, Resdel Inds., 300 E. Live Oak Ave., Arcadia, CA 91006, Tel: 213-684-2600, TWX: 910-582-3219; FSC No.: 10412; Empl.: 225; *Dist. Mgr.:* W. Schwartz

RESISTANCE TECHNOLOGY INC., 1260 Red Fox Rd., St. Paul, MN 55112, Tel: 612-636-9770, FAX: 910-563-3601; *Sls. Mgr.:* T. Michael Ferris

FAX: 312-863-4272

RESISTORS, INC., 5226 W. 26th St., Chicago, IL 60650, Tel: 312-652-7555; Empl.: 35; *Sls. Mgr.:* Marlene Pingel ..... **A•2019**

Local Sales Offices & Reps

AR	Little Rock, Erickson Sls.	501-455-0618
CA	Santa Clara, K M Entprs.	408-986-1458
FL	Tampa, SRT Mktg.	813-884-4805
IL	Bensenville, Heighway Tech. Sls.	312-860-7900
IN	Indianapolis, Elctrn. Reps., Inc.	317-894-1414
IA	Cedar Rapids, J.R. Sls.	319-393-2232
KS	Overland Pk., EPI/Inc.	913-642-9118
LA	Chalmette, Erickson Sls.	504-271-1976
MS	Jackson, EPI, Inc.	601-856-6251
NY	Albany, Net Sls. Co.	518-371-6964
NY	Cortland, Net Sls. Co.	607-756-6592
NY	Rochester, Net Sls. Co.	716-223-1030
NY	Syracuse, Net Sls. Co.	315-662-7996
NY	Webster, Net Sls. Co.	716-671-0022
NC	Charlotte, Polytech Svcs.	704-372-4161
TX	Dallas, Erickson Sls.	214-739-5833
TX	Round Rock, Erickson Sls.	512-244-3068
WA	Mercer, E.C.S.	206-232-9301

RESONANT POWER TECHNOLOGY, 3350 Scott Blvd., Bldg. 60, Santa Clara, CA 95051, Tel: 408-982-0200, FAX: 408-748-9694; FSC No.: 0BZ13; Empl.: 6; *Sls. Mgr.:* Dan H. Burgoon

REVERE CORPORATION OF AMERICA, 845 N. Colony Rd., Wallingford, CT 06492, Tel: 203-269-7701, TELEX: 96-3482, TWX: 710-476-3197; Empl.: 389; *Sls. Mgr.:* R. Paukstys

REXNORD CHEMICAL PRODUCTS, Engineered Products Div., 6120 E. 58th Ave., Commerce City, CO 80022, Tel: 303-289-5651, FAX: 303-289-5283; *Sls. Mgr.:* Michael P. Manegold

RFD, INC., 5024 Nassau St., Tampa, FL 33607, Tel: 813-872-1502, TWX: 810-876-9146; *Sls. Mgr.:* Thomas W. Facer

RFI CORPORATION, 100 E. Pine Aire Dr., Bay Shore, NY 11706, Tel: 516-231-6400, TWX: 510-227-6233, FAX: 516-231-6465; FSC No.: 13619; Empl.: 350; *Sls. Mgr.:* Robert Fitzpatrick ..... **A•1687**

Local Sales Offices & Reps

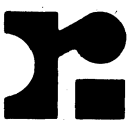
AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Scottsdale, Williams-Assocs.	602-947-4297
CA	Alhambra, M.W. Riedel Co.	213-283-7694
CA	Mountain View, Peninsula Tech. Sls.	415-965-3636
CO	Commerce City, Williams Assocs.	303-289-5647
FL	Clearwater, Tech-Rep Assocs.	813-576-9900

IL	Palatine, Technlg. Sls., Inc.	312-991-6600
IN	Fort Wayne, Denton Mktg., Inc.	219-486-0665
IA	Marion, Ensco-Rep	319-381-1466
KS	Wichita, Ensco-Rep	316-683-1070
MD	Rockville, Mechtronics Sls.	301-340-2130
MO	Maryland Heights, Ensco-Rep	314-423-3935
NH	Hudson, EMC Sls., Inc.	603-889-5751
NJ	Cherry Hill, H.J. White Co.	609-428-4544
NM	Albuquerque, Williams-Assocs.	505-255-1638
NY	Great Neck, Trionic Assocs.	516-466-2300
NC	Winston-Salem, Murcota Corp.	919-722-9445
TX	Garland, McBride Sci. Sls.	214-494-5000
UT	Salt Lake City, Williams Assocs.	801-485-6511
WI	Waukesha, Technlg. Sls., Inc.	414-786-5015

RF MONOLITHICS, INC., 4441 Sigma Rd., Dallas, TX 75244, Tel: 214-233-2903, TELEX: 463-0088, FAX: 214-387-8148; FSC No.: 2U874; Empl.: 90; *Sls. Mgr.:* C. Baker, T. Hinkle, W. Spurgeon

RF POWER LABORATORIES, INC., 22125 17th Ave. S.E., , Bothell, WA 98021, Tel: 206-481-8833, TELEX: 32-1042, FAX: 206-486-1002; FSC No.: 057143; Empl.: 17; *Sls. Mgr.:* Kris Parmar

RHG ELECTRONICS LABORATORY, INC., Adams Russell, 161 E. Industry Ct., Deer Park, NY 11729, Tel: 516-242-1100, TWX: 510-227-6083, FAX: 516-242-1222; Empl.: 250; *Sls. Mgr.:* Sid Wolin



FAX: 714-896-0971

RHOMBUS INDUSTRIES, 15801 Chemical Ln., Huntington Bch., CA 92649-1595, Tel: 714-898-0960, TWX: 910-596-1826; Empl.: 60; *Sls. Mgr.:* L. G. Luthy; *Dist. Mgr.:* L. G. Luthy ..... **A•1613-1617**

Local Sales Offices & Reps

AL	Huntsville, Cross Assocs., Inc.	205-534-4477
AL	Huntsville, CMR Cross Assocs.	205-883-5991

DELAY LINES

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Datatronics

A DIVISION OF DATAMAX ELECTRONICS

AZ	Tempe, A-5 Company	602-968-4923
CA	Fallbrook, Gary Chilcote Assocs.	619-728-7678
CA	Irvine, J. V. Earley & Assocs.	714-833-1806
CA	Santa Clara, Westrep	408-988-8833
CO	Parker, A-5 Co.	303-841-3651
FL	Orlando, Perrott Assocs., Inc.	305-298-7748
ID	Boise, Cascade Comps.	208-343-9886
IL	Skokie, Rendell Sls. Co.	312-967-1513
MA	Malden, J. K. Assocs.	617-321-2922
MI	Warren, D.E.M. Elctrn. Sls.	313-595-9444
MN	Eden Prairie, Electro-Mark, Inc.	612-944-5850
NJ	Leonia, Peter E. Schmitt Co.	201-944-2806
NC	Raleigh, Eltron Sls., Ltd.	703-635-1933
OH	Cleveland, JMK Elctrns.	216-886-7100
PA	Phoenixville, Henry G. Richter, Inc.	215-495-6176
TX	Austin, Space Elctrns.	512-346-2215
TX	Houston, Space Elctrns.	713-266-9245
Can	Toronto, Ont., True North Technlg., Ltd.	416-744-2233

Local Distributors

CA	Agoura, Image Elctrns.	818-707-0911
CA	Costa Mesa, Eric Elctrns.	714-751-1185
CA	Manhattan Bch., Prime Electro Prods.	213-379-3642
CA	Milpitas, California Capacitor, Inc.	800-624-9579
CA	San Diego, Sigma Gen. Corp.	619-565-2000
CA	San Jose, Eric Elctrns.	408-432-1111
CA	Tustin, Image Elctrns.	714-259-0900
MA	Danvers, Nu Horizons Elctrns. Corp.	617-777-8800
MN	Minneapolis, Stark Elctrns. Supp.	612-332-1325
NJ	Pine Brook, Nu Horizons Elctrns. Corp.	201-882-8300
NY	Amityville, Nu Horizons Elctrns. Corp.	516-226-6000
NY	E. Rochester, Nu Horizons Elctrns. Corp.	716-248-5980
NY	Mt. Vernon, QAR Indl. Elctrn. Sls.	914-699-2224
WI	Mequon, Taylor Elec. Co.	414-241-4321
Can	Nepean, Ont., Carsten Elctrns. Ltd.	613-726-9250
Can	Scarborough, Ont., Carsten Elctrns. Ltd.	416-495-7705
Can	St. Laurent, Que., Carsten Elctrns. Ltd.	514-334-8321

RICHARD HIRSCHMANN OF AMERICAN, See Hirschmann

RICHARD-LEE CO., Box 724, New Providence, NJ 07974, Tel: 201-276-0710, FAX: 201-276-6179; Empl.: 8

RICHARDS, ARKLAY S., CO., INC., 72 Winchester St., Newton Highlands, MA 02161-1793, Tel: 617-527-4385; *Sls. Mgr.:* L. K. Richards

RICHCO PLASTIC CO., P.O. Box 804238, Chicago, IL 60680, Tel: 312-539-4060, TWX: 910-221-1938; FSC No.: 06915; Empl.: 250; *Sls. Mgr.:* Ted E. Pavoris; *Dist. Mgr.:* Ted Pavoris

RIDGE TOOL CO., Sub. Emerson Elec. Co., 400 Clark St., Elyria, OH 44036, Tel: 216-323-5581, TELEX: 0243420

RIFA, INC., 403 International Pkwy., Ste. 500, Richardson, TX 75081, Tel: 214-480-8300, TELEX: 735389 ERICS RCHN, FAX: 680-1059 ..... **D•1949**

Local Sales Offices & Reps

AL	Huntsville, EMA, Inc.	205-536-3044
CA	Garden Grove, Elsco Elctrns.	714-891-4621
CA	Los Altos, PEI	415-968-1803
CA	San Diego, Elsco Elctrns.	619-292-1771
CT	Seymour, Sturdy Corp.	203-888-1480
FL	Indiatlantic, Burke Assoc.	305-723-0618
FL	Largo, Burke Assoc.	813-536-4335
FL	N. Palm Harbor, Burke Assoc. Inc.	813-785-1954
FL	Oldsmar, Burke Assoc. Inc.	813-786-8105
IL	Elk Grove Village, Carlson Elctrns. Sls.	312-956-8240
IA	Cedar Rapids, Carlson Elec. Sls. Assoc.	319-377-6341
MD	Hunt Valley, Eagle Sls.	301-666-3930
MA	Wellesley Hills, Sturdy Corp.	617-235-2330
MN	Minneapolis, Holmgren Assocs.	612-786-7641
NV	Reno, Unitronics	916-268-1737
NJ	Marlton, Naudain Assocs., Inc.	609-983-5300
NJ	Parlin, JMR Sls., Inc.	201-254-8484
NY	Latham, H. C. Johnson	518-383-2239
NY	Rochester, H.C. Johnson	716-586-0777
NY	Wading River, JMR Sls.	516-929-5756
NC	Raleigh, EMA, Inc.	919-847-8800
TX	Austin, Tesco, Inc.	512-834-8374
TX	Dallas, Tesco, Inc.	214-553-1200
WA	Redmond, EMG-Elec. Mktg. Grp.	206-882-0962
WI	Milwaukee, Carlson Elctrns., Sls.	414-476-2790

RIL ELCTRNS., INC., 125 Titus Ave., P.O. Box H, Warrington, PA 18976, Tel: 215-EL5-1361; Empl.: 25

RISK, GEORGE, INDS., 802 S. Elm St., Kimball, NE 69145, Tel: 308-235-4645, TWX: 910-620-9040, FAX: 308-235-3561; FSC No.: 24229; Empl.: 100; *Sls. Mgr.:* J. Fisher; *Dist. Mgr.:* J. Fisher ..... **B•1833**

Local Sales Offices & Reps

AL	Huntsville, BCI	205-539-4411
CA	Escondido, Cirolia Elctrn. Sls.	619-743-3015
CA	Santa Ana, VR Elctrns.	714-558-1295
CA	Santa Clara, Context Engrg. Co.	408-748-8676
FL	Casselberry, T Squared Mktg.	305-628-8911
GA	Chamblee, BCI	404-455-0405
IL	Wheaton, Chadra-Schilke & Assoc.	312-653-8126
MA	Lexington, Jodan Tech.	617-863-8898
NY	Huntington Sta., Morgan Elctrn. Sls.	516-549-5180
OH	Painesville, JAC Mktg.	216-357-9858
OR	Beaverton, Advanced Power Prods.	503-646-0994
WA	Redmond, Advanced Power Prods.	206-852-9558
Can	Toronto, Ont., Tienkay, Inc.	416-736-1221

Local Distributors

CA	Los Angeles, Electric Switches	213-660-1310
CA	Santa Ana, Advanced Computer Prods.	714-558-8813
MA	Cambridge, Hi Tek Elctrns., Inc.	617-491-0442

RITTAL

FAX: 513-325-0399

RITTAL CORP., 1900 E. Leffel Lane, Springfield, OH 45505, Tel: 800-637-4425, TELEX: 241 354; Empl.: 35 ..... **C•1086-1088**

Local Sales Offices & Reps

CA	Anaheim, Rittal Corp.	714-527-7337
CA	Concord, Q-Con	415-682-2020
CA	San Jose, Rittal Corp.	408-258-6968
CO	Littleton, Elctrn. Comp. Sys.	303-797-0894
CT	Bristol, Rittal Corp.	203-589-1134
CT	Bristol, Rittal Corp./Mike Seib	203-589-1134
GA	Lawrenceville, Lakewood Inds.	404-995-8842
IL	Downers Grove, Rockford Controls Co.	312-960-2046
IL	Downers Grove, Rockford Controls Co.	312-960-2447
IN	Fort Wayne, Rockford Controls Co.	312-960-2113
MD	Towson, Affiliated Technlg.	301-583-8822
MI	Brighton, Rittal Corp.	313-229-7072
MI	Brighton, Rittal Corp./Chuck Marino	313-229-7072
MN	Shoreview, Ten-Tech	612-481-0274
MS	Jackson, Doby Assoc.	601-981-1138
OH	Cleveland, Rittal Corp.-Dwight Patterson	216-251-4676
OH	Columbus, Rittal Corp.-Scott Puderbaugh	614-764-1108
OH	Springfield, Rittal Corp.-Hdqrs.	513-325-1141
PA	Exton (Phil.), Rittal Corp.-Todd Davis	215-524-7388
RI	Cranston, Rittal Corp.-Greg Demirjian	401-942-3344
TX	Dallas, The Power Connection	214-357-8207
Can	Toronto, Werner Pischel-PTS Engrg.	416-842-8680

Relco

FAX: 519-696-2670

RITZ ELECTRONICS/RELCO, 196 Queen St. N., New Dundee, Ont., Canada N0B 2E0, Tel: 519-696-2616; Empl.: 30; *Sls. Mgr.:* Leonard Snow; *Dist. Mgr.:* Leonard Snow ..... **C•1089; D•1950-1951**

Local Sales Offices & Reps

CA	Redondo Bch.	213-318-9601
CA	Torrance, U.S. Power Converting Co.	213-316-9984
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

Local Distributors

CA	Redondo Bch.	213-318-9601
CA	Torrance, Leonard Snow & Assocs./U.S. Power	213-316-9984
Can	New Dundee, Ont., Ritz Elctrns.	519-696-2616

RLC ELECTRONICS, INC., 83 Radio Cir., Mt. Kisco, NY 10549, Tel: 914-241-1334, TWX: 710-571-2103, FAX: 914-241-1753; FSC No.: 12598; Empl.: 75; *Sls. Mgr.:* Philip H. Wright; *Dist. Mgr.:* Sheldon Seissler/Joe Norelli

RMC POWER SEMICONDUCTOR, BBC, 2150 W. 6th Ave., Broomfield, CO 80020, Tel: 303-469-1883, 1-800-992-0312, TELEX: 299745, FAX: 303-469-8394; Empl.: 16; *Sls. Mgr.:* Dave Whitcomb; *Dist. Mgr.:* Dave Whitcomb

RMF PRODUCTS, INC., 1275 Paramount Pkwy., P.O. Box 520, Batavia, IL 60510, Tel: 312-879-0020, FAX: 312-879-6749; Empl.: 11; *Sls. Mgr.:* R. Frieders ..... **C•1635**

RMS COMPANY, Connector Division, 980 Osborne Rd., Minneapolis, MN 55432, Tel: 612-786-1520, FAX: 612-786-1771; *Sls. Mgr.:* Jack M. Lundeen

RMS ELECTRONICS INC., 50 Antin Pl., Bronx, NY 10462, Tel: 212-892-6700, 800-223-8312, FAX: 212-829-7740; Empl.: 50; *Dist. Mgr.:* Lee R. Heller

RMS TECHN., 11833 Bunker Blvd., Ste. 100, Newport News, VA 23601, Tel: 804-873-0100; FSC No.: 59606; Empl.: 42

ROANWELL, 180 Varick St., New York, NY 10014, Tel: 212-989-1090, TWX: 710-581-6555; FSC No.: 82872; Empl.: 75; *Sls. Mgr.:* Ken Dobbins; *Dist. Mgr.:* Ken Dobbins

RO ASSOCIATES

FAX: 408-744-1521

RO ASSOCIATES, INC., 246 Caspian Dr., Box 61419, Sunnyvale, CA 94088, Tel: 408-744-1450, TWX: 910-339-9304; FSC No.: 24230; Empl.: 90; *Sls. Mgr.:* R. D. Okada ..... **D•1952-1957**

Local Sales Offices & Reps

AL	Huntsville, Lee Assocs.	205-533-5896
AZ	Phoenix, Tech. Sls. Inc.	602-246-1614
CA	Los Angeles, West Coast Reps.	714-558-6100
CA	San Francisco, Richards Assocs.	408-297-3010
CO	Denver, F.G. Mktg.	303-795-9176
DC	Washington, Gans & Pugh	703-527-3262
FL	Orlando, Honeyco	305-299-1222
IL	Chicago, Mar-con Assocs. Inc.	312-675-6450
KS	Lenexa, Midtec	913-541-0505
MD	Baltimore, Gans & Pugh	703-527-3262
MA	Boston, Power Factor	617-234-6415
MN	Minneapolis, R J Inc.	612-866-3661
MO	St. Louis, Midtec	314-275-8666
NM	Albuquerque, Fry-Gates, Inc.	505-262-1525
NY	Mt Vernon, Sonkin Assocs.	914-968-8282
OH	Centerville, Omega Sls., Inc.	513-434-5507
PA	Philadelphia, Gans & Pugh	215-699-6655
TX	Dallas, Barry Sls.	214-234-0255
TX	Houston, Barry Sls.	713-784-5860
WA	Seattle, West Coast Reps.	206-243-3340
Can	Missisauga, Ont., T. W. Wilson Sls.	416-677-8200
Can	Vancouver, BC, Tracan Elctrn. Western Ltd.	604-984-4141

ROBBINS & MYERS, Motion Control Group, 1600 Second St. South, Hopkins, MN 55343, Tel: 612-931-2700, TELEX: 4310124; *Sls. Mgr.:* Harry Webber; *Dist. Mgr.:* Marshall French

ROBERT SHAW INSTRUMENT DIV., Kendall Lane, Natick, MA 01760, Tel: 617-875-9711, TWX: 710-346-0398, FAX: 617-872-8437; Empl.: 600; *Sls. Mgr.:* David LeBlanc

ROBINSON-HALPERN, Teleflex, Inc., One Apollo Rd., P.O. Box 248, Plymouth Meeting, PA 19462-0248, Tel: 215-825-9200, TWX: 510-660-8637; FSC No.: 12400; Empl.: 80; *Sls. Mgr.:* Robert C. Rehborn, Prod. Mgr.

Robinson Nugent

FAX: 812-945-0804

ROBINSON NUGENT, INC., 800 East 8th St., New Albany, IN 47150, Tel: 812-945-0211, TWX: 810-540-4082; Empl.: 567; *Sls. Mgr.:* Terry Johnson; *Dist. Mgr.:* Vic Siccone ..... **C•1527-1530**

Local Distributors

MO	Maryland Heights, LComp	314-291-6200

ROBISON ELECTRONICS, P.O. Box 8121, San Luis Obispo, CA 93403-8121, Tel: 805-544-8000, FAX: 805-544-8091; FSC No.: 19080; Empl.: 45

ROCHESTER INSTRUMENT SYSTEMS, 255 N. Union St., Rochester, NY 14605, Tel: 716-263-7700, TELEX: 978457, TWX: 82971, FAX: 716-262-4777; Empl.: 330

ROCKLAND INSULATED WIRE & CABLE, 87 Broadway, Haverstraw, NY 10927, Tel: 914-429-3103, FAX: 914-947-1712; FSC No.: 12111

ROCKLAND SCIENTIFIC CORPORATION, 10 Volvo Dr., Rockland Indl. Pk., Rockleigh, NJ 07647, Tel: 201-767-7900, TWX: 710-991-9852; Empl.: 60; *Sls. Mgr.:* M. Schiavone

ROCKWELL FILTER PRODUCTS, 2990 Airway Ave., Costa Mesa, CA 92626, Tel: 714-641-5311, TELEX: 685532 (COLLINS CSMA), FAX: 714-641-5380; FSC No.: 2X491; Empl.: 75; *Sls. Mgr.:* Bob Johnson

ROCKWELL INT'L., 4311 Jamboree Rd., Newport Beach, CA 92660, Tel: 800-854-8099, TWX: 910-591-1654; FSC No.: 34576; Empl.: 1995; *Sls. Mgr.:* K. MacDonald; *Dist. Mgr.:* K. Foster

ROCKWELL INTERNATIONAL TELECOMMUNICATIONS, 1200 N. Alma Rd., Richardson, TX 75081, Tel: 214-996-5000, TELEX: 73-307, 73-2490, TWX: 910-867-4709; Empl.: 7,000; *Sls. Mgr.:* Phil Ritzmann

RODALE ELCTRNS. CORP., 603 Chestnut St., Garden City, NY 11530, Tel: 516-222-0050, TWX: 510-222-0274; *Sls. Mgr.:* John B. Clement

RODELCO ELECTRONICS CORP., 111 Haynes Ct., Ronkonkoma, NY 11779, Tel: 516-981-0900; Empl.: 44

ROD-L ELECTRONICS, INC.

FAX: 415-326-1993

ROD-L ELECTRONICS, INC., 1098 Hamilton Ct., Menlo Park, CA 94025, Tel: 415-322-0711, TWX: 296210; Empl.: 20; *Sls. Mgr.:* Tom Cooke ..... **D•1316-1317**

Local Sales Offices & Reps

CA	Menlo Park, ROD-L (factory)	415-322-0711
CO	Conifer, Energy Equip. Sls.	303-972-3335
IL	Elk Grove, Loren Green Assocs.	312-593-0282
IN	Indianapolis, Loren Green Assocs.	317-293-9827
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Cockeysville, Sci. Reps.	301-321-1411
MA	Reading, Scheinfein Assocs.	617-944-2304
MI	Detroit, Micro Sls	313-464-4520
MN	Minneapolis, Hei-Lite Sls	612-861-6051
MO	St. Louis, Midtec Assocs.	314-275-8666
NJ	Fairfield, Addem Sls.	201-882-0993
NJ	Pennsauken, Sci. Reps.	609-662-5222
NY	De Witt, DB Assocs.	315-446-0220
OH	Centerville, Micro Sls.	513-433-8171
OH	N. Olmsted, Micro Sls	216-734-3080
OK	Tulsa, Spectra Sls	918-663-7188
OR	Beaverton, Core II Mktg	503-641-0877
TX	El Paso, Venturesearch	915-594-4094
TX	Houston, Spectra Sls.	713-270-8212
TX	Richardson, Spectra Sls.	214-234-3600
VA	Fairfax, Sci. Reps.	703-385-0600
WA	Redmond, Core II Mktg	206-885-4344
WA	Spokane, Core II Mktg	509-922-2971
WV	Pittsburg, Micro Sls	412-471-0105
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

Local Distributors

CA	Menlo Park, Rod-L (Factory)	415-322-0711
Can	Ontario, Webster Instrs. Ltd.	416-625-0600

ROEAN INDUSTRIES, INC., 12970 Branford, Ste. C, Pacoima, CA 91331, Tel: 818-767-7047, TELEX: 758630, FAX: 818-768-4974; Empl.: 8

ROEDERSTEIN ELCTRNS., INC., P.O. Box 5588, Statesville, NC 28677, Tel: 704-872-8101, TELEX: 240802, TWX: 301-240802, FAX: 704-872-8023; *Sls. Mgr.:* Rick Price; *Dist. Mgr.:* Fred Fernandez

ROGAN, 3455 Woodhead Dr., Northbrook, IL 60062, Tel: 312-498-2300, 800-423-1543, FAX: 312-498-2334; FSC No.: 86797; Empl.: 100; *Sls. Mgr.:* D. Pelletier; *Dist. Mgr.:* D. Pelletier

ROGERS CORP., Bus Products Division, 5750 East McKellips Rd., Mesa, AZ 85205, Tel: 602-830-3370, FAX: 602-830-3370

ROGERS CORPORATION, Circuit Components Div., 2400 S. Roosevelt St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-967-9385

ROGERS CORPORATION, Circuit Materials Div., Box 4000, Chandler, AZ 85244, Tel: 602-963-4584, FAX: 602-732-9381

ROGERS CORPORATION, Flexible Interconnections Div., Box 700, Chandler, AZ 85244, Tel: 602-963-4584, TELEX: 140-223, TWX: 910-950-1961, FAX: 602-963-4584 (ext 521)

ROGERS CORPORATION, Microwave Materials Div., 100 S. Roosevelt Ave., Chandler, AZ 85244, Tel: 602-961-1382, FAX: 602-961-1302

ROGERS CORPORATION, Molding Materials Div., P.O. Box 550, Manchester, CT 06040, Tel: 203-646-5500, FAX: 203-646-5503

ROGERS CORPORATION, Soladyne Div., 7447 Convoy Ct., San Diego, CA 92111, Tel: 619-279-7872, FAX: 619-277-9105

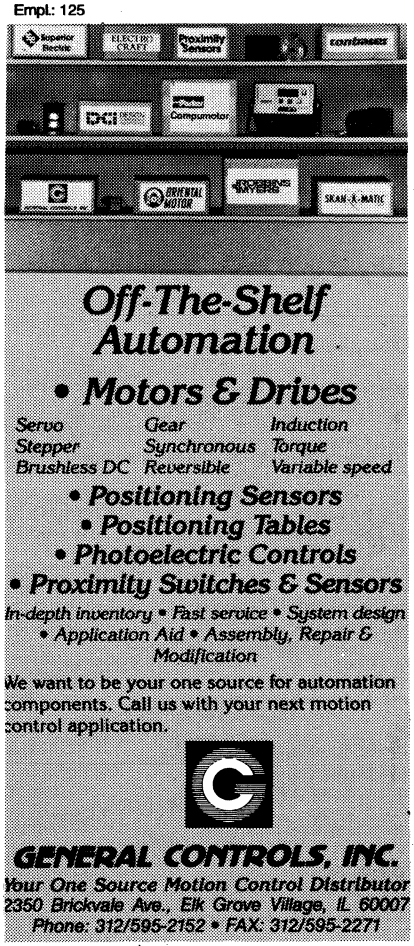
ROGERS CORPORATION, Special Products Div., 645 W. 24th St., Tempe, AZ 85282, Tel: 602-967-0624, FAX: 602-966-8851

ROGERS CORP., One Technology Dr., Rogers, CT 06263, Tel: 203-774-9605, TWX: 710-448-0047; Empl.: 2500; *Sls. Mgr.:* Paul L. Anderson

ROHDE & SCHWARZ, INC., 4425 Nicole Drive, Lanham, MD 20706, Tel: 301-459-8800, FAX: 301-459-2810; FSC No.: 82199; Empl.: 65; *Sls. Mgr.:* David R. Cook

ROHM CORP., 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721; Empl.: 125; *Sls. Mgr.:* Al Kirwan; *Dist. Mgr.:* Al Kirwan

ROHM CORPORATION, 8 Whatney, Irvine, CA 92718, Tel: 714-855-2131, TWX: 910-595-1721, FAX: 714-855-1669; Empl.: 125



ROLM SYSTEMS DIVISION, IBM Corp., 4900 Old Ironsides Dr., M/S 605, Santa Clara, CA 95054, Tel: 408-986-1000; Empl.: 4,100; *Dist. Mgr.:* Ken Batorski

ROLYN OPTICS CO., 706 Arrowgrand Circle, Covina, CA 91722-2199, Tel: 818-915-5707/5717, TELEX: 67-0380, FAX: 818-915-1379

ROSE ELECTRONIC, INC., Energy Products Group, 2461 Autumn Vale Dr., San Jose, CA 95131, Tel: 408-263-2934, FAX: 408-263-4263; Empl.: 13; *Sls. Mgr.:* Ted Williams; *Dist. Mgr.:* Ted Williams

ROSE ENCLOSURES SYS., INC., 12140 Parklawn Dr., Rockville, MD 20852, Tel: 301-984-1783, TELEX: 908-107 Resi Rove, FAX: 301-984-8670; FSC No.: 4Y520/C0242; Empl.: 35; *Sls. Mgr.:* Warren Hudacek ..... **C•1090**

Local Sales Offices & Reps

AL	Adamsville, South Rep	205-674-3056
CA	Irvine, Comp. Mktg.	714-951-5950
FL	Tampa, Florida Comp. Sls.	813-960-7044
GA	Atlanta, South Rep	404-262-6942
IL	Chicago, Paddock Mktg.	312-452-7852
IA	Cedar Rapids, Tech. Elctrns.	319-366-5443
NY	Rochester, J. G. Welch Assocs.	716-244-1100
NC	Kernersville, Heritage Sls.	919-996-4374
OH	Chagrin Falls, Pine Sls.	216-247-6198
PA	Frazer, ICI	215-889-0650
WA	Federal Way, K. R. Jensen Sls.	206-874-2772
WI	Milwaukee, Taylor Mktg.	414-332-1211

Local Distributors

Can	Vancouver, BC, Memco	604-590-1553

ROSEMOUNT CORP., Sensall/National Sonics, 250 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-6600, FAX: 516-273-6651; Empl.: 140; *Sls. Mgr.:* V. McCormack

ROSEMONT-NASHVILLE, INC., See Chromalox Instrs. & Controls

ROSS ENGINEERING CORP., 540 Westchester Dr., Campbell, CA 95008, Tel: 408-377-4621, TELEX: 858840, TWX: 910-590-8033; FSC No.: 23598; Empl.: 45; *Sls. Mgr.:* Hugh C. Ross ..... **B•1577**

ROTEK INSTRUMENT CORP., 390 Main St., Waltham, MA 02254, Tel: 617-899-4611, TELEX: 928034; FSC No.: 06678; *Sls. Mgr.:* Eliot Warner

ROTORQUE TECHNOLOGY CORP., 47915 Westinghouse Drive, Fremont, CA 94539, Tel: 415-659-1552, FAX: 415-659-1601; Empl.: 20; *Sls. Mgr.:* Beth Doolin

ROWE INDUSTRIES, INC., 6225 Benore Rd., P.O. Box 6877, Toledo, OH 43612, Tel: 419-729-9761, TWX: 810-442-1734; FSC No.: 82878; Empl.: 89; *Sls. Mgr.:* D. L. Mang; *Dist. Mgr.:* D. L. Mang ..... **C•1532-1534, 1905**

RTE AEROVOX INC., 740 Belleville Ave., New Bedford, MA 02745, Tel: 617-994-9661, TWX: 710-344-6985, FAX: 617-994-9635; FSC No.: 4K459; Empl.: 850; *Sls. Mgr.:* Jack Chmura; *Dist. Mgr.:* Bob Ritchie .... **A•1688-1690**

Local Sales Offices & Reps

AL	Huntsville, 20th Century Mktg.	205-533-9281
AZ	Scottsdale, Interstate Mktg.	602-244-9050
CA	Campbell, Luscombe Engrg. Co.	408-370-2020
CA	San Diego, Bestronics, Inc.	714-452-5500
CA	Woodland Hills, Interstate Mktg.	818-883-7606
CO	Littleton, M.R.C.	303-794-4684
CT	North Haven, J.E. Boeing Co.	203-239-5369
DE	Greenville, H. Anderson	302-655-2917
FL	Orlando, E.P.M. Corp.	305-425-6149
GA	Norcross, 20th Century Mktg.	404-446-1999
IL	Elk Grove Village, Carlson Elctrn. Sls.	312-956-8240
IN	Ft. Wayne, F. J. Campisano Co.	219-747-2633
IN	Indianapolis, F. J. Campisano Co.	317-253-7651
IA	Cedar Rapids, Carlson Elctrn. Sls.	319-377-6341
MD	Monkton, Imagitron Sls. Co.	301-374-5600
MA	Chelmsford, J. E. Boeing Co.	617-256-5800
MI	Farmington Hills, Carrier & Gable	313-477-8700
MN	Minneapolis, Comstrand	612-788-9234
MO	Grandview, Beneke & McCaul	816-765-2998
NM	Albuquerque, Hewitt & Assocs.	505-299-7746
NY	Ithaca, B. Dean	607-257-1111
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Wappingers Falls, Bob Dean	914-297-6406
NC	Matthews, R. G. Sls.	704-847-0049
OH	Cincinnati, F. J. Campisano Co.	513-574-7111
OH	Cleveland, F.J. Campisano Co.	216-749-5550
OH	Dayton, Schmidt & Assocs.	513-293-6652
OK	Tulsa, Ammon & Rizos Co.	918-663-8788
PA	Coraopolis, F.J. Campisano Co.	412-264-5151
TN	Knoxville, 20th Century Mktg., Inc.	615-966-2099
TX	Austin, Ammon & Rizos	512-454-5131
TX	Houston, Ammon & Rizos Co.	713-781-6240
TX	Richardson, Ammon & Rizos	214-644-5591
WI	Milwaukee, Carlson Elctrn. Sls.	414-476-2790
EXP	Santurce, PR, J. E. Boeing Co.	809-722-6942

Local Distributors

AL	Huntsville, Marshall Inds.	205-881-9235
AZ	Phoenix, Arizona Comps. Co.	602-269-5655
AZ	Phoenix, Elctrn. Supp.	602-276-1199
AZ	Phoenix, Future Elctrns.	602-968-7140
CA	Chatsworth, Future/Cetec	818-700-0914
CA	Chatsworth, Marshall Inds.	818-407-4150
CA	El Monte, Marshall Inds.	818-459-5590
CA	Hayward, Kea Elctrns.	415-887-2900
CA	Irvine, Future Elctrns.	714-250-4141
CA	Irvine, Integrated Elctrns. Corp.	714-837-9960
CA	Irvine, Marshall Inds.	714-458-5395
CA	Milpitas, Marshall Inds.	408-943-4600
CA	Milpitas, Projections Unltd., Inc.	408-748-9280
CA	Rancho Cordova, Marshall Inds.	916-635-9700
CA	Riverside, Elctrn. Supp. Co.	213-626-6795
CA	Sacramento, Integrated Elctrns. Corp.	916-424-5297
CA	San Diego, Elctrn. Supp. Co.	619-693-8222
CA	San Diego, Future/Cetec	619-278-5020
CA	San Diego, Marshall Inds.	619-578-9606
CA	San Diego, Projections Unltd., Inc.	619-453-7900
CA	San Jose, Elctrn. Supp. Co.	408-297-3726
CA	San Jose, Future/Cetec	408-434-1114
CA	San Jose, Integrated Elctrns. Corp.	408-435-1000
CA	Tustin, Projections Unltd., Inc.	714-544-2700
CA	Westlake Vl, Distel/JACO	805-495-9998
CO	Denver, Integrated Elctrns. Corp.	303-292-5537
CO	Thornton, Marshall Inds.	303-451-8383
CO	Westminster, Future Elctrns.	303-650-0123
CT	Bethel, Future Elctrns.	203-624-0105
CT	E. Haven, J-V Elctrns.	203-469-2321
CT	Meriden, JACO Elctrns.	203-235-1422
CT	Wallingford, Cronin Elctrns.	203-265-3134
CT	Wallingford, Marshall Inds.	203-265-3822
FL	Altamonte Springs, Future Elctrns.	305-767-8414
FL	Clearwater, Future Elctrns.	813-578-2770
FL	Ft. Lauderdale, Marshall Inds.	305-928-0661
FL	Ft. Lauderdale, NRC Elctrns.	305-772-4500
FL	Melbourne, GRS/Rome Elctrns.	305-242-8151
FL	Orlando, Marshall Inds.	305-841-1878
GA	Augusta, Dixie Elctrns.	404-722-2055
GA	Norcross, Future Elctrns.	404-441-7676
GA	Norcross, Marshall Inds.	404-923-5750
ID	Boise, Radar Elec. Co.	208-336-2227
IL	Hoffman Estates, Integrated Elctrns. Corp.	312-843-2040
IL	Mt. Prospect, Magnuson Elctrns.	312-956-0700
IL	Schaumberg, Future Elctrns.	312-882-1255
IL	Schaumberg, Marshall Inds.	312-490-0155
IL	Schaumburg, QPS Elctrns.	312-884-6620
IL	W. Chicago, PEI/Genesis	312-232-0394
IN	Indianapolis, Magnuson Elctrns.	317-247-5108
IN	Indianapolis, Marshall Inds.	317-297-0483
IN	Indianapolis, PEI/Genesis	317-637-5571
IN	South Bend, PEI/Genesis	219-287-2911
IA	Cedar Rapids, DEE Elctrns.	319-365-7551
KS	Lenexa, Marshall Inds.	913-492-3121
KS	Overland Pk., Franklin Elctrns. Co.	913-888-4982
MD	Baltimore, PEI/Genesis	301-529-2200
MD	Columbia, Future Elctrns.	301-995-1222
MD	Gaithersburg, Marshall Inds.	301-840-9450
MA	Burlington, TLC Comps. Corp.	617-273-0140
MA	Needham, Cronin Elctrns.	617-449-5000
MA	Westborough, Future Elctrns.	617-366-2400
MA	Wilmington, JACO Elctrns.	617-273-1860
MA	Wilmington, Marshall Inds.	617-658-0810
MI	Benton Harbor, PEI/Genesis	616-927-3519
MI	Livonia, Chelsea Inds./R.S. Elctrns.	313-525-1155
MI	Livonia, Future Elctrns.	313-261-5270
MI	Livonia, Marshall Inds.	313-525-5850
MN	Eden Prairie, Future Elctrns.	612-944-2200
MN	Plymouth, Marshall Inds.	612-559-2211
MO	Maryland Hgts., Chelsea Inds.	314-997-7709
MO	St. Louis, Franklin Elctrns.	314-993-5333
NH	Hudson, C & H Elctrns.	603-882-1133
NH	Manchester, Cronin Elctrns.	603-624-0105
NJ	Camden, GRS Elctrns.	609-964-8560
NJ	Camden, PEI/Genesis	609-541-4200
NJ	Clifton, J-Mar Elctrns.	201-772-6400
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NJ	Fairfield, Marshall Inds.	201-882-0320
NJ	Mt. Laurel, Future Elctrns.	609-778-7600
NJ	Mt. Laurel, Marshall Inds.	609-234-9100
NJ	Rutherford, JACO Elctrns.	201-942-4000
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NY	Hauppauge, JACO Elctrns.	516-273-5500
NY	Hauppauge, LI., Marshall Inds.	516-273-2424
NY	Johnson City, Marshall Inds.	607-798-1611
NY	Liverpool, Future Elctrns.	315-451-2371
NY	Rochester, Future Elctrns.	716-272-1120
NY	Rochester, Marshall Inds.	716-235-7620
NY	Rome, Rome Elctrns.	315-337-5400
NC	Charlotte, Dixie Elctrns.	704-377-4348
NC	Raleigh, Marshall Inds.	919-878-9882
NC	Winston-Salem, Dixie Elctrns.	919-724-5961
OH	Akron, AESCO	216-762-8818
OH	Columbus, AESCO	614-882-6762
OH	Dayton, Marshall Inds.	513-236-8088
OH	Solon, Marshall Inds.	216-248-1788
OR	Beaverton, Future Elctrns.	503-645-9454
OR	Beaverton, Integrated Elctrns. Corp.	503-641-1690
OR	Beaverton, Marshall Inds.	503-643-5555
OR	Portland, Radar Elec. Co.	503-232-3404
PA	Cornwell Hgts., PEI/Genesis	215-673-0400
PA	McKean, Advacom, Inc.	814-476-7774
PA	Pittsburgh, Marshall Inds.	412-963-0441
SC	Columbia, Dixie Elctrns.	803-779-5332
SC	Greenville, Dixie Elctrns.	803-297-1435
TN	Gray, Dixie Elctrns.	615-477-3838
TN	Knoxville, Dixie Elctrns.	615-938-4131
TX	Austin, Marshall Inds.	512-837-1991
TX	Carrollton, Marshall Inds.	214-770-0616
TX	El Paso, Marshall Inds.	915-593-0706
TX	Houston, Marshall Elctrns.	713-895-9200
TX	Richardson, JACO Elctrns.	214-235-9575
UT	N. Salt Lake City, Integrated Elctrns. Corp.	801-298-1869
UT	Salt Lake City, Future Elctrns.	801-972-8489
UT	Salt Lake City, Marshall Inds.	801-485-1551
WA	Bellevue, Integrated Elctrns. Corp.	206-455-2727
WA	Bellevue, Marshall Inds.	206-641-6800
WA	Redmond, Future Elctrns.	206-881-8199
WA	Richland, Radar Elec. Co.	509-943-8336
WA	Seattle, Radar Elec. Co.	206-282-2511
WA	Spokane, Radar Elec. Co.	509-747-3053
WI	Brookfield, Marshall Inds.	414-797-8400
WI	Milwaukee, Marsh Elctrns.	414-475-6000
Can	Calgary, Alberta, Future Elctrns.	403-235-5325
Can	Downsville, Ont., Future Elctrns.	416-638-4771
Can	Edmonton, Alberta, Future Elctrns.	403-438-2858
Can	Ottawa, Ont., Future Elctrns.	613-820-8313
Can	Pointe Claire, Que., Future Elctrns.	514-694-7710
Can	Scarborough, Ont., Carsten Elctrns.	416-495-9999
Can	St. Fox, Que., Future Elctrns.	418-682-8092
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Can	Winnipeg, Manitoba, Future Elctrns.	204-786-7711

RTE DELTEC CORP., 2727 Kurtz St., San Diego, CA 92110, Tel: 619-291-4211, 800-854-2658, TELEX: 910-335-1241; FSC No.: 52297; Empl.: 200; *Sls. Mgr.:* Jeff Frank

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FAX: 619-291-2584

RTE POWER/MATE, 2727 Kurtz St., San Diego, CA 92110, Tel: 800-843-8544, 619-299-3800, TWX: 910-335-1241; Empl.: 175 ..... **D•1958-1959**

RTRON CORP., 7324 Lawndale, Skokie, IL 60076, Tel: 312-679-7180, TWX: 910-223-0810; FSC No.: 19130; *Sls. Mgr.:* R. McLean

RTS Systems

FAX: 818-843-7953

RTS SYSTEMS, INC., 1100 W. Chestnut St., Burbank, CA 91506, Tel: 818-840-7119, TELEX: 194855; Empl.: 75; *Sls. Mgr.:* Shelley Brown Harrison; *Dist. Mgr.:* Shelley Brown Harrison ..... **B•1026; D•1074-1075**

RUSH ENTERPRISES INC., 20 Hampshire Drive, Hudson, NH 03051, Tel: 603-886-9460; Empl.: 10; *Sls. Mgr.:* Richard Mulcahy

RUSH/HOUSTON, INC., 600 Kealrick, Ste C-40, Houston, TX 77060, Tel: 713-682-5151; *Sls. Mgr.:* Fred Murphy

RUSSTECH ENGINEERING COMPANY, INC., 23322 (D) Madero Road, Mission Viejo, CA 92691, Tel: 714-472-0880

RUSTRAK INSTRUMENTS, Mark IV Company, Rte. 2 & Middle Rd., E. Greenwich, RI 02818, Tel: 401-884-6800, 800-332-3202, TWX: 710-387-1500; Empl.: 250; *Sls. Mgr.:* John Olobri; *Dist. Mgr.:* John Olobri

RUTHERFORD RESEARCH, Box 249, Rutherford, NJ 07070, Tel: 201-933-2091; Empl.: 4; *Sls. Mgr.:* Dr. A. Blanck; *Dist. Mgr.:* Dr. A. Blanck

RVS ELECTRONICS, INC., 40 North St., Middletown, NY 10940, Tel: 914-342-3199, TELEX: 820778; Empl.: 15

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S A B NIFE, INC., Div. of Sonesson, P. O. Box 100, George Washington Hwy., Lincoln, RI 02865, Tel: 401-333-1170, 800-556-6764, TELEX: 92-9407; Empl.: 150; *Sls. Mgr.:* Alan Feo; *Dist. Mgr.:* Alan Feo

SABRE COMMUNICATIONS CORP., 3400 Hwy 75 N, P.O. Box 536, Sioux City, IA 51102, Tel: 712-258-6690, FAX: 712-258-8250; FSC No.: 60348; *Sls. Mgr.:* Jerry W. Audus; *Dist. Mgr.:* Richard Krone

SABRITEC, 1733 Kaiser Ave., Irvine, CA 92714, Tel: 714-660-1970, TELEX: 678401, FAX: 714-660-9136; FSC No.: 58795; Empl.: 35

SAFE POWER SYSTEMS, 528 W. 21st St., Tempe, AZ 85023, Tel: 602-894-6864

SAFE POWER SYSTEMS, Acme Electric Corporation, 528 W. 21st St., Tempe, AZ 85282, Tel: 602-894-6864, FAX: 602-921-0470; *Sls. Mgr.:* Rod Pullen; *Dist. Mgr.:* Jim Heidenreich

SAFT AMERICA INC., Box 1886, Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547620, TWX: 810-786-5866 ..... **D•1428, 1483-1490**

SAFT AMERICA INC., 107 Beaver Ct., Cockeysville, MD 21030, Tel: 301-771-3200, TWX: 710-862-2637 ..... **D•1428, 1483-1490**

Local Sales Offices & Reps

CA	Chatsworth, Mike Murphy, Zone Mgr.	818-998-0626
CA	Grenada Hills, Don Sandler	818-360-1853
CA	Redwood City, John Marciano	415-365-4539
FL	Boca Raton, Vince Malkiewicz	305-395-1535, 800-328-5049
GA	Marietta, Doug Thompson, Zone Mgr.	404-992-6950
IL	Carol Stream, Tom Roberts	312-690-8035
IL	Oak Forest, Dan Misheck, Zone Mgr.	312-687-6690
MA	W. Hanover, Chuck Dare	617-871-0204
MN	Maplewood, George Petrich	612-770-0082
OH	Brownsville, Roy Edgar	216-861-1877
PA	Bensalem, Milton Batley	215-831-9520

Local Distributors

AZ	Tempe, Anjon Entprs.	602-894-1332
CA	Chatsworth, Mil-Com Dist. Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, CH & M Entprs.	818-980-7358
CA	San Rafael, Elctms. Plus	415-457-0466
CO	Englewood, Indl. Elctms.	303-694-9444
FL	Altamonte Springs, TNR Tech., Inc.	800-346-0601
FL	Ft. Lauderdale, P.A. Intl.	305-566-5799
FL	Hialeah, Pro Battery Specialists	305-944-8800
GA	Decatur, ELS Prods.	800-521-2903,800-334-5066
IL	Downers Grove, Telecomm. Dvcs. (TDI)	800-323-7307,312-971-3460
IL	Rosemont, Advent Elctms.	312-297-6200
IN	Indianapolis, Advent Elctms.	317-872-4910
IA	Cedar Rapids, Advent Elctms.	319-363-0221
MA	Billerica, A. W. Mayer	617-229-2255
MA	Danvers, Generation Elctms.	617-777-4866
MA	Middleboro, Glynn Elctms.	617-947-4262
MI	Farmington Hills, Advent Elctms.	313-477-1650
MN	Minneapolis, D.C. Battery Prods, Inc.	612-721-8547
NM	Albuquerque, Alliance Elctms.	505-292-3360
NY	Deer Pk., TNR Tech., Inc.	516-242-4800
NY	Rochester, Masline Elctms.	716-546-5373
NC	Charlotte, Electro Sys., Inc.	704-525-2421
OH	Cincinnati, Schuster Elctms.	216-425-8134
PA	Bensalem, Avex Elctms.	215-638-3300
TN	Mt. Juliet, Batteries Unltd.	615-754-8179
TX	Houston, K-Tec (Kent) Elctms.	713-780-7770
TX	Spring, Battery Pak, Inc.	713-367-9393, 1-800-245-1138
UT	Salt Lake City, Standard Supp. Co.	801-486-3371
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls. (N.)	206-883-2343

SAFT AMERICA, INC., Portable Battery Division, 711 Industrial Blvd., Valdosta, GA 31601, Tel: 912-247-2331, TELEX: 547-620; Empl.: 1200; *Sls. Mgr.:* R. Bartmes ..... **D•1428, 1483-1490**

Local Sales Offices & Reps

CA	Chatsworth, SAFT America, Inc.	818-998-0626
CA	Granada Hills, SAFT America, Inc.	818-360-1853
CA	Redwood City, SAFT America Inc.	415-365-4539
FL	Boca Raton, SAFT America, Inc.	305-338-7730
GA	Marietta, SAFT America, Inc.	404-992-6950
IL	Carol Stream, SAFT America, Inc.	312-690-8035
IL	Oak Forest, SAFT America, Inc.	312-687-6690
MA	Hanover, SAFT America, Inc.	617-871-0204
MN	Minneapolis, SAFT America, Inc.	612-770-0082
OH	Columbus, SAFT America, Inc.	216-861-1877
PA	Philadelphia, SAFT America, Inc.	215-831-9520

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CA	Carlsbad, Energy Concepts	619-942-3144
CA	Chatsworth, Mill Comm. Distrs., Inc.	818-998-3111
CA	Mountain View, Energy Sls.	415-969-0800
CA	N. Hollywood, C.H. & M	818-980-7358
CA	San Rafael, Elctms. Plus	415-457-0466
CO	Englewood, Industrial Elctms.	303-694-9444
FL	Altamonte Springs, TNR Tech.	800-346-0601
FL	Hialeah, Pro Battery	305-944-8800
GA	Decatur, ELS Prods.	404-981-2288
IL	Downers Grove, Jabro Batteries	312-964-9358
IL	Downers Grove, Telecomms. Dvcs., Inc.	800-323-7307
MA	Billerica, A. W. Mayer Co., Inc.	800-225-6600
MA	Middleboro, Glynn Elctms.	617-947-4262
MI	Livonia, R. S. Elctms.	313-525-1155
MI	Livonia, Vidcom	313-261-9444
MN	Minneapolis, D. C. Battery Prods. Inc,	612-721-8547
NM	Albuquerque, Alliance Elctms., Inc.	505-292-3360
NY	Deer Park, TNR Tech., Inc.	516-242-4800
NY	Flushing, W & W Assocs.	718-961-2103
NC	Charlotte, Electro Sys., Inc.	704-525-2421
PA	Bensalem, Avex Elctms. Corp.	800-345-1295
TN	Mt. Juliet, Batteries Unlimited	615-754-8179
TX	Houston, Kent Elctms.	713-780-7770
TX	Richardson, Kent Elctms.	214-669-2600
TX	Spring, Battery Pk.	713-367-9393
UT	Salt Lake City, Standard Supp. Co.	800-453-7036
VA	Falls Church, Perrott Engrg. Labs, Inc.	703-532-0700
WA	Redmond, Energy Sls.	206-883-2343

SAGE LABORATORIES, INC., 11 Huron Dr., Natick, MA 01760, Tel: 617-653-0844, TWX: 710-346-0390, FAX: 617-653-5671; FSC No.: 07180; *Sls. Mgr.:* Tony Cieri

SAIA

FAX: 219-262-8819

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SAMARIUS PRECISION INSTRUMENTS, INC., 300 Seymour Ave., P.O. Box 377, Derby, CT 06418, Tel: 203-735-7405, TWX: 710-451-2495; FSC No.: 18065; Empl.: 90

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CA Anaheim, Westrep 213-404-3881
CA Campbell, Kottmeier 408-371-8700
CA Fallbrook, Gary Chilcote Assocs. 619-728-7678
CO Boulder, Front Range Mktg. 303-443-4780
FL Coral Springs, Hal Elec. 305-752-7520
IL Lisle, W.G. Controls 312-963-5954
IN Indianapolis, Needler Sls. 317-255-8056
KS Parker, S. W. Wollard 913-898-6552
MD Gaithersburg, Naudain Assocs. 301-258-5040
MN Shorewood, Frank Anthony Mktg. 612-474-2850
MO St. Louis, S. W. Wollard/Saunders 314-576-4650
NM Albuquerque, C. T. Carlberg & Assocs. 505-888-3883
NY Great Neck, CBA Tylinski Assocs. 516-466-9070
NY Rochester, J. G. Welch 716-244-1100
NC Raleigh, B. T. Funderburk 919-846-2373
NC Raleigh, Century Elec. 919-782-2116
OH Medina, J. C. Hofstetter 216-241-4880
PA Huntington Valley, Inacker Sls. 215-947-5660
RI Warwick, Schumacher & Yarrington ... 401-884-5671
TX Plano, High Tech Sls. 214-612-0216
UT Midvale, Front Range Mktg. 801-566-2500
WA Redmond, Quadra Sls. 206-883-3550
WI Mequon, Badgerep 414-241-9200
PR Caguas, K. D. Tronics 809-746-0275
Can Oakville, Ont., Haltronics 416-844-2121

Local Distributors

AL Birmingham, Forbes 205-251-4104
AL Huntsville, Forbes 205-837-1579
AZ Phoenix, Force Elec. 602-437-1060
CA Buena Pk., Cypress 714-521-5230
CA Chatsworth, Milcomm 818-998-3111
CA San Diego, Cypress 619-292-5613
CA San Diego, Southland 619-578-6634
CA Santa Clara, Cypress 408-980-2500
CA Sunnyvale, Abacus 408-732-2000
CO Englewood, Indl. Elec., Inc. 303-694-9444
CO Wheat Ridge, Cypress 303-431-2622
CT East Haven, J.V. Elec. 203-469-2321
CT Yatesville, Schaal, Inc. 203-269-3779
FL Winter Pk., Deanco 305-671-5100
GA Marietta, Deanco 404-429-0126
IL Addison, Belford Elec. 312-691-1100
IN Carmel, Altex 317-848-1323
MD Gaithersburg, Deanco 301-948-5444
MD Middletown, Current Comps. 301-473-5333
MA Burlington, Schaal, Inc. 617-272-1506
MA Canton, Impact Sls. 617-821-1500
MI Grand Rapids, Calder Elctrns. 616-698-7400
MN Hibbing, Minn Tech 218-262-5228
MN New Brighton, Parts 1 612-633-8079
MO Kansas City, Elec. Supp. 816-931-0250
MO St. Louis, Franklin Elec. 314-993-5333
NJ Fairfield, Deanco 201-575-7960
NM Albuquerque, Walker Elec. 505-883-2992
NY Hauppauge, Broadline Elec. 516-231-4100
NY Ithaca, Deanco 607-257-4444
NC Raleigh, Century Elec. 919-782-2116
NC Raleigh, Deanco 919-851-2065
NC Winston-Salem, Kirkman Elec. 919-722-9131
OH Cincinnati, Schuster 513-489-1400
OH Twinsburg, Schuster Elec. 216-425-8134
OR Tualatin, Moore 503-692-5333
PA McKean, Advacom 814-476-7774
PA Norristown, Century Elec. 215-631-5400
TX Dallas, Cypress 214-869-1435
TX Stafford, Southwest 713-240-4000
VA Virginia Bch., Deanco 804-499-3322
WA Redmond, Priebe Elec. 206-881-2363
WI Milwaukee, Marsh 414-475-6000
Can Montreal, Que., Ferro Technique Ltd. .. 514-341-3450
Can Scarborough, Ont., Carsten Elctrns. Ltd. 416-495-7705
Can Surrey, BC, Memco 604-590-1553

S & EI MANUFACTURING, Box 832, Northridge, CA 91324, Tel: 818-349-4111, TWX: 910-493-1252; FSC No.: 24152; Empl.: 65

SANDERS ASSOCIATES, INC., ECBD, A Lockheed Company, 955 Perimeter Rd., Manchester, NH 03108-8500, Tel: 603-645-5548, TWX: 710-220-1845; FSC No.: 31637; Empl.: 760; *Sls. Mgr.:* James Korcuba; *Dist. Mgr.:* James Korcuba

SANDERS ASSOCIATES, INC., A Lockheed Company, EMC Dept., 95 Canal St., Nashua, NH 03061-2004, Tel: 603-885-3602, TELEX: 94-3430, TWX: 710-228-1894, FAX: 603-885-2066; FSC No.: 94117; *Sls. Mgr.:* (EMC) R. Bossart

SANDERS ASSOCIATES, INC., MICROWAVE, 955 Perimeter Rd., Manchester, NH 03108, Tel: 603-645-6000 Ext. 4299, TELEX: 710-220-1845; Empl.: 760; *Sls. Mgr.:* James C. Korcuba

S & H INDUSTRIES, INC.

FAX: 215-822-3417

S & H INDS., 2257 North Penn Rd., Hatfield, PA 19440, Tel: 215-822-7211; Empl.: 50; *Sls. Mgr.:* Frank Picciano ..... **D•1960, 2150**

SAN FERNANDO ELEC. MFG., SFE Technlg.

SANFORD-MILLER CORP., 8 John St., Lynbrook, NY 11563, Tel: 516-593-2025, 800-645-5900; Empl.: 10

SAN FRANCISCO CUSTOM LABEL, 999 Blandford Blvd., Redwood City, CA 94062, Tel: 415-573-6365; Empl.: 27; *Sls. Mgr.:* D. R. Zamzow

SANKEN ELECTRIC CO., LTD., Overseas Operations, 1-22-8 Nishi-Ikebukuro, Toshima-ku, Tokyo, Japan 171, Tel: 03-986-6164, TELEX: 272-2323 SANKEN J; FSC No.: 03-986-8637; Empl.: 4,830; *Sls. Mgr.:* K. Imaizumi; *Dist. Mgr.:* Kerry Ochiai

SAN-O INDUSTRIAL CORP., 85 Orville Dr., Bohemia, NY 11716, Tel: 516-567-5556, TWX: 510-228-7701, FAX: 516-567-5128; Empl.: 50; *Sls. Mgr.:* S. Terry/P. Wernick/A. Konon

SANTA BARBARA RESCH. CTR., 75 Coromar Dr., Goleta, CA 93117, Tel: 805-968-3511, TELEX: 910-334-1885, TWX: Hacsbar; Empl.: 2025; *Sls. Mgr.:* D.K. Smith

SANTA FE TEXTILES, Barcel Wire & Cable, 3151 W. Adams St., Santa Ana, CA 92704-5863, Tel: 714-751-7733, TELEX: 910-595-1959; FSC No.: 31415; Empl.: 20; *Sls. Mgr.:* Mike Ross

SANYO

SANYO ENERGY CORPORATION

FAX: 619-690-2122

SANYO ENERGY CORP., 1201 Sanyo Ave., San Diego, CA 92073, Tel: 619-690-6620; Empl.: 500; *Sls. Mgr.:* Joseph A. Carcone ..... **D•1491**

Local Sales Offices & Reps

CA San Diego, Sanyo Energy 619-690-6620
CO Denver, West Inc. 303-477-8180
FL Gainesville, Sanyo Energy 904-376-6711
IL Bensonville, Sanyo Elec., Inc. 312-595-5600
MN Edina, Hanna-Lind Ltd. 612-925-5700
NJ Little Ferry, Sanyo Energy 201-641-2333
TX Austin, Swearingen Sls. 512-339-8663
UT Centerville, West Inc. 801-295-5544
UT Salt Lake City, Stand. Supp. 801-486-3371

Local Distributors

CA Long Bch., Battery Specialists 213-437-1809
CA San Jose, Powell Elctrns. 408-943-9020
CO Denver, Car-Go Battery Co. 303-296-8763
MA Stoughton, Adcour 617-784-8123
NJ Clifton, Engrd. Assemblies 201-340-0600
NC Raleigh, Engrd. Assemblies 919-790-9700
NC Winston-Salem, Progressive Technlgs. 919-761-1375
OR Aloha, Elctrn. Concepts 503-642-9715
PA Philadelphia, Powell Elctrns. 215-365-1900
TX Houston, Kent Elctrns. 713-780-7770
WA Seattle, Rep West 206-283-8351

SANYO SEMICONDUCTOR CORP., 7 Pearl Ct., Allendale, NJ 07401, Tel: 201-825-8080, TELEX: 135138 SANYOSEMI ALNJ; Empl.: 22; *Sls. Mgr.:* Koichi Takahashi; *Dist. Mgr.:* Aki Goto

SAPHIKON, INC., 51 Powers St., Milford, NH 03055, Tel: 603-673-5831, TELEX: 95-3067, FAX: 603-673-1256; Empl.: 32; *Sls. Mgr.:* Paul Sullivan

SARONIX, 4010 Transport at San Antonio, Palo Alto, CA 94303, Tel: 415-856-6900, TELEX: 348465, FAX: 415-856-4732; FSC No.: 61441; Empl.: 32; *Sls. Mgr.:* Dean Ransom; *Dist. Mgr.:* Dean Ransom ..... **A•1458-1462**

Local Sales Offices & Reps

AL Huntsville, Electramark, Inc. 205-883-9948
CA Fallbrook, Gary Chilcote Assocs. 619-728-7678
CA Irvine, Saronix 714-955-1220
CO Denver, Lindberg Co. 303-758-9033
FL Altamonte Springs, Sls. Engrg. Concepts 305-682-4800
FL Deerfield Beach, Sls. Engrg. Concepts 305-426-4601
FL St. Petersburg, Sls. Engrg. Concepts Inc. 813-823-6221
GA Norcross, Electramark, Inc. 404-446-7915
GA Snellville, J & B Sls., Inc. 404-985-1940
IL Elk Grove Vl., Parcom, Inc. 312-228-6360
IN Kokomo, Schillinger Assocs., Inc. 317-455-2708
KS Kansas City, BC Elctrn. Sls., Inc. 913-342-1211
KS Wichita, BC Elctrn. Sls., Inc. 316-722-0104
MA Hingham, Northeast Reps., Inc. 617-749-8700
MI Jenisen, R. C. Nordstrom & Co. 616-457-5762
MI Southfield, R. C. Nordstrom & Co. 313-559-7373
MO St. Louis, BC Elctrn. Sls. 314-521-6683
NV Reno, Galena Technlg. Grp. 702-786-5030
NJ Cherry Hill, Trinkle Sls. 609-795-4200
NJ Englewood, Harold Gray Assocs. 201-894-0894
NM Albuquerque, Lindberg Co. 505-881-1006
NC Raleigh, J & B Sls. 919-783-9440
OH Dayton, J. C. Hofstetter 513-296-1010
OH Medina, J. C. Hofstetter 216-241-4880
OK Tulsa, Logic 1 918-494-0765
OR Beaverton, William J. Purdy Co. 503-641-9373
TX Austin, Logic 1 Sls. 512-459-1297
TX Richardson, Logic 1 Sls. 214-234-0765
UT Salt Lake City, Lindberg Co. 801-277-2643
WA Redmond, William J. Purdy Co. 206-882-3144
EXP CA, Palo Alto, SaRonix 415-856-6900
Can Rexdale, Ont., Bestec Elctrns. 416-674-1330

Local Distributors

CA Anaheim, Deco Elctrns. 714-630-8252
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA Manhattan Beach, Prime Electro Prods. 213-379-3642
CA San Diego, Deco Elctrns. 619-693-1595
CA San Diego, Southland Comps. 619-578-6630
CA Sherman Oaks, Delay Line Dists., Inc. 818-986-9455
CA Sunnyvale, Target Elctrns. 408-734-5611
CO Englewood, Indl. Elctrns. 303-694-9444
IL Palantine, Technlg. Sls. Inc. 312-991-6600
IN Indianapolis, MAR Elctrns., Inc. 317-633-6699
KS Overaland Pk., Chelsea Inds. 913-362-1923
MD Columbia, Aztech Elctrns., Inc. 301-995-6800
MI Livonia, Chelsea Elctrns./RS 313-525-1155
MO Maryland Hgts., Chelsea Elctrns./Olive 314-426-4500
NH Atkinson, Astrum Elctrns., Inc. 603-898-3399
NJ Camden, General Radio Supp. Co. 609-964-8383
NJ Whippany, ADI 201-428-0510
NY Hauppauge, Chelsea Elctrns./Fairmont 516-231-3313
NY Mt. Vernon, QAR 914-699-2224
NY Stonybrook, Dove Elctrn. Comps. 516-689-7733
NC Raleigh, Sager/Service Plus 919-850-9550
OR Portland, Radar Elec. Co. 503-232-3404
PA McKean, Advacom, Inc. 814-476-7774
TX Richardson, Ewing Elctrns., Inc. 214-231-6725
UT Salt Lake City, Standard Supp. 801-486-3371
WA Seattle, Radar Elec. Co. 206-282-2511
WI Milwaukee, Technlg. Sls. Inc. 414-786-5015
Can Downsview, Ont., Westburne Elctrns. 416-635-2980

SAVOY ELECTRONICS, P.O. Box 5727, Ft. Lauderdale, FL 33310, Tel: 305-563-1333, 800-327-1282, FAX: 305-563-1378; FSC No.: 13075; Empl.: 50; *Sls. Mgr.:* J. Marlowe

SAWTEK INC., P.O. Box 609501, Orlando, FL 32860-9501, Tel: 407-886-8860, TELEX: 514083, TWX: 810-862-0835; FSC No.: 58068; Empl.: 150 ..... **A•1463**

Local Sales Offices & Reps

AL Huntsville, L & D, Inc. 205-837-1469
AZ Scottsdale, Faser Tech. Sls. 602-948-4404
CA Los Altos, Cain-White & Co. 415-948-6533
CA Van Nuys, R-L Assocs. 818-782-7826
FL Maitland, D. J. Ellis & Assocs. 305-645-1101
GA Atlanta, L & D 404-395-7079
IL Elk Grove Vl., Oasis Sls. Corp. 312-640-1850
IN Ft. Wayne, J & B Engrg. Sls. Co. 219-483-2813
KS Overland Park, Barnes-Midwest Sls. .. 913-469-9688
MD Burtonsville, Eastern Instr. Corp. 301-384-8500
NH Merrimack, John Callahan Assoc., Inc. 603-424-5700
NJ Clarksburg, Micro-Lambda 609-259-0400
NY Buffalo, Quality Comps. 716-837-5430
NY Manlius, Quality Comps. 315-682-8885
NY New Rochelle, Robert Diamond, Inc. .. 914-632-2828
NC Greensboro, L & D Inc. 919-292-3201

NC Raleigh, L & D Inc. 919-876-5301
TX Richardson, Vector Sls. 214-234-4291
WA Bellevue, Cain-White & Co. 206-462-2118
WI Brookfield, Oasis Sls. Corp. 414-782-6660

SAXTON WIRE AND CABLE, 215 N. Rte. 303, Congers, NY 10920, Tel: 914-268-6848, 800-431-2774, 800-872-9866, FAX: 914-268-7542; FSC No.: 16164; Empl.: 75; *Sls. Mgr.:* Bill Cullen

SAYLOR ELECTRONICS INT'L, INC., 1824 Calash Dr., Carson City, NV 89701, Tel: 702-883-4184; Empl.: 4

ZERO SCANBE
UNIT OF ZERO CORPORATION

FAX: 818-444-3953

SCANBE, Unit of Zero Corporation, 3445 Fletcher Ave., El Monte, CA 91731, Tel: 818-579-2300, TWX: 910-587-3437; Empl.: 125; *Sls. Mgr.:* Frank Cooper/Gary Smith; *Dist. Mgr.:* Annamrie Trunco ..... **C•1091**

Local Sales Offices & Reps

AZ Phoenix, Holder Hauer 602-242-4025
CA Concord, Qualtech North 415-680-1800
CA Corona, Assocd. Rep Network 714-371-6280
CA Orange, Qualtech South 714-639-9820
CA San Diego, Mesa Engrg. 619-278-8021
CA Sunnyvale, Qualtech North 408-732-4800
CA Thousand Oaks, Qualtech South 805-495-7100
CO Denver, Holder Hauer 303-427-3443
CT Stamford, Tech Applications Assocs. .. 203-327-2934
FL Casselberry, Dyne-A-Mark 407-629-5557
FL Clearwater, Dyne-A-Mark 813-441-4702
FL Ft. Lauderdale, Dyne-A-Mark 305-771-6501
GA Norcross, Mtn. Electro Prods., Inc. 404-448-5594
IL Elk Grove Village, Control Sls. 312-595-2110
KS Lenexa, Midtec 913-541-0505
MD Rockville, Spectro 301-294-9770
MA Westborough, Tech. Applications Assocs. 617-366-9781
MI Grosse Pt. Pk., Greiner Assocs. 313-499-0188
MN Edina, Micro Resources 612-830-1454
MO St. Louis, Midtec 314-275-8666
NJ Springfield, Gebhardt Mktg. 201-376-4415
NM Albuquerque, Neico Electronix 505-293-1399
NM Albuquerque, S & S Technlgs. 505-255-5599
NC Wake Forest, Mtn. Electro Prods. 919-556-7103
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OK Stillwater, Acudata 405-743-1886
OR Beaverton, Thorson Co. 503-644-5900
PA Allison Pk., Monument Tech. 412-487-1770
PA Jenkintown, Monument Tech. 215-884-3737
TX Austin, Acudata 512-478-1018
TX Houston, Acudata 713-580-2451
TX Plano, Acudata 214-424-3567
UT Salt Lake City, Holder Hauer 801-532-2111
WA Bellevue, Thorson Co. 206-455-9180
WA Lynnwood, Blair Hirsh Co., Inc. 206-774-8151
WI Thiensville, Control Sys. 414-242-4580

Local Distributors

AZ Phoenix, Cetec 602-272-7951
CA Fountain Valley, Comps. Ctr. 714-979-0433
CA San Jose, Rose Elctrns. 408-263-9700
CA South Gate, Cetec 213-773-6521
CO Englewood, Hall-Mark 303-790-1662
CT Bethel, Heilind Elctrns. 203-797-8600
CT East Haven, J.V. Elctrns. 203-469-2321
FL Orlando, Hall-Mark Elctrns. 305-855-4020
FL Pompano Bch., Hall-Mark Elctrns. 305-971-9280
IL Wooddland, Hall-Mark Elctrns. 312-860-3800
IN Indianapolis, Advent Elctrns. 317-872-4910
KS Lenexa, Hall-Mark Elctrns. 913-888-4747
MD Columbia, Hall-Mark Elctrns. 301-988-9800
MD Jessup, Treeko Sls. 301-470-3300
MA Newton, Greene-Shaw 617-969-8900
MA Wilmington, Heilind Elctrns. 617-657-4870
MI Livonia, R.S. Elctrns. 313-525-1155
MN Eden Prairie, Hall-Mark Elctrns. 612-941-2600
MN Minneapolis, Indl. Comps. 612-831-2666
MO Earth City, Hall-Mark Elctrns. 314-291-5350
MO St. Louis, Olive Elctrns. 314-426-4500
NJ Cranford, Garden State Elctrns. 201-272-6400
NM Albuquerque, International Elctrns. 505-345-8127
NY Bohemia, Car-Lac Elctrns. 516-567-4200
NY Buffalo, Summit Elctrns. 716-887-2800
NY Lynbrook, Peerless Radio 516-593-2121
NY Rochester, Summit Elctrns. 716-334-8110
NC Raleigh, Hall-Mark Elctrns. 919-872-0712
OH Solon, Hall-Mark Elctrns. 216-349-4632
OR Beaverton, Rose Elec. Distr. Co. 503-629-9288
PA Essington, Tri-Com 215-521-3080
TX Austin, Hall-Mark Elctrns. 512-258-8848
TX Dallas, Hall-Mark Elctrns. 214-553-4300
TX Dallas, International Elctrns. 214-233-9323
TX Houston, Hall-Mark Elctrns. 713-781-6100
WA Seattle, R.V. Weatherford 206-575-1340
WI Milwaukee, Marsh Elctrns. 414-475-6000

SCANNING DEVICES, INC., 108 Elm St., Waltham, MA 02154, Tel: 617-891-8991; Empl.: 12; *Sls. Mgr.:* David Chanoux

SCHAEVITZ ENGINEERING, U.S. 130, Union Ave., Pennsauken, NJ 08110, Tel: 609-662-8000, TWX: 710-892-0714; FSC No.: 93190; Empl.: 325; *Sls. Mgr.:* Charles Gaver

SCHAFFNER EMC, INC., Components Division, 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, 800-367-5566, TELEX: 685-3444, FAX: 201-467-1330; *Sls. Mgr.:* Ken Schnitzer ..... **A•1691**

Local Sales Offices & Reps

AL Huntsville, Elctrn. Mfrs. Agts. 205-830-4030
AZ Tucson, Clemick & Assocs. 602-744-4003
CA Los Angeles, Universal Comps. 213-641-4255
CA Palo Alto, Mollard Mktg. 415-961-0456
CO Denver, Delltron Co. 303-373-0300
FL Orlando, Honey Co. 305-299-1000
GA Roswell, Elctrn. Mfrs. Agt. 404-992-7240
IL Highland Pk., Bransky Sls. 312-433-2375
IN Indianapolis, Mktg. Engrs. Inc. 317-872-5665
MD Randallstown, Beacon North 703-478-2480
MA Millis, Selmark Assocs. 617-376-2914
MI Holland, Com-Tek Sls. 616-399-7273
MN Mendota Hgts., G-II Sls. 612-454-3086
MO Hazelwood, Jim Moore & Assocs. 314-731-2240
NJ Clifton, R.O.I. Sls. 201-340-1515
NJ Marlton, BGR Assocs. 609-483-1020
NY Rochester, H. C. Johnson Agys. 716-586-0777
NC Charlotte, Elctrn. Mfrs. Agts. 704-365-0547
OH Cleveland, Comps. Inc. 216-243-9200
OR Portland, Harry Levinson Co. 503-245-1902
TX Dallas, D.J. Sls. 214-783-8876
VA Sterling, Beacon North 703-478-2480
WA Seattle, Harry Levinson Co. 206-382-1300

Local Distributors

AZ Tempe, Acacia/VWR Elec. 602-894-2874
CA Buena Pk., Cypress Elctrns. 213-744-0355
CA Gardena, Cal Switch 213-770-2330
CA Irvine, Acacia/VWR Elec. 714-666-0834
CA Manhattan Bch., Prime Electro Prods. 213-379-3642
CA San Diego, Acacia/VWR Elctrns. 619-565-4365
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Southland Comps. 619-578-6630
CA San Jose, Rose Elctrns. 408-263-9700
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Sunnyvale, Acacia/VWR Elec. 408-745-7200
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CT Bridgeport, Millenium Sls. 203-372-2037
IL Schaumburg, QPS Elctrns. 312-884-6620
MD Columbia, D.K. Elctrns. 301-621-5775
MA Canton, Impact Sls. 617-821-1500
MA Framingham, Now Elctrns. 617-872-5816
MI Grand Rapids, RM Elctrns. 616-531-9300
MN New Brighton, Chris Elctrns. 612-631-2647
MO St. Charles, Finnigan Elctrns. 314-946-6201
NV Rancho Cordova, Acacia/VWR Elctrns. 916-638-1861
NJ Kenilworth, Federated Purchasers 201-272-0505
NJ Moorestown, Marlac 609-234-4200
NJ Parsippany, Fabe Electro Sls. 201-299-1123
NY Rochester, Masline Elctrns. 716-546-5373
NY Ronkonkoma, Baldwin Comps. 516-588-5700
PA McKean, Advacom 814-476-7774
TX Plano, Tactic Elctrns. 214-422-0777
TX Richardson, Comp. Tech. Corp. 214-437-2211
WA Seattle, Kam Elctrns. 206-382-1300
WI Racine, Badger Elctrns. 414-637-1256

SCHAFFNER

FAX: 201-467-1330

SCHAFFNER EMC, INC., Instr. Div., 825 Lehigh Avenue, Union, NJ 07083, Tel: 201-851-0644, 800-367-5566, TELEX: 685-3444; *Sls. Mgr.:* Albert A. Chiaravallo ..... **D•1319**

Local Sales Offices & Reps

AL Sci. Dvcs., S.E. 205-536-1969
AZ Odyssey I 602-246-8846
CA (North), Microwave Meas. 415-846-0377
CA (South), Advanced Prods. Sls. 818-706-8351
CO Odyssey I 303-773-8176
DC Electra Tech 703-670-6962
FL Sci. Dvcs., S.E. 305-841-8180
GA Sci. Dvcs., S.E. 404-979-7971
IL Loren F. Green/Cen. 312-593-0282
IN Carter, McCormick & Peirce 317-244-1685
KY Carter, McCormick & Peirce 513-836-0951
MD Electra-Tech 301-877-0344
MA Intersell 617-273-3844
MI Carter, McCormick & Peirce 313-477-7700
MN Loren F. Green/Minn. 612-571-6666
MS Sci. Dvcs., S.E. 904-651-4407
NJ (South), Robert Meyers Assocs. 215-224-1663
NM Odyssey I 505-265-6645
NY (Metro), Bytec 516-781-7400
NY (State), Labtronics 315-455-7314
NC Sci. Dvcs., S.E. 919-765-5776
OH Carter, McCormick & Peirce 216-779-5100
OK Jim Wisdom & Assocs. 918-665-8899
OR Syntek 503-636-6793
PA Roebert Meyers Assocs. 215-224-1663
TX Jim Wisdom & Assocs. 214-470-9093
UT Odyssey I 801-531-1216
VA (North), Electra-Tech 703-670-6962
VA (South), Electra-Tech 804-834-2417
WA Syntek 206-488-0394
WV Carter, McCormick & Peirce 412-733-7490
Can (East), Amos, Mitchell & Assocs. 416-584-2238
Can (West), Jerome & Francis Co. 604-986-1286

SCHAUER MANUFACTURING, 4500 Alpine Ave., Cincinnati, OH 45242, Tel: 513-791-3030, TELEX: 21-4576; Empl.: 195; *Sls. Mgr.:* A. A. Groenewold; *Dist. Mgr.:* Dan Shaw

SCHLAGE ELECTRONICS, 5452 Betsy Ross Drive, Santa Clara, CA 95054-1102, Tel: 408-727-5170, FAX: 408-727-6707; Empl.: 200

SCHLUMBERGER INSTRUMENTS, Schlumberger Technologies, 20 North Avenue, Burlington, MA 01803, Tel: 617-229-4825, ESYLNK: 5106007263, FAX: 914-592-9328; FSC No.: 1T316; Empl.: 44; *Sls. Mgr.:* John Jansen

SCHONSTEDT INSTRUMENT CO., 1775 Wiehle Ave., Reston, VA 22090, Tel: 703-471-1050, TWX: 710-833-9880; Empl.: 45

SCHOTT CORP., 1000 Parkers Lk. Rd., Wayzata, MN 55391, Tel: 612-475-1173, TWX: 910-576-2964; FSC No.: 80023; Empl.: 325; *Sls. Mgr.:* A. Schmitt

SCHOTT ELECTRONICS, 42 Silvermine Road, Seymour, CT 06483, Tel: 203-881-0102, TWX: 710-451-8911, FAX: 203-881-0098; Empl.: 150; *Sls. Mgr.:* Ross Wieringa

SCHOTT GLASS TECHNOLOGIES, INC., 400 York Ave., Duryea, PA 18642, Tel: 717-457-7485, TWX: 510-671-4535; FSC No.: 23-169-1403; Empl.: 500; *Sls. Mgr.:* Josef Nimmerfroh

SCHRACK NORTH AMERICA CORP., 1995 Pond Rd., Ronkonkoma, NY 11779-7209, Tel: 516-737-0099, TELEX: 646149, FAX: 516-737-2550; Empl.: 10; *Sls. Mgr.:* John Walsh; *Dist. Mgr.:* James Amor ..... **B•1578-1584**

Local Sales Offices & Reps

AL Huntsville, DHR Mktg. 205-533-5165
AZ Glendale, Aspen Power 602-931-9289

Schrack
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CO Boulder, Stratford Grp. 303-530-3194
FL Tampa, Florida Comps. 813-960-7044
GA Atlanta, DHR Mktg. 404-451-9848
IL Wheaton, Chadra-Schilke & Assocs. .. 312-653-8126
IN Indianapolis, C.C. Elctrns. 317-255-1508
KS Shawnee Mission, Microtronics (K&M) 913-262-1444
MA Waltham, Gerber Sls. 617-890-3334
MN Roseville, TLC 612-483-2226
MO St. Charles, Microtronics 314-946-8500
NJ Lawrenceville, DVS Co. 609-896-1112
NJ Westwood, Jarms 201-666-9390
NY Syracuse, PI Tronics 315-455-7346
NC Raleigh, DHR 919-781-1961
SC Greenville, DHR Mktg. 803-235-3594
TX Irving, Kite Elctrns. 214-986-0321
VA Richmond, DHR Mktg. 804-359-8803
WA Seattle, Krebs & Assocs. 206-285-8015
Can St. Laurent, Electromatic Comps. Ltd. 514-337-1104

Local Distributors

CA Buena Park, Ford Elctrns. 714-521-8080
CA Santa Monica, Distributor Specialist ... 213-393-9666
CT Hartford, Wes-Garde/Switch Controls 203-527-7705
CT New Haven, Hatry Elctrns. 203-755-1181
FL Lakeland, West-Garde/Swich Controls 813-644-7564
GA Norcross, Wholesale Ind. Elec., Inc. ... 404-447-8431
IL Carol Stream, Lectro Comps. 312-690-0520
IL Crystal Lake, Sub Sem, Inc. 815-459-4139
IA Boise, Bolen's Control House 208-375-3070
MD Gaithersburg, Axis Elctrns. 301-840-9640
MA Andover, Aved Elctrns. 617-657-8310
MA Wilmington, Standard Elctrns. 617-658-5050
MI Troy, Empire Elctrns. 313-585-8130
MN New Brighton, Chris Elctrns. 612-631-2647
NJ Oakland, Relay Specialties 201-337-1000
NY Buffalo, Summit Elctrns. 716-334-8110
NY New Rochelle, Derf Elctrns. 914-235-4600
OH Cincinnati, Schuster Distrs. 216-425-8134
OR Portland, O-Four Controls 503-231-8058
PA Redding, R.A.M. Motor Control 215-376-7102
SC Spartanburg, Harley's Elctrns. 803-582-7961
TX Dallas, Off The Shelf Comps. 214-247-0052
TX Garland, Industrial Equip. 214-271-5494
UT Salt Lake City, Ballard Supp. 801-972-2430
WA Seattle, Radar Elec. Co., Inc. 206-282-2511
WI Cedarburg, Lake-View Elctrns. Corp. .. 414-377-8250

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SCHROFF INCORPORATED, Schroff GMBH, 170 Commerce Dr., Warwick, RI 02886, Tel: 401-732-3770, TELEX: 952175; Empl.: 75; *Sls. Mgr.:* Samuel Hopp ..... **C•1099**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg., Inc. 205-933-9281
AZ Scottsdale, Luscombe Engr. 602-949-9333
CA Los Gatos, Luscombe Engrg. 408-370-2020
CA Pasadena, Luscombe Engr. 213-684-2000
CA San Diego, Luscombe Engr. 619-549-9699
CO Longmont, Luscombe Engrg. 303-772-3342
FL Altamont Springs, Carter Assocs. 305-671-6800
GA Norcross, 20th Century Mktg., Inc. 404-446-1999
IL Hillside, Cadre Tech. Rep. 312-449-3900
IA Marion, MSB Assocs. 319-377-6261
KS Roeland Park, MSB Assocs. 913-432-2131
MD Columbia, Delta III Assocs. 301-730-0790
MI Troy, C. B. Jensen 313-643-0506
MN Minneapolis, D. A. Case Assoc. 612-869-3700
MO St. Charles, MSB Assocs. 314-946-5577
NH Salem, Sales Engr. 603-893-5521
NJ Englewood, Sprung-Nussbaum 201-569-5666
NY Clifton Park, Bastian Sls. 518-452-2026
NY E. Syracuse, Bastian Sls. 315-437-1482
NY Fairport, Bastian Sls. 716-223-0237
NC Cary, 20th Century Mktg., Inc. 919-481-3370
OH Aurora, EMA 216-562-6104
OH Centerville, EMA 513-433-2800
OR Tigard, Elctrn. Comps. Sls. 503-245-2342
PA Huntington Valley, Omega Elctrn. Sls. 215-947-4135
TN Knoxville, 20th Century Mktg., Inc. 615-966-2099
TX Austin, CMZ 512-255-1663
TX Garland, CMZ 214-681-1414
WA Mercer Island, Elctrn. Comp. Sls. 206-232-9301

SCHROFF UK LTD., Maylands Ave., Hemel Hempstead, Herts, England HP2 4SG, Tel: 0442-40471/6, TELEX: 825658; FSC No.: 0442 3508; *Sls. Mgr.:* Mr. B. U. Kaupisch; *Dist. Mgr.:* Mr. K. G. Reynolds

SCHURTER, INC., 1016 Clegg Ct., Petaluma, CA 94952, Tel: 707-778-6311, TELEX: 176-084; FSC No.: 61935; *Sls. Mgr.:* Bruno H. Schurter ... **A•1692-1693; C•1546-1548**

Local Sales Offices & Reps

AL Athens, Effective Mktg. Force 205-233-2947
AZ Scottsdale, Elctrns. Tech. Sls. Assocs., Inc. 602-941-9137
CA Fullerton, Gru Assocs. 714-738-0903
CA Moraga, Ruppert Sls. & Engrg. 415-376-8040
CA San Jose, Ruppert Sls. & Engrg. 408-998-8717
CO Lakewood, Cristee-Meade Co. 303-232-0287
FL Pompano, IMR, Inc. 305-942-2449
GA Lawrenceville, Effective Mktg. Force .. 404-925-2060
GA Lithia Springs, Effective Mktg. Force .. 404-948-4209
IL Arlington Hgts., MJ Petersen & Assoc., Ltd. 312-577-8200
IN Carmel, Newton & Assocs. 317-848-2016
IN Indianapolis, CC Elctrn. Sls. 317-255-1508
MN Minnetonka, Frank Anthony Mktg. 612-934-0773
MS Jackson, Doby Assocs. 601-981-1138
NH Nashua, Bell Controls 603-882-6984
NJ Ho-Ho-Kus, D. J. Fisher Co. 201-652-0090
NJ Medford, Champion Elctrn. Sls. Co. 609-983-0932
NY Fairport, TAC Sls, Inc. 716-425-1070
NC Lillington, Effective Mktg. Force 919-893-9650
OH Beachwood, Electronic Salesmasters 216-831-9555
OR Portland, Westmark 503-641-8780
TN Memphis, Doby Assocs. 901-763-5730
TX Dallas, Reese & Assocs. 214-351-0703
WA Seattle, Westmark 206-281-4025

Local Distributors

CA Scotts Valley, Quail Elctrns. 408-438-6126
CA Sunnyvale, Target Elctrns., Inc. 408-734-5611
IL Elk Grove Village, Nu-Way Elctrn. Distrbs. Inc. 312-437-7120
MD Rockville, FIC Corp. 800-638-6594
MA Wilmington, JV ELctrns. 617-657-6523
OH Strongsville, Fuse World 216-238-1330
OR Tualatin, Moore Elctrns., Inc. 503-692-5333
TX Dallas, Fuses, Inc. 214-341-6407
Can Markham, Ont., Birde Mktg. 416-477-7722

S≈≈E

SCHUSTER ELECTRONICS, 8 Beattie Court, Huntington, NY 11530, Tel: 516-271-0590; *Sls. Mgr.:* Max Schuster

SCIENCE ACCESSORIES CORP., 970 Kings Hwy. W., Southport, CT 06490, Tel: 203-255-1526, TELEX: 964300 SAC SPRT, FAX: 203-254-7271; Empl.: 40; *Sls. Mgr.:* H. A. Cleveland

SCIENCE/ELECTRONICS, P. O. Box 986, Dayton, OH 45401-0986, Tel: 513-228-6011, FAX: 513-228-3353; Empl.: 25; *Sls. Mgr.:* E. E. Pohl; *Dist. Mgr.:* J. Tanksley

SCIENTECH, INC., 5649 Arapahoe Ave., Boulder, CO 80303, Tel: 303-444-1361, 800-525-0522, TWX: 910-940-0994; Empl.: 57

SCIENTIFIC-ATLANTA, INC., See Optima Enclosures

SCIENTIFIC COLUMBUS, INC., Esterline Corporation, 1900 Arlingate Lane, Columbus, OH 43223, Tel: 614-274-0400, TELEX: 245-426, FAX: 614-272-2288; *Sls. Mgr.:* Donald M. Yore

SCIENTIFIC COMMUNICATIONS, INC., 3425 Kingsley Rd., Garland, TX 75041, Tel: 214-271-3685, TWX: 910-860-5172; *Sls. Mgr.:* Donald G. Luiken

SCIENTIFIC RESEARCH CORP., See TRAK Microwave Corp.

SCIENTIFIC SYSTEMS, INC., One Alewife Pl., 35 Cambridge Pk., Cambridge, MA 02140, Tel: 617-661-6364, TELEX: 928201, FAX: 617-661-6253; FSC No.: 2N787; Empl.: 63; *Sls. Mgr.:* Ralph Hawes, VP Sls. & Mktg.

SCIENTIFIC TECHNOLOGIES, Optical Sensor Div. Inc., 31069 Genstar Rd., Hayward, CA 94544, Tel: 415-471-9717, TELEX: 34-5506, FAX: 415-471-9752; Empl.: 100

SCITEQ ELECTRONICS, INC., 8401 Aero Dr., San Diego, CA 92123, Tel: 619-292-0500, TELEX: 882008, FAX: 619-292-9120; FSC No.: 70561; Empl.: 35; *Sls. Mgr.:* Phil Feinberg

SCOPE INCORPORATED, 1860 Michael Faraday Dr., Reston, VA 22090, Tel: 703-471-5600, TWX: 710-883-1178; Empl.: 260; *Sls. Mgr.:* Richard Gizzie

SCREEN DATA CORP., 80 S. Jefferson Rd., Whippany, NJ 07981, Tel: 201-887-7713, 800-248-1212, TELEX: 710-387-209; *Sls. Mgr.:* Michael A. Kling

SC TECHNOLOGY, INC., 2450 Armstrong St., Livermore, CA 94550, Tel: 415-373-9230, FAX: 415-373-9416; *Sls. Mgr.:* Susan L. Karl

SCREENPRINT DOW, See Dow Switch, Div. of Screenprint Dow

SEABOARD ELECTRONICS, 70 Church St., New Rochelle, NY 10805, Tel: 914-235-8073, TELEX: 646289; Empl.: 40; *Sls. Mgr.:* Bernie Klempner; *Dist. Mgr.:* Dr. Richard Ader

SEAC INDUSTRIES, INC., 8237 Hermitage, Richmond, VA 23228, Tel: 804-262-3698

SEACOR INC.

FAX: 201-664-8544

SEACOR, INC., 123 Woodland Ave, Westwood, NJ 07675, Tel: 201-666-5600; Empl.: 45 ..... **A•1171**

Local Sales Offices & Reps

CT Beacon Falls, KSA of England 203-756-8040
IL Rolling Meadows, Heartland Tech. Mktg. 312-577-9222
MA Sudbury, KSA of New England 617-443-5881
MN St. Paul, The Johnsony Co. 612-641-1878
NY Rochester, Upstate Engrg. Sls. 716-225-2383
NY Westwood, Jarms Elctrns. 201-666-9390
NC New Hill, Tom Santel Assocs. 919-362-4091
OH Powell, Val-Skol Sls. 614-889-0174
OH Willoughby, Val-Skol Sls. 216-942-6021
OK Tulsa, Encore Technlg. Co. 918-665-3562
PA King of Prussia, Freedman-Malta Assocs. 215-337-9211
SC Mauldin, Carl Hart Assocs. 803-288-2323
TX Richardson, Encore Technlg. Co. 214-669-0232
TX Round Rock, Encore Technlg. Co. 512-388-7930
WI Brookfield, Heartland Tech. Mktg. 414-796-1128

Local Distributors

CA Garden Grove, Natl. Cap. Supp. 714-892-7744
CA San Jose, Compass Comps. 408-432-7575
CT Wallingford, Mid-State Elctrns. 203-265-9900
FL Ft. Lauderdale, Brothers Elec. 305-561-6700
FL Ft. Lauderdale, NRC Elctrns. 305-772-4500
IL Bensenville, Voyager Elec. 312-860-1300
IL Schaumburg, Q.P.S. 312-884-6620
MA Burlington, T.L.C. 617-273-0140
MA Burlington, TLC 617-273-0140
MA Framingham, Now Elctrns. 617-235-9501
MA N. Chelmsford, Pilgrim Elec. 617-454-9889
MA Needham, Cronin 617-449-5000
MN Eitzen, Capacitor Assocs. 507-495-3130
MN Fridley, Voyager Elctrns. 612-571-7766
NH Hudson, T.N.T. 603-880-8300
NJ E. Brunswick, Brothers Elctrns. 201-238-2200
NY Farmingdale, Pride Elctrns. 516-293-4020
NY Hauppauge, Jaco Elctrns. 516-273-5500
NY Melville, S.A.I. 516-293-2710
NY Ronkonkoma, Spectrum Comp. 516-737-6900
TX Dallas, Off-the-Shelf Comps. 214-238-0808
TX Ft. Worth, C & W Supp. 817-831-0395
TX Richardson, G.T.T. Elctrns. 214-234-1555
WA Seattle, Vesco Elctrns. 206-575-3607

SEA DATA, INC., One Bridge St., Newton, MA 02158, Tel: 617-244-8191, TELEX: 951107; Empl.: 30; *Sls. Mgr.:* D. Crouse

SEALECTRO-BICC ELECTRONICS, 40 Lindeman Dr., Trumbull, CT 06611, Tel: 203-372-4118, TELEX: 71-425-501, FAX: 203-372-6224; FSC No.: 98291; Empl.: 1600; *Sls. Mgr.:* P. Tynan, Dir. Dist. Sls.; *Dist. Mgr.:* P. Tynan, Dist. Sls. Mgr.

SEALTRON, INC., 9705 Reading Road, Cincinnati, OH 45215, Tel: 513-733-8400, TELEX: 62872030, FAX: 513-733-0131; Empl.: 120; *Sls. Mgr.:* James Dawson

SEASTROM MANUFACTURING CO., INC., 701 Sonora Ave., Glendale, CA 91201, Tel: 213-245-9121, TWX: 910-497-2271, FAX: 818-246-6803; FSC No.: 86928; Empl.: 75; *Sls. Mgr.:* Bob Seastrom

SECTOR MICROWAVE IND. INC., 999 Grand Blvd., Deer Park, NY 11729, Tel: 516-242-2300, TWX: 510-227-6075; Empl.: 40; *Sls. Mgr.:* Victor Nelson

SECOINSA/DIGI POWER, 686 E. Gish Rd., San Jose, CA 95112, Tel: 408-288-5600, TELEX: 910-338-0579; Empl.: 90; *Sls. Mgr.:* Ron Murphy; *Dist. Mgr.:* Ron Murphy

SECURITY PLASTICS, INC., 14427 N.W. 60th Ave., Miami Lakes, FL 33014, Tel: 305-823-5440, FAX: 305-557-1431; Empl.: 400; *Sls. Mgr.:* Nelson Rodriguez

SEEQ TECHNOLOGY, 1849 Fortune Dr., San Jose, CA 95131, Tel: 408-432-9550, TELEX: 296609, TWX: 9103382313, FAX: 408-432-9549; Empl.: 400; *Sls. Mgr.:* Phil Ortiz, V.P. Sls.; *Dist. Mgr.:* Carolyn Troland

SEIKO INSTRUMENTS

FAX: 213-517-7792

SEIKO INSTRUMENTS U.S.A., INC., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7770; *Sls. Mgr.:* John Hawkins, Lee Guio; *Dist. Mgr.:* Lee Guio, John Hawkins ..... **A•1464, 1753; B•1085; D•1102**

Local Sales Offices & Reps

AL	Huntsville, Electro-Mech	205-880-0592
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
AZ	Tucson, Fred Board Assocs.	602-299-1508
CA	Irvine, Groh Assoc.	714-837-9871, 619-696-0054
CA	San Diego, Groh Assocs.	619-453-7572
CA	San Jose, Exis, Inc.	408-287-6680
CO	Lakewood, Candal, Inc.	303-935-7128
CT	Madison, Focus Elctrn. Sls.	203-245-4314
FL	Plantation, Gallagher & Assocs.	305-473-2101
GA	Norcross, Electro-Mech	404-447-6478
IL	Elk Grove Village, TriStar Grp., Inc.	312-593-0200
IN	Greenwood, Valentine & Assocs.	317-888-2260
IN	South Bend, Valentine & Assocs.	219-233-1779
IA	Cedar Rapids, J.R. Sls. Engrg., Inc.	319-393-2232
KS	Overland Park, Kebco	913-541-8431
KS	Wichita, Kebco	316-733-1301
MD	Middleton, S. T. Woolard Co.	301-371-4500
MA	Taunton, Focus Elctrns.	617-824-3840
MI	Grosse Pointe Pk., Greiner Assoc.	313-499-0188
MN	Eden Prairie, High Tech	612-944-7274
MO	St. Louis, Kebco	314-576-4111
NJ	Manville, DynoRep, Inc.	201-685-1851
NM	Albuquerque, Fred Board Assocs.	505-888-1121
NC	Raleigh, Electo-Mech	919-790-9300
OH	Brunswick, J. N. Bailey & Assocs.	216-273-3798
OH	Columbus, J. N. Bailey & Assocs.	614-262-7274
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
OR	Tigard, Elctrn. Comp. Sls.	503-245-2342
TN	Jonesboro, Electro-Mech	615-753-2964
TX	Austin, TL Mktg.	512-453-4586
TX	Dallas, TL Mktg.	214-484-6800
TX	Houston, TL Mktg. Inc.	713-589-2763
UT	Salt Lake City, Aspen Sls.	801-467-2401
WA	Mercer Island, Elctrn. Comps. Sls.	206-232-9301
WA	Spokane, Elctrn. Comp. Sls.	509-456-0100
WI	Brookfield, TriStar Grp., Inc.	414-782-2670
Can	Burnaby, B.C., Tech-Trek, Ltd.	604-439-1373
Can	Mississauga, Ont., Tech-Trek, Ltd.	416-238-0366
Can	Nepean, Ont., Tech-Trek Ltd.	613-726-9562
Can	Richmond, B.C., Tech-Trek, Ltd.	604-271-2764
Can	Ville St. Laurent, Tech-Trek, Ltd.	514-337-7540

Local Distributors

AZ	Phoenix, Sterling Elctrns.	602-268-2121
CA	Agoura Hills, Pacesetter Elctrns.	818-991-3984
CA	Anaheim, Pacesetter Elctrns. USA	714-779-5855
CA	Benicia, Paragon Sys.	707-746-5950
CA	Irvine, OBI	714-250-9003
CA	Mountain View, I/O Sls.	415-968-1080
CA	Reseda, Jan Dvcs.	818-708-1100
CA	San Diego, Added Value Elctrns.	619-278-1990
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	San Jose, Merit Elctrns.	408-434-0800
CA	Sunnyvale, Pacesetter Elctrns. USA	408-734-5470
CA	Tustin, Added Value Elctrns.	714-259-8258
CO	Englewood, Sterling Elctrns.	303-796-7338
CT	Wallingford, Sager Elctrns.	203-265-6865
CT	Wallingford, Sterling Elctrns.	203-265-9535
FL	Tampa, Lectro Distrs.	813-960-1631
ID	Boise, Radar Elec.	208-336-2227
IL	Elk Grove Vl, RM Elctrns.	312-358-0300
IL	Northbrook, Classic Comps.	312-272-9650
IN	Indianapolis, RM Elctrns.	317-291-7110
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KS	Overland Park, Sterling Elctrns.	913-236-5589
MD	Middletown, Current Comps.	301-473-5333
MA	Hingham, Sager Elctrns.	617-749-6700
MA	Norwood, Emtel	617-769-9500
MA	Woburn, Sterling Elctrns.	617-938-6200
MI	Grand Rapids, RM Elctrns.	616-531-9300
MN	Minneapolis, Aerospace Computer Supps.	612-884-4725
NH	Salem, Sager Elctrns.	603-898-1348
NJ	S. Plainfield, Sterling Elctrns.	201-769-7000
NJ	Sparta, Instrs. & Equip.	201-729-4293
NM	Albuquerque, Sterling Elctrns.	505-884-1905
NY	E. Syracuse, Add Elctrns.	315-437-0300
NY	Hauppauge, Sager Elctrns.	516-348-1300
NY	Mt. Vernon, QAR	914-699-2224
NY	Victor, ADD Elctrns.	716-924-4760
NC	Raleigh, Sager/Svc. Plus Elctrns.	919-850-9550
OH	Cincinnati, Schuster	513-489-1400
OK	Tulsa, Sterling Elctrns.	918-663-2410
OR	Portland, Radar Elec.	503-232-3404
OR	Tualatin, Moore Elctrns.	503-692-5333
PA	Exton, VSH Elctrns.	215-363-2250
PA	Pittsburgh, CAM/RPC	412-782-3770
TX	Austin, Sterling Elctrns.	512-836-1341
TX	Dallas, Sterling Elctrns.	214-243-1600
TX	Houston, Sterling Elctrns.	713-627-9800
VA	Sterling, Sterling Elctrns.	703-450-2373
WA	Richland, Radar Elec.	509-943-8336
WA	Seattle, Radar Elec.	206-282-2511
WA	Spokane, Radar Elec.	509-747-3053
WI	New Berlin, Classic Comps.	414-786-5300
CO	Wheatridge, Added Value Elctrns.	303-422-1701
Can	Burnaby, B.C., ITT/RAE Multicomps.	604-291-8866
Can	Concord, Ont., ITT Multicomps.	416-736-1144
Can	Downsview, Westburne Indl. Entprs.	416-635-2980
Can	Markham, Semad Div. DEW Elctrns.	416-475-8500

SEIKO INSTRUMENTS U.S.A., INC., Robotics/Automation Div., 2990 W. Lomita Blvd., Torrance, CA 90505, Tel: 213-517-7863, FAX: 213-517-7792

SEKAI ELECTRONICS OF AMERICA, INC., 14700 E. Firestone Blvd., Suite 122, La Mirada, CA 90638, Tel: 714-670-1854, TELEX: 882756, FAX: 714-670-1855; FSC No.: 8V398; Empl.: 6; *Sls. Mgr.:* Larry Klementowski

selco

FAX: 714-739-1507

SELCO PRODUCTS CO., SEL Sales, Inc., 7580 Stage Rd., Buena Park, CA 90621, Tel: 714-521-8673, TELEX: 65-5457; Empl.: 18; *Sls. Mgr.:* Bill Wilkinson; *Dist. Mgr.:* Bill Keneipp ..... **B•1867; C•1636; D•1394**

Local Sales Offices & Reps

CA	Arcadia, HMC, Inc.	818-447-0958
CA	La Mesa, Summit Sls.	619-697-0646
CA	Sunnyvale, Pass Assocs.	408-735-9040
IL	Elk Grove Vl, Parcom Inc.	312-228-6360
MA	Andover, Crawford Assocs.	617-470-2122
NJ	Watchung, Dolan Assocs.	201-753-2671
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Hatboro, J. S. Wurts Co.	215-674-3562
UT	Salt Lake city, Sage Assocs.	801-467-5451
WA	Bellevue, Luscombe Engrg.	206-223-1541

Local Distributors

CA	Arcadia, Parco	818-447-0958
IL	Wheeling, Hawk Elctrns.	312-459-4091
MA	Andover, Crawford Assocs.	617-470-2122
NJ	Watchung, Dolan Sls.	201-753-2671
NY	New York City, Martin Audio/Video	212-541-5900

SEL-REX DIV., OMI Intl. Corp., 75 River Rd., Nutley, NJ 07110, Tel: 201-667-5200, TELEX: 133-320, TWX: 710-989-1423; Empl.: 250; *Sls. Mgr.:* Larry Price

SEMICOA, 333 McCormick Ave., Costa Mesa, CA 92626, Tel: 714-979-1900, TELEX: 678-315, TWX: 910-595-1961, FAX: 714-557-4541; FSC No.: 34156; Empl.: 85; *Sls. Mgr.:* M. Gregson

SEMICON COMPONENTS, INC., Div. of Semicon, Inc., 10 North Ave., Burlington, MA 01803, Tel: 617-272-9015, TWX: 710-332-1919; Empl.: 300; *Sls. Mgr.:* Jack Lawrence

SPM
SPM

FAX: 914-698-5386

SEMICONDUCTOR PACKAGING MATERIALS CO., 431 Fayette Ave., Mamaroneck, NY 10543, Tel: 914-698-5353, ESYLNK: 910-380-9209 ..... **C•1122**

Local Sales Offices & Reps

AZ	Tempe, Spectrum Assoc., S.W.	602-966-1788
CA	Anaheim, California Tech Svcs.	714-630-8470
CA	Santa Clara, California Tech. Svcs.	408-496-1155
CO	Fort Collins, Rep Sls., Inc.	303-226-1504,
CT	Southington, Libby Assocs.	203-747-5601
FL	Pompano Beach, J. P. Elctrn. Sls.	305-782-6830
IL	Downers Grove, Physics Equip.	312-960-4054
NC	Raleigh, Spears & Assocs.	919-846-9711,
PA	Franconia, Scharas Assocs.	215-582-0450
TX	Dallas, Dallas Indl. Sls.	214-669-2608
WA	Bellevue, Mars	206-747-3292

SEMICONDUCTOR TECHNOLOGY, INC., 3131 S.E. Jay St., Stuart, FL 34997, Tel: 305-283-4500, TWX: 510-953-7511, FAX: 305-286-8914; FSC No.: 50891; Empl.: 45

Local Sales Offices & Reps

AL	Huntsville, Micro Sls. Inc.	205-881-0001
AZ	Scottsdale, Fred Board Assocs.	602-994-9388
CA	Costa Mesa, Solid State Sls.	714-650-8414
CA	Mountain View, Leddy Assocs.	415-969-6313
CO	Englewood, Comp. Sls.	303-779-8060
CT	Guilford, Bay Colony	203-453-5424
FL	Altamonte Springs, APM Assoc.	305-869-6831
FL	Ft. Lauderdale, APM Assoc.	305-565-0056
FL	Tampa, APM Assoc.	813-886-2457
GA	Marietta, Micro Sls. Inc.	404-971-3037
IL	Downers Grove, Splon Assocs.	312-665-5993
IN	Fort Wayne, Scott Elect.	219-484-7865

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IA	Cedar Rapids, Lorenz Sls.	319-377-4666
KS	Overland Pk., Lorenz Sls.	913-649-5556
MD	Towson, Arbotek	301-825-0775
MA	Westboro, Bay Colony	617-870-1930
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, Bill Deming & Assocs.	612-888-5000
MO	Bridgeton, Lorenz Sls.	314-298-8585
NE	Lincoln, Lorenz Sls.	402-475-4660
NJ	Hasbrouck Heights, Comp Tech Sls.	201-288-7400
NM	Albuquerque, Q. A. Elctrns.	505-888-1121
NY	New Hyde Park, Comp Tech Sls.	516-593-2628
NY	Syracuse, Electra Sls.	315-463-1248
NC	Raleigh, Micro Sls. Inc.	919-881-0007
OH	Cincinnati, Scott Elect.	513-791-2513
OH	Cleveland, Scott Elect.	216-473-5050
OH	Dayton, Scott Elect.	513-294-0539
OH	Reynoldsburg, Scott Elctrns.	614-863-1281
OH	Vandalia, Cleary Sls.	513-890-8642
OR	Portland, IVC Inc.	503-297-3364
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Dallas, M-Rep	214-484-5711
UT	Salt Lake City, Component Sls.	801-268-8440

SEMIKRON, INC., 11E Executive Dr., P.O. Box 66, Hudson, NH 03051-0066, Tel: 603-883-8102, 1-800-258-1308, TELEX: 6711011, FAX: 603-883-8021; FSC No.: 58687; Empl.: 60; *Sls. Mgr.:* Frank Haase; *Dist. Mgr.:* Bruce Sessler

SEMTECH, 652 Mitchell Rd., Newbury Park, CA 91320, Tel: 805-498-2111, TWX: 910-336-1264; FSC No.: 14099;Multiple; Empl.: 200; *Sls. Mgr.:* John Pennant-Jones; *Dist. Mgr.:* John Pennant-Jones

SEMTRONICS CORP., 211 Prospect Pk., P.O. Box 2248, Peachtree City, GA 30269, Tel: 404-487-6681, TELEX: 8107662244, FAX: 404-487-1128; Empl.: 30; *Sls. Mgr.:* Gregory Galaida

SENCORE, 3200 Sencore Dr., Sioux Falls, SD 57107, Tel: 605-339-0100, 800-843-3338, TWX: 910-660-0300, FAX: 605-335-6379; FSC No.: 33347; Empl.: 250; *Sls. Mgr.:* Doug Bowden

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Local Sales Offices & Reps

AZ	Scottsdale, Williams Assocs.	602-947-4297
CO	Commerce City, Williams Assocs.	303-289-5647
DC	Washington, Whitcomb Assocs.	202-737-0763
IL	Lincolnwood, Saffro & Assocs.	312-677-9720
KS	Shawnee Mission, Comtel - Midwest	913-268-0762
MD	Baltimore, Whitcomb Assocs.	301-889-1245
MA	Lexington, Zieco	617-861-8300
MI	Southfield, Comtel Instrs. Co.	313-358-2505
MN	Minneapolis, Hei-Lite Sls.	612-861-6051
MO	St. Louis, Comtel - Midwest	314-991-5363
NM	Albuquerque, Williams Assocs.	505-255-1638
NY	Mount Vernon, Elctrl. Instr. Svc.	914-699-9717
OH	Cleveland, Comtel Instrs. Co.	216-442-8080
OH	Dayton, Comtel Instrs. Co.	513-426-5310
OH	Hilliard, Comtel Instrs. Co.	614-876-8305
OK	Tulsa, Data Mktg. Assocs.	918-494-2711
PA	Pittsburgh, Comtel Instrs. Co.	412-922-5720
TX	Austin, Data Mktg. Assocs.	512-443-7722
TX	Dallas, Data Mktg. Assocs.	214-661-0300
TX	Houston, Data Mktg. Assocs.	713-780-2511
TX	San Antonio, Data Mktg. Assocs.	512-342-3031
UT	Salt Lake City, Williams Assocs.	801-532-7701
WI	Lake Mills, Saffro & Assocs.	414-648-2605

SENSORAY, 44106 Old Warm Springs Blvd., Fremont, CA 94538, Tel: 415-657-7290; Empl.: 5; *Sls. Mgr.:* Karen Reeves

SENSOR CORP., Box 140, Scottdale, PA 15683, Tel: 412-887-4080; Empl.: 6

Sensor Scientific, inc.

FAX: 201-227-8063

SENSOR SCIENTIFIC, INC., 1275 Bloomfield Ave., Fairfield, NJ 07006, Tel: 201-227-7790, 800-524-1610, TWX: 910-240-3313; Empl.: 60; *Sls. Mgr.:* Carol Dunbar ..... **B•1868-1869**

Local Sales Offices & Reps

CA	Irvine, Vale Elctrn. Assoc.	714-551-4004
CA	San Diego, Vale Elctrns.	619-693-0113
CA	Saratoga, Mead Advantage	408-741-5300
CA	Van Nuys, Vale Elctrns.	818-705-0283
CO	Ft. Collins, Rep. Sls.	303-226-1504
CT	Hartford, Sturgeon Co.	203-249-7800
FL	Hollywood, Askland Elctrn. Corp.	305-987-1074
IL	Des Plaines, ESCO Assocs.	312-298-5310
MA	Needham, Sturgeon Co.	617-444-6603
NJ	Wayne, Breen Assocs.	201-696-8683
NY	E. Syracuse, Bastian Sls. Agy.	315-437-1482
NY	Fairport, Bastian Sls. Agy.	716-223-0237
NY	Port Crane, Bastian Sls. Agy.	607-772-3421
NY	Roslyn Hts., November Elctrn. Sls.	516-621-6378
TX	Dallas, Allied Comps. Inc.	214-238-0408
TX	Houston, Allied Comps. Inc.	713-988-1600

SENSOR SYSTEMS, INC., 8929 Fullbright Ave., Chatsworth, CA 91311, Tel: 818-341-5366, TELEX: 69-1583; *Sls. Mgr.:* E. Schneider

SENSOR TECHN., 21012 Lassen St., Chatsworth, CA 91311, Tel: 213-882-4100, TWX: 910-494-4776; Empl.: 350; *Sls. Mgr.:* Robert Bryden

SENSOTEC, INC., 1200 Chesapeake Ave., Columbus, OH 43212, Tel: 614-486-7723, TWX: 810-482-1188; FSC No.: 29927; *Sls. Mgr.:* Jack Feil ..... **B•1918-1920**

Local Sales Offices & Reps

AL	Birmingham, Sesco, Inc.	205-988-8304
AZ	Sun City, Hannah-Hill, Inc.	602-933-4623
CA	Carlsbad, FLW, Inc.	619-434-5251
CA	Costa Mesa, FLW, Inc.	714-751-7512
CA	Hayward, FLW, Inc.	415-786-9070
CA	Van Nuys, FLW, Inc.	818-989-5236
CO	Broomfield, Hannah-Hill, Inc.	303-460-0602
CT	Wallingford, Pat Jenks Assocs.	203-265-9939
FL	St. Petersburg, Sesco, Inc.	813-576-6991
GA	Atlanta, Sesco, Inc.	404-458-6423
IL	Chicago, Comtel Midwest Corp.	312-539-4838
IN	Indianapolis, Comtel Midwest Corp.	317-253-1681
IA	Cedar Rapids, Comtel Midwest Corp.	319-377-9434
KS	Overland Pk., Advanced Indl. Sys.	913-432-8065
LA	Baton Rouge, Sesco, Inc.	504-928-4951
MD	Rockville, Farrell Assocs.	301-424-9460
MA	Woburn, Pat Jenks Assocs.	617-938-0488
MI	Southfield, Comtel Instrs.	313-358-2505
MN	Wayzata, Comtel Midwest Corp.	612-476-1551
MO	Ellisville, Advanced Indl. Sys.	314-391-0366
NJ	Elizabeth, Instrmn. Prods. Inc.	201-351-1155
NY	Williamsville, Maxwell Bennett Assocs.	716-634-2107
NC	Cary, Sesco, Inc.	919-467-7482
OH	Cleveland, Comtel Instrs.	216-442-8080
OH	Columbus, Comtel Instrs.	614-876-8305
OH	Dayton, Comtel Instrs.	513-426-5310
OK	Tulsa, Sesco, Inc.	918-622-3868
PA	Frazer, FLW, Inc.	215-251-9700
PA	Pittsburgh, Comtel Instrs.	412-922-5720
SC	Greenville, Sesco, Inc.	803-297-8306
TN	Knoxville, Sesco, Inc.	615-588-5455
TX	Austin, Sesco, Inc.	512-892-2490
TX	Dallas, Sesco, Inc.	214-231-9364
TX	Houston, Sesco, Inc.	713-999-3510
TX	Plano, Sesco, Inc.	214-867-8880
WA	Bellevue, Showalter Instrs.	206-746-7970
WA	Richland, Showalter Instrs.	509-943-5288
WI	New Berlin, Comtel Midwest Corp.	414-544-6042

SENSYM, INC., 1255 Reamwood Ave., Sunnyvale, CA 94089, Tel: 408-744-1500, TELEX: 176376, FAX: 408-734-0407; FSC No.: 67234; Empl.: 150; *Sls. Mgr.:* Fred James; *Dist. Mgr.:* Tom Johnson

SENTRY MANUFACTURING, Crystal Park, Chickasha, OK 73018, Tel: 405-224-6780; Empl.: 30; *Sls. Mgr.:* Barbara Maberry

SEQUENTIAL INFORMATION SYSTEMS INC., 249 N. Saw Mill River Rd., Elmsford, NY 10523, Tel: 914-592-5930, TWX: 710-567-1212, FAX: 914-592-6014; Empl.: 85; *Sls. Mgr.:* Murray E. Vinarub

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SERCO PRODUCTS DIVISION, Serco Mold, 612 Commercial Ave., Covina, CA 91723, Tel: 818-331-0517, 800-843-8172(Calif.); Empl.: 45; *Sls. Mgr.:* Neil Reckon ..... **C•1094-1095**

Local Sales Offices & Reps

CA	Corta Madera, Paul O'Neal & Assocs.	415-924-1691,408-778-2599
CA	Covina, Serco Prods.	818-331-0517
CA	Valencia, Lessing & Assocs.	805-295-0225
GA	Norcross, Hollingsworth & Still, Inc.	404-447-1700
IL	Cary, Ellinger Sls. Corp.	312-639-1850
MA	Waltham, Gerber Sls. Corp.	617-890-3334
MI	Farmington Hills, A. B. Friedman Sls. Co.	313-851-0659
NY	Pt. Washington, Ashtec, Inc.	516-767-0336
TX	Richardson, R. F. Kimball Co., Inc.	214-231-3447
Can	Ontario, Avotronics Ltd.	416-475-2024

Local Distributors

AL	Montgomery, Handley's Elctrn. Ctr. Inc.	205-262-4885
AZ	Phoenix, Capital Elctrns.	602-252-5897
AZ	Phoenix, Elctrn. Distrs.	602-955-8303
AZ	Phoenix, Elctrn. Emporium Inc.	602-437-8633
AZ	Tucson, Electronic City	602-622-1173
CA	Canoga Park, Sandy's Elctrns.	818-346-0510
CA	Costa Mesa, Mar Vac Elctrns.	714-650-2001
CA	Fremont, Fry's Elctrns.	415-683-8969
CA	Fullerton, RF Elctrns.	714-447-1133
CA	Goleta, DOW Elctrns.	805-968-7272
CA	Hawiian Gardens, DOW Elctrns.	213-421-3786
CA	Hollywood, Pacific Radio Exchange	213-462-1393
CA	Inglewood, Inglewood Elctrns.	213-674-2366
CA	Oxnard, DOW Elctrns.	805-486-6353
CA	Pasadena, DOW Elctrns.	818-793-1195
CA	Pomona, DOW Elctrns.	818-966-8461
CA	Sacramento, Mar Vac California Radio	916-922-6531
CA	San Jose, Quement Elctrns.	408-998-5900
CA	Santa Clara, Comps. Ctr.	408-988-3751
CA	Santa Maria, Elctrn. Parts Supermart	805-925-8604
CA	Sunnyvale, Fry's Elctrns.	408-733-1770
CT	Wallingford, Midstate Elctrns.	203-265-9900
FL	Delray Bch., Fastbolt FL Corp.	305-272-3100, 800-233-5036
FL	Largo, Applied Specialties of FL Inc.	800-722-4599
FL	Tampa, Sunnex Elctrn. Supp. Inc.	813-885-4074
GA	Norcross, Whls. Indl. Elctrns. Inc.	404-447-8431, 800-282-1857
IL	S. Holland, Union Elctrn. Distrs.	312-333-4100, 800-648-6657
MA	Lynn, Land Elctrns. Inc.	617-592-2220
MA	Waltham, Atlantic Comps.	617-890-3334
MI	Detroit, Elctrn. Parts Co.	313-891-7400
MN	S. Minneapolis, Tor Tec Corp.	612-866-3661
NY	Hempstead, Davis Elctrns.	516-483-9200
NC	Durham, Southeastern Elctrns.	919-638-8204
NC	Greensboro, Guilford Elctrn. Supp. Inc.	919-275-1385
NC	Raleigh, Southeastern Elctrns.	919-828-2311
NC	Winston-Salem, Elctrn. Distrbg. Inc.	919-723-1097
TN	Clarksville, Randolph, Hale & Matthews Inc.	615-647-2325
WI	Fond du Lac, Fedco Elctrns. Inc.	414-922-6490
WI	Milwaukee, Marsh Elctrns. Inc.	414-475-6000

SERIAL LAB PRODS., INC., 162 Cook Lane, P.O. Box 766, Marlboro, MA 01752, Tel: 617-481-1684, TELEX: 955318 Attn: SERIAL LAB; Empl.: 12; *Sls. Mgr.:* R. L. Wiedeman; *Dist. Mgr.:* D. Kreck

SERMETEL, 155 Limerick Rd., Limerick, PA 19468, Tel: 215-948-5100, TELEX: 84-6335, TWX: 710-637-1263; Empl.: 177; *Sls. Mgr.:* Luke McLaughlin

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SERVO-TEK PRODUCTS CO., 1086 Goffle Rd., Hawthorne, NJ 07506, Tel: 201-427-3100, TELEX: 130273; Empl.: 60; *Sls. Mgr.:* T. J. Daly ..... **B•1254**

SETRA SYSTEMS, INC., 45 Nagog Park, Acton, MA 01720, Tel: 508-263-1400, 1-800-25-SETRA, TELEX: 4430243, FAX: 508-264-0292; FSC No.: 53367; Empl.: 95; *Sls. Mgr.:* Ed Cope ..... **B•1922-1923**

Local Sales Offices & Reps

AL	Huntsville, Burnette Techno Metrics	205-830-2832
AK	Anchorage, Unit Process	907-561-5600
CA	Concord, QCon, Inc.	415-682-2020
CA	Los Angeles, Dynasales Co.	213-268-1175
CO	Westminster, RMS Sls.	303-429-1111
FL	Orlando, Datarep	305-843-5224
GA	Atlanta, Craft Assocs.	404-256-0420
HI	Honolulu, Unit Process	808-488-7625
IL	Wheaton, Ray Knitter Assocs., Inc.	312-690-6363
IN	Ft. Wayne, Domino, Inc.	219-456-5512
LA	Metairie, Slaton & Assocs., Inc.	504-455-3855
MD	Columbia, Stein Instrs.	301-596-3748
MA	Framingham, J. M. Lancaster Co.	617-875-8893
MI	Hazel Park, Tiby Co.	313-547-3550
MN	Plymouth, Data Elctrns.	612-559-1434
MO	St. Louis, Adelphi, Inc.	314-821-1232
MT	Billings, Unit Process	406-252-0455
NJ	Cedar Grove, KLS Assocs.	201-785-4450
NM	Albuquerque, TMA, Inc.	505-345-8921
NY	E. Rochester, A & D Dvcs.	716-385-2778
NY	Sydney, A&D Dvcs.	607-563-8488
OH	Cleveland, Tiby Co.	216-371-5335
OH	Dayton, Tiby Co.	513-277-3822
OK	Tulsa, Inotek Corp.	918-627-1500
OR	Portland, Unit Process	503-227-5264
PA	Cheltenham, Stein Instrm.	215-379-1990
TX	Dallas, Inotek Corp.	214-243-7000
TX	Houston, Inotek Corp.	713-688-7000
WA	Kirkland, Unit Process	206-827-0433
Can	Ont., B. H. McGregor	416-677-1431

SEVEN MOUNTAINS SCI. INC., P.O. Box 650, Boalsburg, PA 16827, Tel: 814-466-6559; Empl.: 4; *Sls. Mgr.:* Josephine Chesworth

SFERNICE, INC.

FAX: 303-242-5917

SFERNICE, INC., 461 North 22nd Street, Grand Junction, CO 81502, Tel: 303-242-0810; FSC No.: 05347; *Sls. Mgr.:* G. W. (Jerry) Krebill; *Dist. Mgr.:* Danny Jagirdar ..... **A•1848, 2020-2030, 2099; B•1870-1871**

Local Sales Offices & Reps

AZ	Tempe, Semper Fi Sls., Inc.	602-730-9553
CA	Chatsworth, WCV Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
CA	Glendale, Mission Mktg. Grp.	818-247-9110
CA	Santa Clara, I-Square, Inc.	408-988-3400
CO	Denver, West, Inc.	303-477-8180
CT	Bloomfield, F.S.I.	203-243-3122
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IN	Ft. Wayne, Denton Mktg., Inc.	219-486-0665
IA	Hiawatha, Ard Sls.	319-393-6392
MA	Glouchester, F.S.I.	617-281-3864
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Plymouth, Dunlop Consits.	612-544-1070
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
UT	Salt Lake City, West, Inc.	801-292-8787
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Mississauga, Ont., Source Elctrns., Ltd.	416-676-0830

Local Distributors

CA	Chatsworth, Petell/Passive Comps.	818-341-1743
CA	San Diego, Neumann Elctrns.	619-695-3005
CA	Westlake Vl, Distel, Inc.	805-495-9998
CA	Yorba Linda, Zeus Comps.	714-921-9000
CO	Denver, Integrated Elctrns.	303-292-6121
CT	Meriden, Jaco Elctrns.	203-235-1422
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Hoffman Estates, Integrated Elctrns.	312-843-2040
MD	Columbia, Aztech Elctrns.	301-995-6800
MA	Burlington, TLC Comps.	617-273-0140
MN	St. Paul, Shelley-Ragon	612-648-2828
NJ	Clifotn, J-Mar Elctrns.	201-772-6400
NY	Bohemia, Justin Elctrns.	516-589-4000
NY	Cicero, Andco Elctrns.	315-699-2660
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Portchester, Zeus Comps.	914-937-7400
NY	Whippany, American Dists.	201-428-0510
OH	Cincinnati, Eclipse of Ohio	513-661-7733
OH	Dayton, Televox, Inc.	513-454-1225
OR	Beaverton, Integrated Elctrns.	503-641-1690
TX	Richardson, Jaco, Inc.	214-235-9575
TX	Richardson, Zeus Comps.	214-783-7010
UT	N. Salt Lake City, Integrated Elctrns.	801-298-1869
VT	Rutland, SAI, Inc.	802-775-7126
WA	Bellevue, Integrated Elctrns.	206-455-2727

SFE TECHNOLOGIES, 1501 1st St., San Fernando, CA 91340, Tel: 818-365-9411, TWX: 910-496-1535, FAX: 818-365-5117; FSC No.: 96733; Empl.: 2000; *Sls. Mgr.:* Joe Lucia

S. F. PRODUCTS CORPORATION, P. O. Box 369, Southport, CT 06490, Tel: 203-929-6180; Empl.: 8; *Sls. Mgr.:* Norman W. Johanson; *Dist. Mgr.:* R. S. Johanson

SGS-ATES SEMICONDUCTOR CORP., 240 Bear Hill Rd, Waltham, MA 02154, Tel: 617-890-6688, TELEX: 923495; Empl.: 9000

SGS SEMICONDUCTOR CORPORATION, 1000 E. Bell Road, Phoenix, AZ 85022, Tel: 602-867-6100, TELEX: 249976,667479(Western Union), TWX: 910-950-4654; FSC No.: 7X328; Empl.: 200; *Sls. Mgr.:* Tony Santoni; *Dist. Mgr.:* Jim Nord

Shallco

FAX: 919-934-3298

SHALLCO, INC., Box 1089, Smithfield, NC 27577, Tel: 919-934-3135; Empl.: 40; *Sls. Mgr.:* M. D. Sutton ..... **B•1788-1793**

Local Sales Offices & Reps

CA	Irvine, Groh Assocs.	714-837-9871
CA	Santa Clara, Fischer Assocs.	408-733-7350
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IN	Fort Wayne, J & B Engrg. Sls. Co.	219-483-2813
IA	Cedar Rapids, S & O Sls.	319-363-7323
MD	Towson, Holden Engrg. Sls.	301-823-3763
MA	Norwood, MPS Elctrn.	617-769-8700
MN	Minneapolis, R-J Inc.	612-866-3661
NY	E. Rockaway, HLJ	516-599-2999
NY	Manhattan, Lothar Sanford Corp.	212-757-3881
NY	Pittsford, D. Hurley Sls.	716-586-6159
OH	Englewood, Allen Nace Co.	513-836-0931
OR	Portland, Comp. Technlg., Inc.	503-292-1518
PA	King of Prussia, Freedman-Malta Assocs.	215-337-9211
TX	Dallas, Oeler & Menelaides, Inc.	214-361-8876

Local Distributors

FL	Jacksonville, Southeast Elctrns.	904-356-3007
OH	Cincinnati, United Radio	513-761-4030
TN	Bristol, Broadcast Equip. & Supp.	615-878-2531
TX	Dallas, Wholesale Elctrns.	214-824-3001
Can	Montreal, Que., Braydon Electro	514-332-5650

SHALLTRONIX CORP., Preston St., P.O. Box 235, Selma, NC 27576, Tel: 919-965-6346; FSC No.: 58258; *Sls. Mgr.:* Joe Deans ..... **D•1322**

Local Sales Offices & Reps

TX	Arlington, Electronic Prod. Reps.	817-467-0377

SHAPE MAGNETRONICS, INC., 901 DuPage Ave., Lombard, IL 60148, Tel: 312-620-8394, TWX: 910-991-2352, FAX: 312-620-0784; Empl.: 110; *Sls. Mgr.:* Judy M. Madden; *Dist. Mgr.:* Judy M. Madden

SHAPIRO SCIENTIFIC INST., 3500 E. Coast Hwy., Corona del Mar, CA 92625, Tel: 714-675-1024; Empl.: 7

SHARP, Microelectronics Div., Display Grp., Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759 ..... **B•1086-1091**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AL	Mobile, Interep Assocs.	205-478-1036
AZ	Scottsdale, Thorson Desert State, Inc. (TDSI)	602-998-2442
CA	Newport Bch., Plustronics	714-476-8009
CA	San Diego, Mesa Comps.	619-278-8021
CA	Santa Clara, Quorum Tech. Sls.	408-0812
CA	Sherman Oaks, Plustronics	818-995-8908
CO	Denver, Seale & Assocs., Inc.	303-756-8855
CT	Southington, Orion/DSA Grp.	203-621-8371
FL	Boca Raton, Lawrence Assocs.	407-368-7373
FL	Casselberry, Lawrence Assocs.	305-830-6174
FL	Oldsmar, Lawrence Assocs.	813-787-2773
GA	Norcross, Interep Assocs.	407-449-8680
IL	Des Plaines, Electron Mktg.	312-298-2330
IN	Indianapolis, STB & Assocs.	317-844-9227
KS	Wichita, Baka Corp.	316-682-8411
MD	Linthicum, Advanced Technlg. Sls., Inc.	301-789-9360
MA	Marlborough, Orion/DSA Grp.	617-480-0516
MA	Wakefield, Orion/DSA Grp.	617-245-5220
MI	Grand Rapids, DEM Sls., Inc.	616-364-4024
MI	St. Clair Shores, DEM Sls. Inc.	313-777-1750
MN	Minneapolis, Comstrand	612-788-9234
MO	Creve Coeur, Baka Corp.	314-878-4224
NJ	Allendale, Eastec Assocs.	201-934-7135
NJ	W. Berlin, QED Elctrns.	609-346-9254
NY	Pittsford, Noeth-Honsinger	716-586-9002
NC	Raleigh, Zucker Assocs.	919-782-8433
OH	Dayton, Five Star Elctrns., Inc.	513-299-1718
OH	Solon, Five Star Elctrns., Inc.	216-349-1611
OR	Beaverton, Blair Hirsh	503-641-1875
PA	Spring House, QED Elctrns., Inc.	215-643-9200
TN	Greenville, Interep Assocs.	615-639-3491
TX	Austin, Impaq Sls. Co.	512-474-1125
TX	Carrollton, Impaq Sls. Co.	214-247-3300
TX	Houston, Impaq Sls. Co.	713-820-0288
WA	Lynwood, Blair Hirsh	206-774-8151
WI	Waukesha, Electron Mktg.	414-547-1505
Can	Mississauga, Ont., Hi-Tech Sls. Co., Ltd.	416-672-0284
Can	Montreal, Que., Hi-Tech Sls.	514-386-4728
Can	Surrey, B.C., Enerlec Sls.	604-888-1667

Local Distributors

AL	Huntsville, Marshall	205-881-9235
AZ	Phoenix, Marshall	602-496-0290
CA	Del Mar, Added Value	619-792-0257
CA	Irvine, Marshall	714-458-5394
CA	Los Angeles, Marshall	818-407-4150
CA	Orange, Milgray	203-795-0711
CA	Orange, Western Micro	714-637-0200
CA	Sacramento, Marshall	916-635-9700
CA	San Diego, Marshall	619-578-9606
CA	San Diego, Western Micro	619-453-8430
CA	San Francisco, Marshall	408-943-4600

CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheat Ridge, Added Value 303-422-1701
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Marshall 913-492-3121
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611
NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1991
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
VA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
Can Ottawa, Ont., Space Elctrns. 613-820-8313
Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. 204-339-0554

SHARP, Microelectronics Div., Integrated Circuits, Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759 ..... **A•1754-1756**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AL Mobile, Interep Assocs. 205-478-1036
AZ Scottsdale, Thorson Desert State, Inc. (TDSI) 602-998-2442
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-756-8855
CT Southington, Orion/DSA Grp. 203-621-8371
FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Casselberry, Lawrence Assocs. 305-830-6174
FL Oldsmar, Lawrence Assocs. 813-787-2773
GA Norcross, Interep Assocs. 404-449-8680
IL Des Plaines, Electron Mktg. 312-298-2330
IN Indianapolis, STB & Assocs. 317-844-9227
KS Wichita, Baka Corp. 316-682-8411
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
MA Marlborough, Orion/DSA Grp. 617-480-0516
MA Wakefield, Orion/DSA Grp. 617-245-5220
MI Grand Rapids, DEM Sls., Inc. 616-364-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minneapolis, Comstrand 612-788-9234
MO Creve Couer, Baka Corp. 314-878-4224
NJ Allendale, Eastec Assocs. 201-934-7135
NJ W. Berlin, QED Elctrns. 609-346-9254
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Spring House, QED Elctrns., Inc. 215-643-9200
TN Greenville, Interep Assocs. 615-639-3491
TX Austin, Impaq Sls. Co. 512-474-1125
TX Carrollton, Impaq Sls. Co. 214-247-3300
TX Houston, Impaq Sls. Co. 713-820-0288
WA Lynwood, Blair Hirsh 206-774-8151
WI Waukesha, Electron Mktg. 414-547-1505
Can Mississauga, Ont., Hi-Tech Sls. Co., Ltd. 416-672-0284
Can Montreal, Que., Hi-Tech Sls. 514-386-4728
Can Surrey, B.C., Enerlec Sls. 604-888-1667

Local Distributors

AL Huntsville, Marshall 205-881-9235
AZ Phoenix, Marshall 602-496-0290
CA Del Mar, Added Value 619-792-0257
CA Irvine, Marshall 714-458-5394
CA Los Angeles, Marshall 818-407-4150
CA Orange, Milgray 203-795-0711
CA Orange, Western Micro 714-637-0200
CA Sacramento, Marshall 916-635-9700
CA San Diego, Marshall 619-578-9606
CA San Diego, Western Micro 619-453-8430
CA San Francisco, Marshall 408-943-4600
CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheatridge, Added Value 303-422-1701
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk., Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MS Kansas City, Marshall 913-492-3121
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611
NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1911
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
WA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
Can Ottawa, Ont., Space Elctrns. 613-820-8313
Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. 204-339-0554

SHARP, Microelectronics Div., Optoelectronics, Sharp Plaza, Mahwah, NJ 07430, Tel: 201-529-8757, TELEX: 71 134327, FAX: 201-529-8759; *Sls. Mgr.:* Terry Manton; *Dist. Mgr.:* Dave Matthews ..... **A•2142-2144; B•1148-1151, 1178-1179, 1282-1294, 1585, 1925**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AL Mobile, Interep Assocs. 205-478-1036
AZ Scottsdale, Thorson Desert State Inc. (TDSI) 602-998-2442
CA Newport Bch., Plustronics 714-476-8009
CA San Diego, Mesa Comps. 619-278-8021
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Sherman Oaks, Plustronics 818-995-8908
CO Denver, Seale & Assocs., Inc. 303-756-8855
CT Southington, Orion/DSA Grp. 203-621-8371
FL Boca Raton, Lawrence Assocs. 407-368-7373
FL Casselberry, Lawrence Assocs. 305-830-6174
FL Oldsmar, Lawrence Assocs. 813-787-2773
GA Norcross, Interep Assocs. 404-449-8680
IL Des Plaines, Electron Mktg. 312-298-2330
IN Indianapolis, STB & Assocs. 317-844-9227
KS Wichita, Baka Corp. 316-682-8411
MD Linthicum, Advanced Technlg. Sls., Inc. 301-789-9360
MA Marlborough, Orion/DSA Grp. 617-480-0516
MA Wakefield, Orion/DSA Grp. 617-245-5220
MI Grand Rapids, DEM Sls., Inc. 616-364-4024
MI St. Clair Shores, DEM Sls., Inc. 313-777-1750
MN Minneapolis, Comstrand 612-788-9234
MO Creve Coeur, Baka Corp. 314-878-4224
NJ Allendale, Eastec Assocs. 201-934-7135
NJ W. Berlin, QED Elctrns. 609-346-9254
NY Pittsford, Noeth-Honsinger 716-586-9002
NC Raleigh, Zucker Assocs. 919-782-8433
OH Dayton, Five Star Elctrns., Inc. 513-299-1718
OH Solon, Five Star Elctrns., Inc. 216-349-1611
OR Beaverton, Blair Hirsh 503-641-1875
PA Spring House, QED Elctrns., Inc. 215-643-9200
TN Greenville, Interep Assocs. 615-639-3491
TX Austin, Impaq Sls. Co. 512-474-1125
TX Carrollton, Impaq Sls. Co. 214-247-3300
TX Houston, Impaq Sls. Co. 713-820-0288
WA Lynwood, Blair Hirsh 206-774-8151
WI Waukesha, Electron Mktg. 414-547-1505
Can Mississauga, Ont., Hi-Tech Sls. Co., Ltd. 416-672-0284
Can Montreal, Que., Hi-Tech Sls. 514-386-4728
Can Surrey, B.C., Enerlec Sls. 604-888-1667

Local Distributors

AL Huntsville, Marshall 205-881-9235
AZ Phoenix, Marshall 602-496-0290
CA Del Mar, Added Value 619-792-0257
CA Irvine, Marshall 714-458-5394
CA Los Angeles, Marshall 818-407-4150
CA Orange, Western Micro 714-637-0200
CA Sacramento, Marshall 916-635-9700
CA San Diego, Marshall 619-578-9606
CA San Diego, Western Micro 619-453-8430
CA San Francisco, Marshall 408-943-4600
CA Saratoga, Western Micro 408-725-1660
CA Tustin, Added Value 714-259-8258
CO Denver, Marshall 303-451-8444
CO Wheat Ridge, Added Value 303-422-1701
CT Orange, Milgray 203-795-0711
CT Wallingford, Marshall 203-265-3822
DC Washington, Milgray 301-621-8169
FL Ft. Lauderdale, Marshall 305-977-4880
FL Orlando, Marshall 305-767-8585
FL Tampa, Marshall 813-573-1399
FL Winter Pk, Milgray 305-647-5747
GA Atlanta, Marshall 404-923-5750
GA Atlanta, Milgray 404-393-9666
IL Chicago, Marshall 312-490-0755
IL Chicago, Milgray 312-350-0490
IN Indianapolis, Marshall 317-297-0483
KS Kansas City, Marshall 913-492-3121
KS Kansas City, Milgray 913-236-8800
KS Wichita, Marshall 316-264-6333
MD Baltimore, Milgray 301-995-6169
MD Gaithersburg, Marshall 301-840-0228
MA Boston, Marshall 617-658-0810
MA Burlington, Milgray 617-657-5900
MA Burlington, Western Micro 617-273-2800
MI Livonia, Marshall 313-525-5850
MN Minneapolis, Marshall 612-559-2255
MO St. Louis, Marshall 314-291-4650
NJ Fairfield, Marshall 201-882-0169
NJ Marlton, Milgray 609-983-5010
NY Farmingdale, Milgray 516-391-3000
NY Hauppauge, Marshall 516-273-1515
NY Johnson City, Marshall 607-798-1611

NY Pittsford, Milgray 716-235-0830
NY Rochester, Marshall 716-235-7620
NC Raleigh, Marshall 919-876-7383
OH Cleveland, Marshall 216-248-1788
OH Cleveland, Milgray 216-447-1520
OH Columbus, Marshall 614-891-7580
OH Dayton, Marshall 513-898-4480
OR Beaverton, Western Micro 503-629-2082
OR Portland, Marshall 503-643-5555
PA Philadelphia, Marshall 609-778-8720
PA Pittsburgh, Marshall 412-963-0441
TX Austin, Added Value 512-459-8519
TX Austin, Marshall 512-837-1991
TX Brownsville, Marshall 512-542-4589
TX Dallas, Added Value 214-404-1144
TX Dallas, Marshall 214-233-5200
TX Dallas, Milgray 214-248-1603
TX El Paso, Marshall 915-593-0706
TX Houston, Marshall 713-895-9200
UT Murray, Marshall 801-261-1888
UT Salt Lake City, Added Value 801-975-9500
UT Salt Lake City, Marshall 801-485-1580
UT Salt Lake City, Milgray 801-272-4999
WA Redmond, Western Micro 206-881-6737
WA Seattle, Marshall 206-641-6800
WI Waukesha, Marshall 414-797-8400
Can Calgary, Alberta, Space Elctrns. 403-235-5325
Can Edmonton, Alberta, Space Elctrns. 403-438-2858
Can Montreal, Que., Marshall 514-848-9112
Can Montreal, Que., Space Elctrns. 514-694-7710
Can Ontario, Marshall 416-674-2161
Can Ontario, Milgray 416-756-4481
Can Ottawa, Ont., Marshall 416-674-2168
Can Ottawa, Ont., Space Elctrns. 613-820-8313
Can Toronto, Ont., Milgray 416-756-4481
Can Toronto, Ont., Space Elctrns. 416-638-4771
Can Vancouver, B.C., Space Elctrns. 604-438-5545
Can Winnipeg, Manitoba, Space Elctrns. 204-339-0554

SHELDAHL, INC., P.O. Box 170, Hwy 3 North, Northfield, MN 55057, Tel: 507-663-8000, TWX: 910-565-2180, FAX: 507-663-8365

SHELLY associates

FAX: 714-669-1081

SHELLY ASSOCIATES, INC., 14281 Chambers Road, Tustin, CA 92680, Tel: 714-669-9850, TELEX: 85-2263; FSC No.: 00303; Empl.: 30; *Sls. Mgr.:* Chuck Feeney; *Dist. Mgr.:* Chuck Feeney ..... **B•1092**

Local Sales Offices & Reps

AZ Tempe, Spectrum Assocs., S.W. 602-966-1788
CA Anaheim, Spectrum Assocs., Inc. 714-630-6977
CA Mountain View, Leddy Assocs. 415-969-6313
CO Broomfield, Connors Co. 303-466-9628
FL Ft. Lauderdale, Hollingsworth & Still, Inc. 800-241-5712
FL Tampa, Hollingsworth & Still, Inc. 800-241-5712
GA Norcross, Hollingsworth & Still, Inc. 404-447-1700
IL Skokie, Electro Tech Mktg. 312-676-3151
IN Ft. Wayne, Scott Elctrns. 219-484-7865
IN Indianapolis, Scott Elctrns. Inc. 317-841-0010
MD Ellicott City, Tech. Sls., Inc. 301-461-2400
MA Norwood, The MacInnis Co. 617-762-8090
MI Ypsilanti, Techrep, Inc. 313-572-1950
MN Hopkins, Steve Forsythe & Assocs. 612-933-8267
MO Florissant, R. R. Burton & Assocs. 314-831-4069
MO Grandview, R. R. Burton & Assocs. 816-763-5385
NJ Boonton, TMA 201-263-2946
NY N. Syracuse, R. F. Roux Co. 315-458-9169
NY Port Washington, TMA 516-883-2432
NC Charlotte, Hollingsworth & Still, Inc. 800-241-5712
NC Kernersville, Hollingsworth & Still, Inc. 800-241-5712
OH Cincinnati, Scott Elctrns. 513-791-2513
OH Cleveland, Scott Elctrns. Inc. 216-473-5050
OH Kettering, Scott Elctrns., Inc. 513-294-0539
OH Reynoldsburg, Scott Elctrns. 614-863-1281
OR Beaverton, Luscombe Engrg. Co. 503-636-6664
PA Boyertown, Tech. Sls., Inc. 800-225-4335
PA Pittsburgh, Scott Elctrns. 412-963-6116
TX Stafford, A & E Sls., Inc. 713-499-3210
WA Bellevue, Luscombe Engrg. Co. 206-223-1541
WI Brookfield, Electro-Tech Mktg. Assocs. 414-785-9554

Local Distributors

AR Ft. Smith, Radio, Inc. 501-646-5200
CA Anaheim, Bisco Inds. Inc. 714-635-0380
CA Fremont, VIC/TAL Sls. 415-651-6420
CA San Jose, Bisco Inds. Inc. 408-435-8980
CT Norwalk, Park Distrs. Inc. 203-853-2010
CT Wallingford, Midstate Elctrns. Co. 203-265-9900
FL Bradenton, Specialty Distbg. 813-756-9571
FL Clearwater, Jenkins Supp. Co., Inc. 813-584-5282
GA Atlanta, A-C Equip. Co. 404-451-2747
IL Franklin Park, Bisco Inds. Inc. 312-451-1230
IN Indianapolis, Mar Elctrns., Inc. 317-633-6699
IA Cedar Rapids, Iowa Radio Supp. Co. .. 313-393-4510
IA Cedar Rapids, Iowa Radio Supp. Co. .. 319-393-4510
MA Woburn, Bisco Inds. 617-938-8590
MO Kansas City, Elctrns. Supp. Co., Inc. ... 816-931-0250
NJ Cranford, Garden State Indl. Elctrns. .. 201-272-6400
NJ East Brunswick, Brothers Elctrns. 201-238-2200
NJ Fair Lawn, Relay Specialties 201-797-3313
NJ Oakland, Relay Specialties 201-337-1000
NY Elmsford, White Plains Elctrl. 914-592-9555
NY Huntington, Energy Elctrl. Supp. 516-549-2722
NC Raleigh, Svc. Plus Elctrns. 919-850-9550
OH Dayton, Televox, Inc. 513-294-4499
OH Strongsville, Roberts Elctrns. Co., Inc. 216-238-1711
OH Twinsburg, Advacom, Inc. 216-425-8477
OK Tulsa, Radio, Inc. 918-587-9123
PA McKean, Advacom 814-476-7774
TN Chattanooga, Specialty Distbg. Co. 615-267-9531
TX Arlington, Bisco Inds. 817-640-7046
TX Dallas, Wilkinson Brothers Co. 214-941-9963
TX Midland, ESI Supp. 915-694-9657
WI Mequon, Lakeview Elctrns. 414-377-8250

SKC

FAX: 818-764-6845

SHINANO KENSHI CORP. (SKC), 7525 Ethel Ave., Ste. I, N. Hollywood, CA 91605, Tel: 818-764-4266; Empl.: 6; *Sls. Mgr.:* Ken Shimizu ..... **B•1255**

Local Sales Offices & Reps

AL Madison, Benchmark 205-464-0033
CA North Hollywood, Shinano Kenshi Corp. 818-764-4266
CA Santa Clara, Norcomp, Inc. 408-727-7707
CO Denver, Tech Rep Sls. Co. 303-758-7031
CT Bloomfield, SIR Assocs. 203-243-9343
FL Melbourne, Phoenix Comps. 305-723-4414
GA Norcross, Benchmark 404-446-1711
MA Westford, SIR Assocs. 617-692-2500
MI Southfield, Fred Gehrke & Assoc. 313-559-5363
MN Eagan, REL Comp. 612-452-9541
NJ Maple Shade, Bi-Tech 609-667-7374
NJ Oxford, Malin Assocs. 201-689-7398
NC Charlotte, Mackay Smith & Assocs. ... 704-372-1188
NC Raleigh, Mackay Smith & Assocs. 919-847-2277
OR Portland, Intertech Sls. 503-775-7885
TX Austin, Precision Technlg. Assocs. 512-250-0201
TX Richardson, Precision Technlg. Assoc. 214-234-8071
UT Sandy, Intermountain Technlg. 801-566-5000

Local Distributors

CA N. Hollywood, Digilog Dvcs., Inc. 818-764-9777

Shindengen America, Inc.

FAX: 805-373-3710

SHINDENGEN AMERICA INC., 2649 Townsgate Road, Ste. 200, Westlake Vl, CA 91361, Tel: 805-373-1130; Empl.: 7; *Sls. Mgr.:* Peter Gajewski; *Dist. Mgr.:* Peter Gajewski ..... **D•1961-1963**

Local Sales Offices & Reps

AL Huntsville, 20th Century Mktg., Inc. 205-533-9281
AZ Phoenix, Southwest Tech. Sls. 602-893-1209
CA San Diego, Power Assocs. 619-275-0641
CA Santa Clara, Quorum Tech. Sls. 408-980-0812
CA Simi Valley, Tri-Electro Sls., Inc. 805-527-3317
CO Englewood, BC & Assocs. 303-694-3999
CT Middletown, Gerber Sls. Corp. 203-347-3000
GA Norcross, 20th Century Mktg., Inc. 404-446-1999
IL Rolling Meadows, Eagle Tech. Sls., Inc. 312-991-0700
KS Olathe, C-Tron 319-373-2029
MD Randallstown, Chesapeake Indl. Mktg. 301-922-5997
MA Waltham, Gerber Sls. Corp. 617-890-3334
MI Lathrup Vl., R. C. Nordstrom & Co. 313-559-7373
MN St. Paul, Arkco Sls. 612-777-7454
MO St. Charles, C-Tron, Inc. 314-928-8078
NY N. Bellmore, Aurora Mktg., Inc. 516-221-0764
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Cary, 20th Century Mktg., Inc. 919-481-3370
OH Dayton, Thompson & Assocs. 513-435-7733
OR Portland, Crown Elctrns. 503-620-8320
PA Dresher, CMS Mktg. 215-885-4424
TN Knoxville, 20th Century Mktg., Inc. 615-966-2099
TX Dallas, Talo Prods., Inc. 214-644-6010
UT American Fork, BC & Assocs. 801-467-2363
WA Bellevue, Crown Elctrns. 206-643-8100
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SIGMA SYSTEMS CORP., 3163 Adams Ave., San Diego, CA.92116, Tel: 619-283-3193, FAX: 619-283-6526; Empl.: 21; *Sls. Mgr.:* T. Stewart **D•1187**

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SILICONIX, INC., 2201 Laurelwood Rd., Santa Clara, CA 95054, Tel: 408-988-8000, TWX: 910-338-0227; Empl.: 2600; *Sls. Mgr.:* Walter Senges; *Dist. Mgr.:* Chuck Sweet

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MO St. Louis, Engrg. Svcs. Co. 314-997-1515
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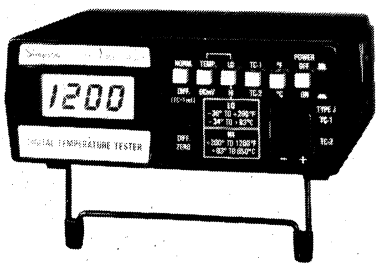

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MO	St. Charles, Microtronics	314-946-8500
NJ	Cherry Hill, Quality Comps.	609-428-6226
NJ	Englewood Cliffs, E. Glass Assocs.	212-586-8440
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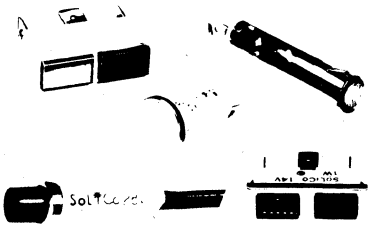

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FREE LINECARD AND CATALOG ON REQUEST

HH Smith

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The Largest Relay & Switches Distributor in the World.

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MASTER DISTRIBUTORS
(213) 452-1229

Local Sales Offices & Reps

AL	Huntsville, Advanced Comps. Mktg.	205-881-5493
AZ	Scottsdale, Advent Comp. Corp.	602-481-0044
CA	Mt. View, Del Bucchia & Assoc.	415-965-8045
CA	San Dimas, JPE Assoc.	818-359-4293
CO	Boulder, The Stratford Grp.	303-530-3194
FL	Tampa, Florida Comp. Sls.	813-960-7044
FL	Winter Springs, Florida Comp. Sls.	305-327-2464
GA	Doraville, Advanced Comps. Mktg.	404-448-2464
IL	Wheaton, Chadra-Schilke	312-653-8126
IN	Fort Wayne, Menze Sls.	219-747-5616
KS	Mission, The Mertens Co.	913-432-9323
MD	Glen Burnie, Macrotech Assocs.	301-766-1111
MA	Canton, Comtek Assoc.	617-828-2948
MI	Dearborn, Pitcher-Poulin, Inc.	313-582-5450
MN	Minneapolis, Tech. Comps. Grp.	612-536-9512
MO	Clayton, Mertens Co.	314-993-6600
NJ	Marlton, Naudain Assocs.	609-983-5300
NJ	Union, Pacent Engrg.	201-687-7197
NJ	Wayne, November Elctrn. Sls.	201-696-8683
NY	Great Neck, Pacent Eng. Co.	516-482-4678
NY	Kingston, R. P. Kennedy Co., Inc.	914-876-2700
NY	Rochester, R. P. Kennedy Co., Inc.	716-271-6322
NC	Siler City, Crossroads Elctrns.	919-742-2372
OR	Beaverton, Evergreen Mktg. Grp.	503-643-8020
WA	Seattle, Evergreen Mktg. Grp.	206-633-3160

Local Distributors

AZ	Phoenix, Minarik Elec. Co.	602-233-3000
CA	Costa Mesa, J & J Elctrns.	714-751-7994
CA	Covina, Selecta Switch	818-967-4123
CA	Gardena, California Switch & Signal	212-538-9830
CA	Hayward, KEA Elctrns.	415-887-2900
CA	Los Angeles, Electric Switches	213-660-1310
CA	Los Angeles, Minarik Elec. Co.	213-624-3161
CA	San Diego, Minarik Elec. Co.	619-560-6632
CA	Santa Clara, Minarik Elec. Co.	408-727-0575
CA	Tustin, Western Switches	714-259-8144
CA	Van Nuys, Wes-Garde Comps. Grp.	213-873-4802
CO	Denver, Minarik Elec. Co.	303-329-3525
CT	Hartford, Wes-Garde Comp. Grp.	203-527-7705
FL	Lakeland, Wes-Garde Comp. Grp.	813-644-7564
GA	Tucker, CID, Inc.	404-491-3143
IL	Carol Spring, Wes-Garde Comp. Grp.	312-653-1460
IL	Crystal Lake, Sub-Sem	815-459-4139
IA	Atkins, The Carl Bergquist Co.	319-446-7456
MA	Canton, Comtek Assocs.	617-828-2948
MI	Michigan, Specialties Mfg.	313-771-2700
MN	Minneapolis, Carl Bergquist	612-835-2322
MO	St. Louis, Wes-Garde Comp. Grp.	314-567-7776
NH	Nashua, Wes-Garde Comp. Grp.	603-880-1971
NJ	Mt. Laurel, Wes-Garde Comp. Grp.	609-778-8190
NY	Woodside, Switches Unltd.	718-478-5000
OH	Westerville, Wes-Garde Comps. Grp.	614-885-0319
OR	Portland, Minarik Elec.	503-253-3402
SC	Columbia, Dixie Elctrns.	803-779-5332
TX	Dallas, Wes-Garde Comp. Grp.	214-357-1768
TX	San Antonio, Minarik Elec.	512-822-7097
WI	Mequon, Lake-View Elctrns.	414-377-8250
Can	Edmonton, Deskin Sls.	403-466-2106
Can	Montreal, Deskin Sls.	514-331-2860
Can	Ottawa, Deskin Sls.	613-729-1099
Can	Richmond, Vancouver, Deskin Sls.	604-324-8343
Can	Toronto, Deskin Sls.	416-475-1412
Can	Winnipeg, Deskin Sls.	403-466-2106

SOSHIN ELECTRIC CO., LTD., No. 18-18, 1-Chome Nakamagome, Ota-Ku, Tokyo, Japan, Tel: (03) 775-2111, TELEX: 246-6377, FAX: (03)775-2071; Empl.: 1,000; *Sls. Mgr.:* N. Hiraide, Foreign Trade Dept.

SOUNDCOAT CO., INC., 1 Burt Dr., Deer Park, NY 11729, Tel: 516-242-2200, TELEX: 12-5514, FAX: 516-242-2246; Empl.: 100; *Sls. Mgr.:* Mr. Carl Wolaver

SOURIAU, INC., 28309 N. Avenue Crocker, Valencia, CA 91355, Tel: 805-257-4830, TELEX: 4720328, TWX: 910-336-1553, FAX: 805-257-2383; Empl.: 79; *Sls. Mgr.:* Keith L. Olsen; *Dist. Mgr.:* Sheridan Loungway

SOUTH AMERICAN DEVELOPMENT CORP., Rte. 9G, R.D. 413, Hyde Park, NY 12538, Tel: 914-229-8866, TELEX: 4990035; Empl.: 80; *Sls. Mgr.:* L. Faber

SOUTHCO, INC., 210 N. Brinton Lake Rd., Concordville, PA 19331, Tel: 215-459-4000, TELEX: 83-1485, TWX: 710-760-1715, FAX: 215-459-4012; *Sls. Mgr.:* R. W. Dougherty

SOUTHERN COMPUTER CORP., 141 W. Wieuca Rd., Ste. 300-B, Atlanta, GA 30342, Tel: 404-252-3340, TWX: 910-250-0481 SOU COMPUQ; *Sls. Mgr.:* Ray Manley

SOUTHERN ELECTRONICS, F-Dyne, 726 So. Flower St., Burbank, CA 91502, Tel: 818-845-2458, FAX: 818-845-6348; Empl.: 100; *Sls. Mgr.:* Wayne Melvin

SOUTHWEST TECH PRODS CORP., 219 W. Rhapsody, San Antonio, TX 78216, Tel: 512-344-0242; Empl.: 34

SPACE ELECTRONICS, INC., Box 2166, Meriden, CT 06450, Tel: 203-235-7755; Empl.: 26; *Sls. Mgr.:* Richard Boynton

SPANTA, INC., 795 Franklin Ave., P.O. Box 193, Franklin Lakes, NJ 07417, Tel: 201-848-0033, TELEX: 136011; Empl.: 10; *Sls. Mgr.:* W. Phifer; *Dist. Mgr.:* W. Phifer

SPARKOMATIC, Rte. 6 & 209, Milford, PA 18337, Tel: 717-296-6444, TWX: 510-260-2682; Empl.: 400; *Sls. Mgr.:* Gary Pomes

SPECIALTY CABLE CORPORATION, P.O. Box 50, Wallingford, CT 06492, Tel: 203-265-7126, 800-243-3959, TWX: 510-100-4275, FAX: 203-269-5293; Empl.: 94

SPECIALTY CONNECTOR CO., 2100 Earlywood Dr., Franklin, IN 46131, Tel: 317-738-2800, TELEX: 217084

SPECIALITY ELECTRONICS, INC., 208 E. Rutherford St., Landrum, SC 29356, Tel: 803-457-3824; Empl.: 10; *Sls. Mgr.:* John Galli ..... **C•1555**

SPECO DIV., Components Specialties, Inc., P.O. Box 624, 1172 Rte. 109, Lindenhurst, NY 11757, Tel: 516-957-8700, 800-645-5516, TELEX: 96-7754; FSC No.: 516-957-9142; Empl.: 29; *Sls. Mgr.:* Eric Forman; *Dist. Mgr.:* Bruce Kurtz

SPECTRACOM CORPORATION, 101 Despatch Drive, East Rochester, NY 14445-1484, Tel: 716-381-4827, TELEX: 9103509587

SPECTRAGRAPHICS CORP., 9125 Rehco Rd., San Diego, CA 92121, Tel: 619-450-0611, TELEX: 295439; Empl.: 170; *Sls. Mgr.:* Ray Barger, VP Sls.; *Dist. Mgr.:* Elliot Shev

SPECTRAL DYNAMICS DIVISION, Scientific-Atlanta, Inc., 4255 Ruffin Rd., San Diego, CA 92123-0575, Tel: 619-268-7100, TWX: 910-335-2022; Empl.: 250

SPECTRA LUX CORP., 12840 N.E. 21 St. Pl, Bellevue, WA 98005, Tel: 206-747-0560; FSC No.: 51896; *Sls. Mgr.:* Ron Bustad

SPECTRAN CORP., 50 Hall Road, Sturbridge, MA 01566, Tel: 617-765-0851, TELEX: 709816, FAX: 347-2747; FSC No.: 6V569; Empl.: 175

SPECTRASCAN, INC., 1110A Elkton Drive, Colorado Springs, CO 80907, Tel: 303-599-9254, TWX: 312194 SPECTRASCAN UD; Empl.: 15; *Sls. Mgr.:* John Condren

SPECTRA SONICS, 3750 Airport Rd., Ogden, UT 84405, Tel: 801-392-7531; Empl.: 35

SPECTRA-STRIP, See Amphenol Products

SPECTRO EQUIPMENT, INC., 13821 Progress Pkwy., N. Royalton, OH 44133, Tel: 216-237-8910; Empl.: 25

SPECTROL ELECTRONICS, 17070 East Gale Ave., City of Industry, CA 91745, Tel: 818-964-6565, TWX: 910-584-1314; Empl.: 600; *Sls. Mgr.:* S. Deiling

SPECTRON GLASS & ELECTRONICS, INC., 595 Old Willets Path, P.O. Box 13368, Hauppauge, NY 11788, Tel: 516-582-5600, TELEX: 968296; FSC No.: 57349; *Sls. Mgr.:* Lonnie Bott

SPECTRONICS CORP., 956 Brush Hollow Rd., Westbury, NY 11590, Tel: 516-333-4840, TWX: 510-222-5877, FAX: 516-333-4840; Empl.: 125; *Sls. Mgr.:* Gerard Hubner

SPECTRUM CONTROL, INC., 2185 W. 8th St., Erie, PA 16505, Tel: 814-455-0966, TWX: 510-699-6871, FAX: 814-455-2550; FSC No.: 33095;5733; Empl.: 450; *Sls. Mgr.:* Herb Bostrom; *Dist. Mgr.:* C. Pirro

SPECTRUM SIGNAL PROCESSING INC., 240 H Street, Blaine, WA 98230, Tel: 1-800-663-8986 (US), 604-438-7266 (Can.), FAX: 604-430-0144; Empl.: 14; *Sls. Mgr.:* Judy A. Bishop

Local Sales Offices & Reps

CA	Manhattan Bch., Forth, Inc.	213-372-8493
MA	Waltham, Spectrum Signal Processing	1-800-323-1842,604-890-3400

Spectrum Technology Inc
a DATUM company

FAX: 805-683-3481

SPECTRUM TECHNOLOGY, INC., DATUM, Incorporated, 300 Lopez Rd., Goleta, CA 93116, Tel: 805-964-7791, TWX: 910-334-1163; FSC No.: 32464; Empl.: 100; *Sls. Mgr.:* Don W. Cope ..... **A•1465-1468**

Local Sales Offices & Reps

AZ	Mesa, Sedco Sls.	602-461-9069
CA	Los Angeles, The Thorson Co.	213-595-0361
CA	San Diego, The Thorson Co.	619-292-8525
CA	San Jose, Frequency Control Assocs.	415-851-8772
CT	Milford, Todino Engrg. Sls.	203-874-6643
FL	Seminole, S.E.S.	813-391-1920
IL	Elgin, R.K. Elctrns.	312-695-8552
MA	Needham, Todino Engrg. Sls.	617-444-7925
NM	Albuquerque, I.M.E.C.	505-883-9010
NY	Melville, Carnes Assocs.	516-694-1600
TX	Dallas, Caton Sls.	214-243-4716
VA	Fairfax, Schibley Assocs.	703-591-3008

Spellman
High Voltage Electronics Corporation

FAX: 516-349-8699

SPELLMAN HIGH VOLTAGE ELCTRNS. CORP., 7 Fairchild Ave., Plainview, NY 11803, Tel: 516-349-8686, TWX: 510-221-2155; Empl.: 150; *Sls. Mgr.:* Tom Stutzbach; *Dist. Mgr.:* Eric Marko ..... **D•1973-1977**

Local Sales Offices & Reps

CA	Costa Mesa, FLW-Southern	714-751-7512
CA	Hayward, FLW-Northern	415-786-9070
FL	Orlando, Gra-Mar, Inc.	305-658-1971
WA	Kirkland, Syntek	206-488-0394
Can	British Columbia, Broman Engrg.	604-254-6311

SPEMCO SWITCHES, 23425 Harper, Box 386, St. Clair Shores, MI 48080, Tel: 800-482-2828, FAX: 313-771-3491; Empl.: 12

SPERRY, A. W. INSTRUMENTS, P.O. Box 9300, Smithtown, NY 11787, Tel: 516-231-7050, 800-645-5398, TELEX: 645104; Empl.: 50; *Sls. Mgr.:* Dennis W. Carroll

SPIRA MANUFACTURING CORP., 12721 Saticoy Street South, North Hollywood, CA 91605, Tel: 818-764-8222, FAX: 818-764-9880; FSC No.: 60050; Empl.: 18; *Sls. Mgr.:* Lisa A Panzich

SPIRICON, INC., 2600 North Main, Logan, UT 84321, Tel: 801-753-3729, TELEX: 296 465 SPIR UR; Empl.: 15; *Sls. Mgr.:* John Gibbs

SPRAGUE ELECTRIC COMPANY, Passive Components Group, 41 Hampton Rd., P. O. Box 9102, Mansfield, MA 02048-9102, Tel: 617-339-8900, TELEX: 928071, TWX: 7103210021; FSC No.: 56289; Empl.: 10,500; *Sls. Mgr.:* Theodore W. Fischer, VP Sls./Mktg., Passive Comps. Grp.; *Dist. Mgr.:* James O'Sullivan, Sls. Mgr. ..... **A•1694, 1757, 2031; D•1142**

Local Sales Offices & Reps

AL	Huntsville, Electramark Inc.	205-539-7040
AL	Madison, EPI Inc.	205-461-7000,205-883-0520
AZ	Mesa, Sprague Electric Company	602-244-0154, 602-831-6762
AZ	Tucson, Sprague Electric Company	602-746-0955
CA	Burlingame, William J. Purdy Co.	415-347-7701
CA	San Diego, Miner Assocs., Inc.	619-566-9891
CA	Santa Ana, Sprague Electric Company	714-549-9913
CA	Van Nuys, Sprague Electric Company	818-994-6500
CO	Denver, William J. Purdy Co.	303-753-6800
CO	Longmont, Todd & Fry Assocs.	303-776-7331
CT	Guilford, Data Mark Inc.	203-453-0575
CT	Southbury, Sprague Electric Company	203-264-9595
CT	Wallingford, Sprague Electric Company	203-284-8300
FL	Altamonte Springs, Sprague Electric Company	305-831-3636

FL Ft. Lauderdale, Sprague Electric Company 305-491-7411
FL Tampa, Sprague Electric Company ... 813-962-1882
GA Atlanta, Elctrn. Mktg. Assocs. 404-448-1215
GA Norcross, Electramark Inc. 404-446-7915
IL Northbrook, D. Dolin Sls. 312-498-6770
IN Indianapolis, Sprague Electric Company 317-253-4247
IA Cedar Rapids, J.R. Sls. 319-393-2232
KS Overland Pk., EPI, Inc. 913-642-9118
KY Lexington, Sprague Elec. Co. 606-224-4230
MD Laurel, Sprague Elec. Co. 301-792-4890
MA burlington, New England Tech. Sls. ... 617-272-0434
MA Framingham, Sprague Electric Company 617-875-3200
MI Ann Arbor, Sprague Electric Company 313-761-2014
MN Minneapolis, HMR, Inc. 612-888-2122
MO St. Louis, EPI, Inc. 314-962-1411
NJ Cherry Hill, Trinkle Sls., Inc. 609-795-4200
NJ Wayne, Sprague Electric Company ... 201-696-8200
NY Central Islip, Sprague Electric Company 516-234-8700
NY Larchmont, Sprague Electric Company 914-834-4439
NY Syracuse, Paston-Hunter Co., Inc. 315-437-2843
NY Syracuse, Sprague Electric Company 315-437-7311
NC Charlotte, Sprague Electric Company 704-527-1306
NC Raleigh, Elctrn. Mktg. Assocs. 919-847-8800
OH Dublin, Sprague Electric Company 614-761-1881
OR Beaverton, William J. Purdy Co. 503-641-9373
SC Greenville, Elctrn. Mktg. Assocs. 803-233-4637
TX Austin, Sprague Electric Company 512-458-2514
TX Dallas, Sprague Electric Company 214-235-1256
WA Redmond, William J. Purdy Co. 206-882-3144
WA Vancouver, Sprague Electric Company 206-892-0361
WI Milwaukee, D. Dolin Sls. 414-482-1111
Can Downsview, Ont., Sprague Electric of Canada, Ltd. 416-665-6066
Can Markham, Ont., Birde Mktg., inc. 416-477-7722
Can Nepean, Ont., Sprague Elec. of Canada, Ltd. 613-726-0696
Can Ottawa, Ont., Sprague Electric of Canada, Ltd. 613-238-2542

SPRAGUE ELECTRIC COMPANY, Advanced Ceramics Group, 267 Lowell Road, Hudson, NH 03051, Tel: 603-881-7200, FAX: 603-881-3168

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, The Capacitor Group, 267 Lowell Rd., Hudson, NH 03051, Tel: 603-881-7200

See Sprague Electric World Headquarters listing for list of sales offices and reps.

SPRAGUE ELECTRIC COMPANY, FIL-MAG Business Unit, 3010 Del Sol Blvd., San Diego, CA 92154-3483, Tel: 619-575-9353, TWX: 619-575-9425, FAX: 619-575-4081 ..... **A•1694, 2031**

See Sprague Electric World Headquarters listing for list of sales offices and reps.

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, Techni-Source, Inc. 602-730-8093
CA Campbell, Sprague Elec. Co. 408-374-1017
CA Cupertino, Sprague Elec. Co. 408-973-7878
CA Long Bch., Sprague Elec. Co. 213-435-9100
CA Mission Viejo, Sprague Elec. Co. 714-830-1740
CA San Diego, Miner Assocs., Inc. 619-566-9891
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-6466,818-244-9884
CA Santa Clara, Criterion Sls. 408-988-6300
CA Van Nuys, Sprague Elec. Co. 818-994-6500
CO Englewood, William J. Purdy Assocs. 303-790-2211
CT Southbury, Sprague Elec. Co. 203-264-9595
CT Wallingford, New England Tech. Sls. Corp. 203-284-8300
DC Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
FL St. Petersburg, Electramark Florida, Inc. 813-894-2299
FL Tampa, Sprague Elec. Co. 813-962-1882
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
GA Norcross, Sprague Elec. Co. 404-263-3715
ID Boise, Bob Sickler Sls. 208-344-9588
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IL St. Louis, MO, EPI Inc. 314-962-1411
IN Indianapolis, Sprague Elec. Co. 317-253-4247
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Pk., EPI Inc. 913-642-9118
KY Jackson, MS, EPI Southwest 601-856-6251
KY Lexington, SAI Mktg. Corp. 606-224-4230
MD Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
MA Burlington, New England Tech. Sls. Corp. 617-272-0434
MI Ann Arbor, Sprague Elec. Co. 313-971-7780
MI Fenton, SAI Mktg. Corp. 313-750-1922
MN Minneapolis, HMR, Inc. 612-888-2122
MS Jackson, EPI Southwest 601-856-6251
MO St. Louis, EPI Inc. 314-962-1411
NE Cedar Rapids, IA, J.R. Sls. Engrg., Inc. 319-393-2232
NH Burlington, MA, New England Tech. Sls. Corp. 617-272-0434
NY Babylon, Astrorep, Inc. 516-422-2500
NY Cherry Hill, Trinkle Sls. Inc. 609-795-4200
NY E. Syracuse, Ossmann Assocs., Inc. ... 315-437-7052
NY Henrietta, Ossmann Assocs., Inc. 716-359-1200
NY Wayne, Astrorep, Inc. 201-696-8200
NC Charlotte, Sprague Elec. Co. 704-527-1306
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Shaker Hgts., SAI Mktg. Corp. 216-751-3633
OR Vancouver, WA, Spargue Elec. Co. 503-225-0493
PA Cherry Hill, NJ, Trinkle Sls., Inc. 215-922-2080
SC Raleigh, NC, Montgomery Mktg., Inc. .. 919-851-0010
TN Huntsville, AL, Montgomery Mktg., Inc. 205-830-0498
TN Jackson, MS, EPI Southwest 601-856-6251
TX Austin, Sprague Elec. Co. 512-458-2514
TX Dallas, Sprague Elec. Co. 214-235-1256
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Englewood, CO, William J. Purdy Assocs. 303-790-2211
VA Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
WA Boise, ID, Bob Sickler Sls. 208-344-9588
WA Vancouver, Sprague Elec. Co. 206-892-0361
WI Brookfield, Sumer, Inc. 414-784-6641
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6707
Can Calgary, Alberta, Vitel Elctrns. 403-278-5833
Can Kanata, Ont., Vitel Elctrns. 613-592-0090
Can La Chine, Que., Vitel Elctrns. 514-636-5951
Can Mississauga, Ont., Vitel Elctrns. 416-676-9720
Can Toronto, Ont., Sprague Elec. of Canada, Ltd. 416-766-6123

Local Distributors

CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2000
CA El Monte, Marshall Inds., Inc. 818-459-5500
CA Santa Clara, Wyle Labs/EMG 408-727-2500
CA Sunnyvale, Acacia/VWR Elctrns. 408-745-7299
CT Milford, Falcon Elctrns., Inc. 203-878-5272
FL Tampa, Reptron Elctrns., Inc. 813-855-4656
IL Chicago, Newark Elctrns. Corp. 312-784-5100
IN Indianapolis, Graham Elctrn. Supp., Inc. 317-634-8202
MD Timonium, Zebra Elctrns., Inc. 301-252-6576
MA N. Adams, Elctrn. Supp. Ctr. 413-664-1086
MA N. Adams, Ico-Rally Corp. 413-664-4951
NY Buffalo, Summit Dists. 716-887-2800
NY Mamorneck, New Yorker Elctrns., Inc. 914-698-7600
NY Melville, Arrow Elctrns. Distbn. Div. 516-391-1300
NY Port Chester, Zeus Comps., Inc. 914-937-7400
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Westbury, Schweber Elctrns. Corp. 516-334-7555
OK Tulsa, Radio, Inc. 918-587-9123
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Almo Elctrns., Inc. 215-698-4003
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Kent Elctrns. 713-780-7770
TX Houston, Sterling Elctrns. 713-623-6600
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Pointe Claire, Montreal, Future Elctrns., Inc. 514-694-7710

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SEMICONDUCTOR GROUP

FAX: 617-853-5049

SPRAGUE ELECTRIC COMPANY, The Semiconductor Group, 115 Northeast Cutoff, Box 2036, Worcester, MA 01613-2036, Tel: 617-853-5000, TWX: 710-340-6304; *Sls. Mgr.:* Brad Marshall, VP Sls. & Mktg., Semiconductor Grp. ..... **A•1757; D•1142**

See Sprague Electric World Headquarters listing for list of sales offices and reps.

Local Sales Offices & Reps

AL Huntsville, Montgomery Mktg., Inc. 205-830-0498
AZ Tempe, Techni-Source, Inc. 602-730-8093
CA Campbell, Sprague Elec. Co. 408-374-1017
CA Cupertino, Sprague Elec. Co. 408-973-7878
CA Long Bch., Sprague Elec. Co. 213-435-9100
CA Mission Viejo, Sprague Elec. Co. 724-830-1740
CA San Diego, Miner Assocs., Inc. 619-566-9891
CA Santa Ana, Jones & McGeoy Sls., Inc. 714-547-5466,818-244-9884
CA Santa Clara, Criterion Sls. 408-988-6300
CA Van Nuys, Sprague Elec. Co. 818-994-6500
CO Englewood, William J. Purdy Assocs. 303-790-2211
CT Southbury, Sprague Elec. Co. 203-264-9595
CT Wallingford, New England Tech. Sls. Corp. 203-284-8300
DC Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
FL St. Petersburg, Electramark Florida, Inc. 813-894-2299
FL Tampa, Sprague Elec. Co. 813-962-1882
GA Norcross, Montgomery Mktg., Inc. 404-447-6124
GA Norcross, Sprague Elec. Co. 404-263-3715
ID Boise, Bob Sickler Sls. 208-344-9588
IL Rolling Meadows, Sumer, Inc. 312-991-8500
IL St. Louis, MO, EPI Inc. 314-962-1411
IN Indianapolis, Sprague Elec. Co. 317-253-4247
IN Indianapolis, SAI Mktg. Corp. 317-545-1010
IA Cedar Rapids, J.R. Sls. Engrg., Inc. 319-393-2232
KS Overland Pk., EPI Inc. 913-642-9118
KY Jackson, MS, EPI Southwest 601-856-6251
KY Lexington, SAI Mktg. Corp. 606-224-4230
MD Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
MA Burlington, New England Tech. Sls. Corp. 617-272-0434
MI Ann Arbor, Sprague Elec. Co. 313-971-7780
MI Fenton, SAI Mktg. Corp. 313-750-1922
MN Minneapolis, HMR, Inc. 612-888-2122
MS Jackson, EPI Southwest 601-856-6251
MO St. Louis, EPI Inc. 314-962-1411
NE Cedar Rapids, IA, J.R. Sls. Engrg., Inc. 319-393-2232
NH Burlington, MA, New England Tech. Sls. Corp. 617-272-0434
NJ Cherry Hill, Trinkle Sls. Inc. 609-795-4200
NJ Wayne, Astrorep, Inc. 201-696-8200
NY Babylon, Astrorep, Inc. 516-422-2500
NY E. Syracuse, Ossmann Assocs., Inc. ... 315-437-7052
NY Henrietta, Ossmann Assocs., Inc. 716-359-1200
NC Charlotte, Sprague Elec. Co. 704-527-1306
NC Raleigh, Montgomery Mktg., Inc. 919-851-0010
OH Columbus, SAI Mktg. Corp. 614-451-0778
OH Dayton, SAI Mktg. Corp. 513-435-3181
OH Shaker Hgts., SAI Mktg. Corp. 216-751-3633
OR Vancouver, WA, Sprague Elec. Co. 503-225-0493
PA Cherry Hill, PA, Trinkle Sls. Inc. 215-922-2080
SC Raleigh, NC, Montgomery Mktg., Inc. .. 919-851-0010
TN Huntsville, AL, Montgomery Mktg., Inc. 205-830-0498
TN Jackson, MS, EPI Southwest 601-856-6251
TX Austin, Sprague Elec. Co. 512-458-2514
TX Dallas, Sprague Elec. Co. 214-235-1256
TX Richardson, Bonser-Philhower Sls. 214-234-8438
UT Englewood, CO, William J. Purdy Assocs. 303-790-2211
VA Cherry Hill, NJ, Trinkle Sls. Inc. 609-795-4200
WA Boise, ID, Bob Sickler Sls. 208-344-9588
WA Vancouver, Sprague Elec. Co. 206-892-0361
WI Brookfield, Sumer, Inc. 414-784-6641
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6707
Can Calgary, Alberta, Vitel Elctrns. 403-278-5833
Can Kanata, Ont., Vitel Elctrns. 613-592-0090
Can La Chine, Que., Vitel Elctrns. 514-636-5951
Can Mississauga, Ont., Vitel Elctrns. 416-676-9720
Can Toronto, Ont., Sprague Elec. of Canada, Ltd. 416-766-6123

Local Distributors

CA Culver City, Hamilton/Avnet Elctrns. .. 213-558-2000
CA El Monte, Marshall Inds., Inc. 818-459-5500
CA Santa Clara, Wyle Labs/EMG 408-727-2500
CA Sunnyvale, Acacia/VWR Elctrns. 408-745-7299
CT Milford, Falcon Elctrns., Inc. 203-878-5272
FL Tampa, Reptron Elctrns., Inc. 813-855-4656
IL Chicago, Newark Elctrns. Corp. 312-784-5100
IN Indianapolis, Graham Elctrn. Supp., Inc. 317-634-8202
MD Timonium, Zebra Elctrns., Inc. 301-252-6576
MA N. Adams, Elctrn. Supp. Ctr. 413-664-1086
MA N. Adams, Ico-Rally Corp. 413-664-4951
NY Buffalo, Summit Dists. 716-887-2800
NY Mamorneck, New Yorker Elctrns., Inc. 914-698-7600
NY Melville, Arrow Elctrns. Distbn. Div. 516-391-1300
NY Port Chester, Zeus Comps., Inc. 914-937-7400
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Westbury, Schweber Elctrns. Corp. 516-334-7555
OK Tulsa, Radio, Inc. 918-587-9123
PA Montgomeryville, Pyttronic Inds., Inc. .. 215-643-2850
PA Philadelphia, Almo Elctrns., Inc. 215-698-4003
TX Ft. Worth, TTI, Inc. 817-831-8300
TX Houston, Kent Elctrns. 713-780-7770

TX Houston, Sterling Elctrns. 713-623-6600
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
Can Pointe Claire, Montreal, Future Elctrns., Inc. 514-694-7710

SPRAGUE GOODMAN

FAX: 516-746-1396

SPRAGUE-GOODMAN ELCTRNS., INC., 134 Fulton Ave., Garden City Pk., NY 11040, Tel: 516-746-1385, TELEX: 14-4533; FSC No.: 52769; Empl.: 80; *Sls. Mgr.:* Michael Trubowitsch ..... **A•1174-1175**

Local Sales Offices & Reps

AL Huntsville, Interep Assocs. 205-533-1730
AZ Phoenix, Sanford Sls. Assocs. 602-957-3570
CA Cupertino, Dura Elctrn. Sls. 408-255-2084
CA Garden Grove, ELSCO Elctrns. 714-891-4621
CO Denver, West Inc. 303-477-8180
CT Beacon Falls, KSA Connecticut 617-443-5881
FL Clearwater, Beacon Elctrn. Assocs. ... 813-796-2378
GA Norcross, Interep Assocs., Inc. 404-449-8680
IL Chicago, B.N.I. Elctrns. 312-775-1717
IN Ft. Wayne, Denton Mktg., Inc. 219-486-0665
IA Marion, M.S.B. Assocs. 319-377-6261
KS Shawnee Mission, M.S.B. Assocs. 913-432-2131
MD Monkton, Imagitron Sls. 301-374-5600
MA Sudbury, KSA of New England 617-443-5881
MI Southfield, Fred H. Gehrke & Assocs. 313-559-5363
MO St. Charles, M.S.B. Assocs. 314-946-5577
NJ Chatham Township, Richman/Waterview Tech. Sls. 201-635-1839
NY Commack, Richman Sls. Co. 516-543-5532
NY Utica, Upstate Engrg. Sls. 315-797-6721
NC Raleigh, Micro Sls. Inc. 919-881-0007
OH Cincinnati, Stegman Blaine Mktg. 513-729-1969
OR Portland, Harry Levinson 503-245-1902
PA Maple Glen, Imagitron/Pennsylvania .. 800-638-3592
TN Greenville, Interep Tennessee 615-639-3491
TX Seagoville, Delta Comps. 214-287-6333
WA Seattle, Harry Levinson Co. 206-382-1300
PR Rio Piedras, Elctrn. Sls. Assocs. 809-762-6459
Can Toronto, Ont., Norgay Entprs. 416-259-9663

Local Distributors

CA Canoga Pk., Schweber Elctrns. 213-999-4702
CA Chatsworth, TTI, Inc. 818-709-1010
CA Garden Grove, Natl. Elctrns. 714-892-7749
CA Gardena, Schweber Elctrns. 213-327-8409
AL Huntsville, Comp. Dists. 205-883-7501
CA Irvine, Kelex Elctrns. 714-863-1230
CA Irvine, Schweber Elctrns. 714-863-0200
CA Milpitas, Projections Unltd. 408-942-1717
CA Milpitas, TTI, Inc. 408-943-9155
AZ Phoenix, Arizona Comps. 602-269-5655
CA Sacramento, Schweber Elctrns. 916-929-9732
CA San Diego, Neumann Elctrns. 619-695-3005
CA San Diego, Projections Unltd. 619-453-7900
CA San Jose, Schweber Elctrns. 408-946-7171
CA Sunnyvale, Acacia/VWR Elctrns. ..... 408-745-7200 (x 69)
CA Tustin, Projections Unltd. 714-544-2700
CO Englewood, Schweber Elctrns. 303-799-0258
CO Lakewood, Acacia/VWR Elctrns. 303-232-2882
CO Westminster, TTI, Inc. 303-429-6806
FL Altamonte Springs, Schweber Elctrns. 305-331-7555
FL Ft. Lauderdale, Bros. Elctrns. of FL 305-561-6700
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Largo, Elctrn. Precepts of FL 813-544-3636
FL Melbourne, Comp. Dists. 305-724-9910
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, TTI, Inc. 305-859-1000
IL Elk Grove Vl, Schweber Elctrns. 312-364-3750
IL Skokie, Kellner Elctrns., Inc. 800-323-0460
IN Indianapolis, Pioneer/Indiana ..... 317-849-7300 (x 350)
KS Overland Pk., Schweber Elctrns. 913-492-2922
MD Columbia, TTI, Inc. 301-995-1331
MD Gaithersburg, Schweber Elctrns. 301-840-5900
MA Bedford, Schweber Elctrns. 617-275-5100
MA Wilmington, Marshall Inds. 617-658-0810
MA Woburn, Sterling Elctrns. 617-938-6200
MA Woburn, TTI, Inc. 617-938-8800
MN Eden Prairie, TTI, Inc. 612-944-5080
MO Earth City, Schweber Elctrns. 314-739-0526
NJ E. Brunswick, Varitech Elctrns. Inc. 201-390-4700
NJ Fairfield, Schweber Elctrns. 201-227-7880
NY Buffalo, Summit Dists., Inc. 716-887-2835/2836
NY Mamoroneck, New Yorker Elctrns. 914-698-7600
AZ Phoenix, Schweber Elctrns. 602-997-4874
AZ Phoenix, TTI, Inc. 602-966-1616
NY Rochester, Schweber Elctrns. 716-424-2222
NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, Tri-Start Elctrns. 516-737-2200
NY Ronkonkoma, TTI, Inc. 516-737-2000
NY Westbury, Schweber Elctrns. ..... 516-334-7555 (x 276)
OH Beachwood, Schweber Elctrns. 216-464-2970
OH Columbus, TTI, Inc. 614-848-5770
OH Dayton, Pioneer/Dayton 513-236-9900
PA Harrisburg, Adtech 717-939-8337
PA Horsham, Schweber Elctrns. 215-441-0600
PA Philadelphia, Almo Elctrns. 215-698-4003
PA Pittsburgh, Schweber Elctrns. 412-782-1600
TX Dallas, Comp. Dists. 214-644-0373
TX Dallas, Schweber Elctrns. 214-661-5010
TX Ft. Worth, TTI, Inc. 800-433-7637
TX Garland, J & S 214-487-8808
VT Charlotte, Kellner Elctrns., Inc. 800-323-0460
WA Redmond, TTI, Inc. 206-882-0291
WA Seattle, Kam Elctrns. 206-382-1300
WI Milwaukee, Marsh Elctrns., Inc. 414-475-6000
WI New Berlin, Schweber Elctrns. 414-784-9020

SPRAGUE SOLID STATE, 3900 Welsh Rd., Willow Grove, PA 19090, Tel: 215-657-8400, TELEX: 476-1101, TWX: 510-661-7267; Empl.: 525

SPRUCE PINE MICA CO., Mtn. Laurel Dr., Spruce Pine, NC 28777, Tel: 704-765-4241, FAX: 704-765-7192; Empl.: 45; *Sls. Mgr.:* Bill Pittman

SPS INC. (MUIRHEAD VACTRIC), 51 Commerce St., Springfield, NJ 07081, Tel: 201-376-1222, TELEX: 13-8275; FSC No.: 0BKV4; Empl.: 60; *Sls. Mgr.:* Bob Conroy

SPS SOFTWARE PRODUCTS & SERVICES, INC., 14 E. 38th Street, 14th Fl., New York, NY 10016, Tel: 212-686-3790, TELEX: 852616, FAX: 212-481-7464; *Sls. Mgr.:* Peter Voletsky

SPUR PRODUCTS CORP., 13649 Beach Ave., Marina Del Rey, CA 90292, Tel: 213-822-7100, FAX: 213-578-0370; Empl.: 19; *Sls. Mgr.:* Ray Lorenz

SQUARE D CO., Executive Plaza, Palatine, IL 60067, Tel: 312-397-2600, TELEX: 247-119; Empl.: 22600; *Sls. Mgr.:* C. N. Thompson, VP; *Dist. Mgr.:* T. W. Wilbor, VP

SR ENGINEERING, BW/IP International, Inc., 13961 Nautilus Dr., Dept. E, Garden Grove, CA 92643, Tel: 714-554-4200, TELEX: 364412INTR-871, FAX: 714-554-1069; FSC No.: 21441; *Sls. Mgr.:* Coleman W. Conrad

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Phoenix, The Knight Co. 602-994-1311
CA Hayward, Liaison, Inc. 415-783-1131
CA Los Angeles, The Knight Co. 714-833-8250
MA Hingham, Shain Assocs., Inc. 617-740-2334
FL Orlando, Hughes Assocs., Inc. 305-774-7117
IL La Grange Pk., Bierhaus Sls. Inc. 312-354-5100
IA Cedar Rapids, Howard R. Brown Sls. Co. 319-366-6635
NH Nashua, Shain Assocs., Inc. 603-881-4881
NY Roslyn Hgts., Travco Assocs. 516-621-3223
WA Seattle, Liaison, Inc. 206-767-3870

SRITEK, INC., 8705 Freeway Dr., Macedonia, OH 44056, Tel: 216-468-3380; Empl.: 40; *Sls. Mgr.:* Dennis Vinci

SSAC Inc

FAX: 315-638-0333

SSAC INCORPORATED, P.O. Box 1000, Baldwinsville, NY 13027, Tel: 315-638-1300, TELEX: 64-6221; FSC No.: 16-0985719; Empl.: 250; *Sls. Mgr.:* G. Weeks ... **B•1589**

Local Sales Offices & Reps

AL Decatur, Tenn Tech, Inc. 205-350-0630
AZ Scottsdale, Vikeland Sls. Inc. 602-948-7921
AR Ft. Smith, Electro-Related Prods. 501-452-4030
CA LaHabra, Nolan Corp. 213-694-2145
CA Pleasanton, Sierra Sls. 415-463-2250
CO Englewood, Computech Mktg. 303-773-3981
FL Tampa, Florida Comp. Sls. 813-960-7044
GA Marietta, Tenn Tech, Inc. 404-971-1419
IL Addison, Vikeland Sls. Inc. 312-832-8425
IN Beech Grove, Control Sls. Inc. 317-786-2272
KS Prairie Vl., George Pearson Co. 913-362-4442
MD Glen Burnie, Faber-Renoff 301-768-4554
MA Southborough, Motion Engrg. Inc. 617-485-2144
MI Lake Orion, JFCO Inc. 313-693-2053
MN St. Paul, Vikeland Sls. Inc. 612-645-4647
NJ Paramus, Prime Indl. Comps. 201-262-9090
NY Fairport, Batian Sls. Agy. Inc. 716-223-0237
NC Charlotte, P L & E Inc. 704-366-9222
OH Cleveland, JFCO Inc. 216-398-6300
PA Maple Glen, Certified Elctrl. Sls. 215-646-8996
PA Pittsburgh, JFCO Inc. 412-823-5400
TX Lewisville, Elec. Control Assocs. 214-221-3143
VA Midlothian, Daniel E. Boehling & Assocs. 804-794-5879
WA Mukilteo, Krippner & Assocs. 206-743-3579
WI Thiensville, TFL Assocs. 414-242-6800
Can Brampton, Ont., CPM Inds. 416-457-2450

Local Distributors

AZ Tempe, Control Design Supp. 602-829-7981
AR Little Rock, Carlton Bates 501-562-9100
CA Anaheim, Control Design Supp. 714-821-1516
CA S. San Francisco, Steven Engrg. 415-588-9200
CT Southington, Electro Mechanical Drvs. 203-621-7335
FL Lakeland, A. A. Elec. 813-665-6941
GA Atlanta, Georgia Control Cen. 404-876-8833
GA Norcross, A. A. Elec. 404-449-8670
IL Carol Stream, Lectro Comps. 312-690-0520
IL Mt. Prospect, Automation Equip. Co. ... 312-398-7550
IN Indianapolis, Control Design 317-788-4559
IA Marion, Control Design Supp. 319-373-2923
KS Wichita, Delta Elec. Supp. 316-262-3756
MA Hingham, Sager Elctrl. Supp. 617-749-6700
MA W. Springfield, Tectrol Assocs. 413-733-3695
MA Woburn, Control Design 617-932-9404
MI Grand Rapids, E.C. Elctrns. Inc. 616-530-0576
MN Minneapolis, Control Design 612-721-1628
MN Minneapolis, United Elec. Co. 612-338-1915
MO Kansas City, Barr-Thorp Elec. Co. 816-531-8840
MO Maryland Heights, French Gerleman .. 314-569-3122
MO Springfield, SMC Elec. 417-865-2822
MO St. Louis, Control Design Supp. 314-426-3150
NJ E. Rutherford, A. A. Elec. Co. 201-777-5477
NJ Edison, Brownell Instrs. & Controls 201-287-2030
NJ Oakland, Relay Specialties 201-337-1000
NY Baldwinsville, Scibetta Dist. 315-622-3993
NY Hauppauge, Sager Elctrns. 516-348-1300
NY Penfield, Carlen Distrs. 716-381-9050
NY Rochester, Masline Elctrns. 716-546-5373
NY Rome, Rome Elctrns. 315-337-5400
NY Woodside, Switches Unltd. 718-478-5000
NC Charlotte, Brownell Electro Inc. 704-597-1270
NC Charlotte, Control Design Supp. 704-588-4410
NC Shelby, Dixie Ind. Supp. 704-482-5641
OH Toledo, Fee & McCarthy, Inc. 419-535-3163
OK Oklahoma City, Carlton Bates 405-681-4446
OR Clackamas, Amfac Elec. 503-657-3020
PA Harrisburg, Cumberland Elctrns. 717-232-9715
PA Malvern, Control Design Supp. 215-296-0150
TX Dallas, Watson Elec. 214-742-8441
VA Glen Allen, Hermitage Distrs. 804-798-3830
WI New Berlin, Control Design Supp. 414-784-1015
Can Concord, Ont., Trade Elec. Supp. 416-661-7111
Can Dorval, Que., Raytech Controls Inc. 514-631-4806
Can Scarborough, Ont., Banke Elctrns. 416-292-5152
Can Woodbridge, Ont., Sonepar 416-747-7800

STACKBIN CORP., Albion Road, P.O. Box 397, Lincoln, RI 02865, Tel: 401-333-1600, 800-346-1018; Empl.: 75; *Sls. Mgr.:* Valerie Baxter

STACKPOLE, CARBON DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, TELEX: 914-514, TWX: 510-693-4511; *Sls. Mgr.:* B. E. Speedy

STACKPOLE COMPONENTS CO., See Ark-les Special Products Grp., Div. of Stackpole Switches

STACKPOLE, MAGNET DIV., 201 Stackpole St., St. Marys, PA 15857, Tel: 814-781-1234, TWX: 510-693-4511, FAX: 814-781-8570; *Sls. Mgr.:* G. A. Olson, Sr. Prod. Sls. Mgr.

STACO, INC., See Staco Transpower

STACO ENERGY PRODUCTS CO., 301 Gaddis Blvd., Dayton, OH 45403, Tel: 513-253-1191, TELEX: 288-032, FAX: 513-253-1723; FSC No.: 83008; Empl.: 146; *Sls. Mgr.:* Robert Simpson

STACOSWITCH, 1139 Baker St., Costa Mesa, CA 92626, Tel: 714-549-3041, TWX: 910-595-1507; FSC No.: 12522;Multiple; Empl.: 100; *Sls. Mgr.:* D. Sugg

STACO TRANSPOWER, 610 W. 6th St., Mt. Carmel, IL 62863, Tel: 618-262-5555, TELEX: 510-525-2254; FSC No.: 83008; Empl.: 100; *Sls. Mgr.:* K. R. Harris

STAFFALL INC., 7 Woodland St, Providence, RI 02908, Tel: 401-351-8282, TWX: 710-381-6964; Empl.: 25

STAINLESS, INC., 3rd St., N. Wales, PA 19454, Tel: 215-699-4871, TWX: 510-661-8097, FAX: 215-699-9597; Empl.: 80; *Sls. Mgr.:* Jess C. Rodriguez

STANCOR PRODUCTS, Hamilton Standard Controls, 131 Godfrey St., Logansport, IN 46947, Tel: 219-722-2244, TWX: 810-295-0699, FAX: 219-722-5189; FSC No.: 80089; Empl.: 400; *Sls. Mgr.:* Terry D. Smith; *Dist. Mgr.:* Terry D. Smith ..... **A•2393**

STANDARD CONDENSER CORP., 1065 W. Addison St., Chicago, IL 60613, Tel: 312-327-5440; FSC No.: 97419; *Sls. Mgr.:* B. P. McLean

STANDARD CRYSTAL CORPORATION, 9940 E. Baldwin Pl., El Monte, CA 91734, Tel: 818-443-2121, TELEX: 4998755, FAX: 818-443-9049; FSC No.: 30149; *Sls. Mgr.:* Don Groh; *Dist. Mgr.:* Betty Longwell ..... **A•1469**

STANDARD ENERGY, Div. WBH Scientific, Inc., Rte. 32, Greenville, NY 12083, Tel: 518-966-4197, TELEX: 754180; *Sls. Mgr.:* Gary Hanington

STANDARD ENVIRONMENTAL SYSTEMS, INC., 383 Minnisink Rd., Totowa, NJ 07512, Tel: 201-256-2200, TWX: 710-988-5722, FAX: 201-256-2820; Empl.: 50

STANDARD GRIGSBY, INC., Flint Industries, 920 Rathbone Ave., Aurora, IL 60507, Tel: 312-844-4300, TWX: 910-232-3138, FAX: 312-844-4286; Empl.: 350; *Sls. Mgr.:* Jeff Shaw; *Dist. Mgr.:* Jeff Shaw ..... **B•1796-1797**

STANDARD GRIGSBY INC., W. Gunther GMBH, Virnsberger Strasse 51, D 8500 Nurnberg 82, West Germany, Tel: 0911-65521, TELEX: 622351, FAX: 0911/6552-239 ..... **B•1796-1797**

Local Sales Offices & Reps

AL	Huntsville, Elctrn. Mktg. Assocs.	205-536-3044
AZ	Scottsdale, Heath & Assocs.	602-945-9546
CA	Laguna Hills, Jack Fitch & Assocs.	714-951-0196
CA	Milpitas, Maxim Elctrn. Sls.	408-946-6001
CO	Englewood, D. M. Harthun & Assocs.	303-792-5050
CT	Madison, Focus Elctrn. Sls.	203-245-2097
FL	Casselberry, Dyne-A-Mark Corp.	305-629-5557
FL	Clearwater, Dyn-A-Mark Corp.	813-441-4702
FL	Ft. Lauderdale, Dyne-A-Mark Corp.	305-771-6501
GA	Atlanta, Elctrn. Mktg. Assocs.	404-448-1215
IL	Elmhurst, Hill-Gray, Inc.	312-832-4101
IN	Indianapolis, Needler Sls. Co., Inc.	317-255-8056
IA	Cedar Rapids, Rep Assocs.	319-373-0152
KS	Parket, S. W. Wollard	913-898-6556
MD	Baltimore, Hagy Corp.	301-529-3995
MA	Taunton, Focus Elctrn. Sls.	617-824-3840
MI	Madison Hgts., Pine Sls.	313-589-0350
MN	Bloomington, Murnco	612-854-4161
NJ	Manville, Dynorep, Inc.	201-685-0135
NM	Albuquerque, Heath & Assocs.	505-296-8084
NY	Syracuse, Advanced Comps. Inc.	315-699-2671
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Cleveland, Finnegan & Co.	216-398-6300
OH	Dayton, Finnegan & Co.	513-890-8322
OR	Beaverton, Micro Sls.	503-645-2841
PA	Feasterville, Knowles Assocs.	215-322-7100
PA	Newton Sq., Hagy Corp.	215-459-0504
PA	Pittsburgh, Finnegan & Co.	412-823-5400
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
TX	Irving, Aid Elctrns.	214-790-4761
WA	Bellevue, Micro Sls.	206-451-0568
WI	Madison, Hill Gray, Inc.	608-246-8155

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CO	Englewood, NEP Elctrns.	303-799-9898
FL	Oakland Pk., Zelcon, Inc.	305-565-2555
MN	Fridley, Voyager Elctrns. Corp.	612-571-7766
NJ	Mt. Laurel, Wes-Garde Comps. Grp.	609-778-8190
OH	Cincinnati, U.R.I. Elctrns.	513-761-4030
WI	Ocowomowoc, G.W. Elctrns. Ltd.	414-567-9445

STANDARD MICROSYSTEMS, 35 Marcus Blvd., Hauppauge, NY 11788, Tel: 516-273-3100, TWX: 510-227-8898; FSC No.: 53848; Empl.: 700; *Sls. Mgr.:* J. P. Chalmin; *Dist. Mgr.:* Steve Brander

STANDARD OIL ENGINEERED MATERIALS CO., Carborundum, P. O. Box 156, Niagara Falls, NY 14302, Tel: 716-278-2000; Empl.: 2000 ..... **A•2032-2033**

STANDARD REFERENCE LABS, INC., See Koep Precision Standards, Inc.

STANDARD WIRE & CABLE CO., 2345 Alaska Ave., El Segundo, CA 90245, Tel: 213-536-0006, (800)-447-0006/821-5276, TELEX: 65-3423, TWX: 910-340-6758, FAX: 213-643-9218; Empl.: 110; *Sls. Mgr.:* Glenn Davis; *Dist. Mgr.:* Jerry Gaither

STANDEX ELECTRONICS, Standex International, 4538 Camberwell Rd., Cincinnati, OH 45209, Tel: 513-871-3777, TELEX: 212066, FAX: 513-871-3779; FSC No.: 56402; Empl.: 450; *Sls. Mgr.:* Charles C. Johnson, VP Sls. ..... **A•1287; B•1576, 1798-1799**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Mesa, Sedco Sls.	602-461-9069
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	Los Altos, Frauman Assocs.	415-941-0660
CO	Longmont, Butler Tech. Sls.	303-651-7703
CT	Beacon Falls, KSA of New England	203-729-6285
FL	Boca Raton, R. W. Mitscher Co.	305-368-3841
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IN	Greenfield, William Deem & Assocs., Inc.	317-326-2357
MD	Edina, Jay Borman Sls. Co.	612-922-5525
MD	Laurel, R. W. Mitscher Co., Inc.	301-498-6090
MA	Sudbury, KSA of New England	617-443-5881
MI	Farmington Hills, W. R. Hummon & Assocs., Inc.	313-474-0661
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
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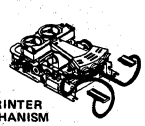
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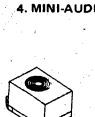
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FL Orlando, MacKay, Smith & Assocs. ... 305-423-4353
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MA	Lowell, Underwood Sls.	617-256-8191
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CO	Wheat Ridge, Trembly Assoc.	303-421-8900
FL	Ft. Walton Bch., South Rep	904-863-2389
GA	Norcross, South Rep	404-262-6942
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LA	Lafayette, Kemp Engrg.	318-269-9452
MD	Columbia, L. D. Lowery Inc.	301-381-0225
MI	Southfield, L. H. Dickelman Co.	313-353-8210
MN	Minneapolis, HMR, Inc.	612-888-2122
MO	St. Louis, Advanced Tech. Sls.	314-878-2921
NJ	West Caldwell, Grimm, Siegel Assocs.	201-575-9300
NY	Buffalo, H. C. Zang Agency	716-877-3677
NC	Charlotte, J. Rudisill Assocs.	704-377-6901
OH	Cincinnati, Stegman Blaine Mktg. Co.	513-729-1969
PA	Broomall, L. D. Lowery, Inc.	215-356-5300
PA	Pittsburgh, R. F. Clark Co.	412-242-9500
TX	Bedford, W. Pat Fralia Co.	817-267-3577
TX	Houston, W. Pat Fralia Co	713-772-1572
WA	Bellevue, Eltech, Inc.	206-643-4330
Can	Scarborough, Ont., Renfrew Elec. Co., Ltd.	416-752-4611

ST-SEMICONDUCTORS OF INDIANA, INC., 415 N. College Ave., P.O. Box 609, Bloomington, IN 47402-0609, Tel: 812-332-1435, TWX: 810-351-1384; Empl.: 100; *Sls. Mgr.:* Roscoe Myers

SUCKLE CORP., 733 Davis St., Dept. EM, Scranton, PA 18505, Tel: 717-346-3871, FAX: 717-346-1612; Empl.: 220; *Sls. Mgr.:* M. H. Brenner

SULLINS ELECTRONICS CORP., P.O. Box 189, 801 E. Mission Rd., San Marcos, CA 92069, Tel: 619-744-0125, TWX: 910-322-1472, ESYLNK: 62912413, FAX: 619-744-6081; Empl.: 100; *Sls. Mgr.:* Judy Evans; *Dist. Mgr.:* Ken Flagg ..... **C•1556-1557**

Local Sales Offices & Reps

AZ	Phoenix, O'Donnell Assocs.	602-944-9542
CA	La Canada, K.C.P. Ent.	818-796-1813
CA	San Diego, CK Assocs.	619-279-0420
CA	Santa Clara, Nova-Tronix	408-727-9530
CA	Santa Clara, Nova-Tronix, Inc.	408-727-9530
CO	Wheatridge, Cluff & Assocs.	303-423-9345
FL	Casselbery, Southern Elctrn. Mktg.	305-831-2822
GA	Lithia Springs, Effective Mktg. Force	404-948-6023
IL	Elmhurst, Utronix Sls., Inc.	312-834-1100
IN	Indianapolis, John Sukup Inc.	317-253-5501
KS	Shawnee Mission, M-S-B Assoc.	913-432-2131
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Harvard, Cycle Sls.	617-456-6868
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
NJ	Medford, Comp. Consultants	609-654-5300
NY	Valley Stream, HLJ Comp-Tech	516-599-2999
OH	Centerville, Omega Sls., Inc.	513-434-5507
TX	Allen, Bozman & Assocs.	214-578-1780
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
WI	Oconomowoc, Artmor Ltd.	414-367-8789
Can	Scarborough, Ont., R-Tronics	416-299-6676

Local Distributors

AL	Birmingham, American Elctrn. Supp.	205-942-4656
AZ	Phoenix, Arizona Comps.	602-269-5655
CA	Burbank, Atwater Elctrns.	818-841-9050
CA	Pasadena, Empire Elctrns.	213-681-2711
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Simi Valley, Lee Johnson Sls.	818-346-5412
CO	Arvada, Denver Beta Wintronic	303-431-7161
CT	Bridgeport, Millenium Elctrn. Sls.	203-372-2037
FL	Winter Park, Deanco	305-671-5100
GA	Marietta, Deanco	404-429-0126
IL	Carol Stream, Lectro Comps.	312-690-0520
IL	Chicago, NEP Elctrns.	312-625-8400
IN	Ft. Wayne, Graham Elctrns.	219-423-3422
IA	Cedar Springs, Barton Digital	319-474-2247
MD	Gaithersburg, Axis Elctrns., Inc.	301-840-9640
MA	Canton, EPC Elctrns. Inc.	617-821-2111
MI	Farmington Hills, Advent Elctrns.	313-477-1650
MI	Grand Rapids, Caider Elctrns.	616-698-7400
MN	St. Paul, Shelley Ragon Inc.	612-642-2828
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NH	Hampstead, Astrum Elctrns.	603-329-9640
NJ	Fairfield, Deanco	201-575-7960
NJ	Union, Meridian Supp.	201-687-6220
NM	Albuquerque, Electronic Parts	505-293-6161
NY	Ithaca, Deanco	607-257-4444
NY	Valley Stream, Forejay Assocs.	516-599-2999
NC	Hickory, Southeastern Elctrns., Inc.	919-828-2311
OH	Solon, REH Elctrns.	216-248-1636
OH	Twinsburg, Schuster Elec. Co.	216-425-8134
OR	Portland, Dunn Elctrns.	503-285-0214
PA	McKean, Advacom	814-476-7774
RI	Warwick, Cal-Greg Comps., Inc.	401-884-5101
TN	Knoxville, Indl. Elctrns., Inc.	615-573-7135
TX	Addison, Connec/Tek, Inc.	214-733-4411
TX	Dallas, Cypress Elctrns.	214-869-1435
UT	Salt Lake City, S.L.C. Wintronics	801-483-1882
VA	Virginia Bch., Deanco	804-499-3322
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Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378

SUMITRONICS, INC., Sumitomo Corporation, 580 N. Pastoria Ave., Sunnyvale, CA 94086, Tel: 408-737-7683, TELEX: 278869; FSC No.: 408-737-9189; Empl.: 40; *Sls. Mgr.:* Ken Fujii

SUMMAGRAPHICS CORP., 777 State Street Extension, Fairfield, CT 06430, Tel: 203-384-1344, TELEX: 964348; Empl.: 170; *Sls. Mgr.:* John Livesay; *Dist. Mgr.:* Jim Whitney

SE

FAX: 618-654-2351

SUMMIT ELECTRONICS, Basler Electric, Box 269, Route 143, Highland, IL 62249, Tel: 618-654-2341, 800-645-2074 ..... **D•1979**

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MN Minneapolis, Electro Serve 612-338-3475
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NM Albuquerque, Trembly Assocs. 505-266-8616
NY Canandaigua, Mamula Sls. 716-394-5560
NY Smithtown, T & K Sales 516-724-3456
PA Exton, Linear Sls. 215-524-8080
TX Houston, Barry Sls. 713-784-5860
TX Richardson, Barry Sls. 214-234-0255
UT N. Salt Lake City, Trembly Assocs. 801-295-4703
VA Richmond, Glasscock & Assocs. 804-740-0063
WA Redmond, Elctrn. Mktg. Grp. 206-882-0962
Can Mississauga, ON, ASG/Wilson Sls. ... 416-677-8200

SUMMIT ENGINEERING CORP., Box 938, Bozeman, MT 59715, Tel: 406-587-4511, TWX: 910-975-1950; Empl.: 300; *Sls. Mgr.:* Marty Connor

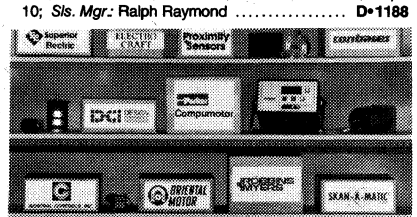
SUMX CORP., Box 14864, Austin, TX 78761, Tel: 512-835-0330, TWX: 910-350-5536, FAX: 512-832-5463; Empl.: 30; *Sls. Mgr.:* Robert K. Hammar

SUNBANK ELECTRONICS, 1740 Commerce Way, Paso Robles, CA 93446, Tel: 805-238-2840, TWX: 910-351-5805; FSC No.: 07418; Empl.: 260; *Sls. Mgr.:* Denis Connolly; *Dist. Mgr.:* Robert Halderman

SUNDSTRAND DATA CONTROL INC., Sundstrand Corporation, P. O. Box 97001, Redmond, WA 98073-9701, Tel: 206-885-3711, TELEX: RCA 286144; Empl.: 2000

Sun Electronic Systems, Inc.

SUN ELECTRONIC SYSTEMS, INC., 1601 NW 38th Ave., Ft. Lauderdale, FL 33311, Tel: 305-587-5577; Empl.: 10; *Sls. Mgr.:* Ralph Raymond ..... **D•1188**



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CT New Milford, D & R Controls 203-355-0921
FL Tampa, State Instrs. 813-933-7676
TX Austin, Ledbetter-Neal Assocs. 512-835-6642

SUN-FLEX CO., INC., 20 Pimentel Ct., Novato, CA 94947, Tel: 415-883-1221; TELEX: 172-208; *Sls. Mgr.:* David Render; *Dist. Mgr.:* David Render

SUN RESEARCH, INC., Box 210, Old Bay Rd., New Durham, NH 03855, Tel: 603-859-7110, TWX: 510-297-4444; *Sls. Mgr.:* Paul A. Blaisdell

SUNRISE ELECTRONICS, INC.

FAX: 818-914-1583

SUNRISE ELECTRONICS, INC., 524 S. Vermont Ave., Glendora, CA 91740, Tel: 818-914-1926, TWX: 910-584-3847; Empl.: 15; *Sls. Mgr.:* Allan V. Carey ..... **A•1758**

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AL Huntsville, Beacon Elctrns. 205-881-5031
AZ Phoenix, Aztec 602-944-9185
CA Los Angeles, West Coast Reps. 714-558-6100
CA San Jose, Reptronics 408-947-0770
CO Denver, Aztec 303-779-5285
FL Boca Raton, Beacon Elctrns. 305-392-3500
FL Clearwater, Beacon Elctrns. 813-796-2378
FL Maitland, Beacon Elctrns. 305-332-1940
GA Atlanta, Beacon Elctrns. 404-256-9640
IL Chicago, Berndt Assocs. 312-283-0713
MA Boston, Design Automation Sls., Inc. .. 603-424-7909
MI Farmington Hills, Carter, McCormic & Peirce 313-477-7700
MN Minneapolis, Berndt 612-546-2021
MO St. Louis, Engrg. Svcs. Co. 314-997-1515
NM Albuquerque, Aztec 505-262-1688
NY New York City, Beta-Lambda 201-446-1100
NY Syracuse, Martin P. Andrews 315-637-5291
NC Raleigh, Beacon Elctrns. 919-787-0330
OH Cleveland, Carter, McCormic & Peirce 216-779-5100
PA Pittsburgh, Carter, McCormic & Peirce 412-733-7490
TX Dallas, Beacon Elctrns. 214-437-1505
UT Salt Lake, Aztec 801-355-9256
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WI Milwaukee, Berndt Assocs. 414-545-8400
Can Montreal, Bytewide 514-636-4121

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SUPERIOR CARBON PRODUCTS, INC., Hwy. 35, Superior Place, Walnut Grove, MS 39189, Tel: 601-253-2442, FAX: 601-253-2430; Empl.: 61; *Sls. Mgr.:* Paul Merrill Kling

SUPERIOR ELECTRIC, 383 Middle St., Bristol, CT 06010, Tel: 203-582-9561, TELEX: 962-446, TWX: 710-454-0682; FSC No.: 58474; Empl.: 800; *Sls. Mgr.:* Charles Ritter/James Hayden; *Dist. Mgr.:* A. Nicholson ..... **A•2370-2371; B•1260-1261; C•1558; D•2155**

Local Sales Offices & Reps
AL Huntsville, Skor, Inc. 205-881-5808
CA Canoga Pk., FLW, Inc. 818-719-0037
CA Carlsbad, FLW, Inc. 619-434-5251
CA Costa Mesa, FLW, Inc. 714-751-7512
CA Hayward, FLW, Inc. 415-786-9070
CO Aurora, Power Sys. 303-292-5587
CT Huntington, Power Tech, Inc. 203-926-0052
FL Altamonte Springs, Raycom, Inc. 305-682-0032
FL Ft. Pierce, Skor, Inc. 305-466-1551
FL Melbourne, Raycom, Inc. 305-259-7988
FL Orlando, Raycom, Inc. 305-859-5504
FL Wellborn, Raycom, Inc. 904-963-5023
GA Atlanta, Skor, Inc. 404-381-7300
IL Vernon Hills, Mike Malich, Co. 312-438-0870
IN Indianapolis, Engrg. Prod. Assocs., Inc. 317-353-6867
MD Gaithersburg, Powell-Pendergraph, Inc. 301-921-4200
MN Edina, Engrg. Prod. Assocs., Inc. 612-835-9022
MS Jackson, Doby Assocs. 601-981-1138
MO St. Louis, Richard Greene Co. 314-994-0222
NJ Union, Tri-Tech Sls. Assocs., Inc. 201-851-0370
NM Albuquerque, Fry Gages, Inc. 505-262-1525
NY E. Syracuse, Ossmann Assocs. 315-437-2332
NY Henrietta, Ossmann Assocs. 716-359-1200
NC Charlotte, Davis Godwin Assocs., Inc. 704-392-6181
OR Portland, Unity Power Sys. 503-620-0373
PA Willow Grove, Powell-Pendergraph ... 215-657-0330
TX Garland, Electrotech Sys. 214-226-8392
TX Grapevine, Electro Tech Sys. 817-481-1583
TX Houston, Elctrl. Sls. Assocs. 713-464-3557
TX Longview, Electro Tech Sys. 214-759-0875
UT Salt Lake City, TEMSA 801-487-8811
VA Richmond, Powell-Pendergraph 804-270-1400
WI Milwaukee, Mike Malich Co. 414-327-6869

SUPERIOR FLUX & MFG. CO., 95 Alpha Pk., Cleveland, OH 44143, Tel: 216-461-3315; Empl.: 10

SUPERTEX, INC., 1225 Bordeaux Dr., P.O. Box 3607, Sunnyvale, CA 94088-3607, Tel: 408-744-0100, TELEX: 6839143 SUPTX, FAX: 408-734-5247; Empl.: 260; *Sls. Mgr.:* Richard Siegel

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Local Sales Offices & Reps
AZ Phoenix, Indl. Elctrns. & Controls 602-894-2375
CA El Toro, Distributed Motion 714-855-9902
CA San Carlos, Campbell & George 415-594-1994
CA Santa Clara, Oriental Motor U.S.A. Corp. 408-988-2655
CO Wheatridge, Control Dvcs. 303-424-9332
FL Altamonte Springs, Automation Sls. Inc. 305-869-6535
IL Elk Grove Vl., General Controls Inc. ... 312-595-2152
IL Rolling Meadows, Oriental Motor U.S.A. Corp. 312-577-0310
IN Indianapolis, Farrel-Argasta Elec. Co. 317-546-4041
IA W. Des Moines, Ramco Elec. Co. 515-225-6933
MA N. Andover, Bagley Intl. 617-688-0062
MI Troy, Axis Sys. 313-689-7575
MN Minnetonka, Vericom Corp. 612-933-0520
MO St. Louis, Neff Power Inc. 314-727-6200
NJ Clifton, Faber Equip. 201-773-8900
NJ Fairfield, Oriental Motor U.S.A. Corp. .. 201-882-0480
NY Rochester, John M. Forster Co. 716-232-5410
NC Charlotte, EMCO Inc. 703-372-8281
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Can Mississauga, Ont., Waffle's Elec. 416-672-0822

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SUSSEX SEMICONDUCTOR, INC., Rte. 206, Branchville, NJ 07826, Tel: 201-948-3633, TELEX: 226000 ETLXUR; Empl.: 12; *Sls. Mgr.:* Mark Iwanski

SWISS JEWEL COMPANY, 406 Lafayette Building, Philadelphia, PA 19106, Tel: 215-925-2867, TELEX: 831-368, FAX: 215-922-3055; Empl.: 5; *Sls. Mgr.:* P. N. Steel, Jr.

SWITCHCRAFT INC.

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SWITCHCRAFT, INC., A Raytheon Company, 5555 N. Elston, Chicago, IL 60630, Tel: 312-792-2700, TWX: 910-221-5199; FSC No.: 82389;multiple; Empl.: 1100; *Sls. Mgr.:* Ken Kline; *Dist. Mgr.:* Dennis Warszona ..... **B•1801-1803; C•1559-1563**

Local Sales Offices & Reps

AL	Huntsville, DHR Mktg.	205-533-5165
AZ	Phoenix, Moss Mktg.	602-957-2065
CA	Los Angeles, Wiley Co.	213-666-1611
CA	San Diego, Wiley Co.	619-453-9018
CA	Santa Clara, Ross Mktg. Assoc.	408-988-8111
CO	Denver, Moss Mktg.	303-455-7205
CT	Stamford, Unesco/Genex	203-322-9308
FL	Coral Springs, HAI Elctrns.	305-752-7520
FL	Melbourne, HAI Elctrns.	305-676-1639
FL	Tampa, HAI Elctrns.	813-963-0743
GA	Atlanta, DHR Mktg. Inc.	404-451-9848
IL	Chicago, Switchcraft Inc.	312-792-2700
IN	Indianapolis, Marketing Engrs.	317-872-5665
KS	Overland Park, Thomas L. Dowell & Assoc.	913-648-7373
MA	Waltham, Unesco/Genex	617-890-1535
MI	Farmington Hills, R. C. Merchant & Co.	313-476-4600
MI	St. Joseph, R. C. Merchant & Co.	616-983-7378
MN	Edina, Mel Foster Tech. Sls.	612-941-9790
MS	Jackson, S. L. Welch	601-932-5534
MO	St. Louis, Thomas L. Dowell & Assoc.	314-849-4234
NJ	Cherry Hill, Trinkle Sls.	609-795-4200
NJ	Englewood Cliffs, Masin-Esco	201-569-8868
NM	Albuquerque, Moss Mktg.	505-292-7505
NY	Hauppauge, Masin-Esco	516-273-3500
NY	Rochester, Apex Assocs.	716-254-6050
NC	Raleigh, DHR Mktg., Inc.	919-781-1961
OH	Dayton, J. C. Hofstetter Co.	513-296-1010
OH	Medina, J. C. Hofstetter Co.	216-241-4880
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SC	Greenville, DHR Mktg. Inc.	803-235-3594
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TX	Dallas, J. Y. Schoonmaker Co.	214-349-1650
TX	Houston, J. Y. Schoonmaker Co.	713-738-2427
UT	Salt Lake City, Moss Mktg.	801-363-5875
WA	Bellevue, Comtec	206-453-1188
WI	Burlington, Switchcraft	414-763-2100
Can	Toronto, Atlas	416-789-7761

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SWITCHING SYSTEMS INTERNATIONAL, 500 Porter Way, Placentia, CA 92670, Tel: 714-996-0909; Empl.: 57; *Sls. Mgr.:* Chris Edman ..... **D•1980-1982**

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CA	Los Alamitos, Power Specialists	213-594-9418
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CA	San Jose, Nelson Elctrn. Sls.	408-293-2600
CO	Denver, Holder Hauer	303-427-3443
CT	North Haven, Power Conversion Sys.	203-281-7270
GA	Athens, ADI Inc.	404-548-0788
IL	Elmhurst, Utronix	312-834-1100
MD	Randallstown, Beacon North Inc.	301-655-2265
VA	Sterling, Beacon North, Inc.	703-478-2480
MA	Woburn, Power Conversion Sys.	617-938-0839
MI	Ann Arbor, KRW Sls.	313-769-0056
NH	Londonderry, Power Conversion Sys.	603-434-2371
NJ	Marlton, Beacon North Inc.	609-596-9456
NM	Albuquerque, Holder Hauer	505-888-9614
NC	Smithfield, ADI Inc.	919-934-8136
OH	Cleveland, KRW Sls. Inc.	216-871-7521
OH	Columbus, KRW Sls. Inc.	614-885-2598
PA	Pittsburgh, KRW Sls. Inc.	412-828-1490
UT	Salt Lake City, Holder Hauer	801-532-2111

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SYLVANIA MINIATURE LIGHTING, GTE Corporation, W. Main St., Hillsboro, NH 03244, Tel: 603-464-5533, TWX: 710-366-0387, FAX: 603-464-0259; FSC No.: 88204; Empl.: 1011; *Sls. Mgr.:* Frank St. Onge, Natl. Sls. Mgr. ..... **B•1163-1165**

Local Sales Offices & Reps

AZ	Scottsdale, Bill Earl & Assocs.	602-994-3813
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CA	El Toro, English/Damco Sls. Assocs.	714-837-3801
CA	Sunnyvale, W.W. Posey Co.	408-746-0771
CT	No. Haven, Coakley, Boyd & Abbett	203-239-6217, 800-225-8402
FL	Maitland, Hutto, Hawkins Assocs.	305-831-2474
FL	Pompano Beach, Hutto, Hawkins Assocs.	305-979-0330
FL	Tampa, Hutto, Hawkins, Assocs., Inc.	813-251-2970
GA	Atlanta, Millar Elctrns.	404-634-3350
IL	Skokie, I.R.I.	312-647-7755
IN	Ft. Wayne, R.O. Whitesell & Assocs.	219-432-5591
IN	Indianapolis, R.O. Whitesell & Assocs.	317-359-9283
IN	Kokomo, R. O. Whitesell	317-457-9127
IA	Cedar Rapids, R. W. Kunz	319-396-5386
KS	Prairie Village, R.W. Kunz	913-648-3535
KY	Peewee Valley, R.O. Whitesell & Assocs.	502-241-1441
LA	Chalmette, Erickson Sls.	504-271-1976
LA	Covington, Cartwright & Bean	504-892-1780
MA	Needham, Coakley, Boyd & Abbett	617-444-5470
MI	Grand Rapids, R.O. Whitesell & Assocs.	616-942-5420
MI	Southfield, R. O. Whitesell	313-559-5454
MI	St. Joseph, R.O. Whitesell & Assocs.	616-983-7337
MN	Minneapolis, Stoss & Assocs.	612-925-2757
MS	Jackson, Cartwright & Bean	601-981-1170
MO	St. Louis, R.W. Kunz	314-966-4977
NJ	Long Valley, Paul A. Sweeney	201-852-1434
NY	Rochester, Electra Sls.	716-427-7860
NY	Syracuse, Electra Sls.	315-463-1248
NC	Raleigh, Millar Elctrns.	919-828-8840
OH	Cincinnati, R.O. Whitesell & Assocs.	513-521-2290
OH	Cleveland, R.O. Whitesell & Assocs.	216-447-9020
OH	Columbus, R.O. Whitesell & Assocs.	614-888-9396
OH	Dayton, R.O. Whitesell & Assocs.	513-298-9546
OR	Beaverton, Electronic Sources Inc.	503-684-0838
PA	Pittsburgh, R.O. Whitesell & Assocs.	412-963-6161
PA	Trevose, P.S.A. Inc.	215-245-0513
TN	Knoxville, R. O. Whitesell	615-694-9476
TN	Memphis, Cartwright & Bean	901-362-8345
TX	Dallas, Erickson Sales	214-739-5833
TX	Houston, Erickson Sales	713-266-1604
TX	Round Rock, Erickson Sls.	512-244-3068
CO	Wheatridge, Cluff & Assocs.	303-423-9354
WA	Bellevue, Electronic Sources Inc.	206-451-3500
WI	Milwaukee, F.C. DuBois & Assocs.	414-774-3100

SYMBEX CORP., 3M Co., 72 Corwin Dr., Box 938, Painesville, OH 44077, Tel: 216-354-0925, TWX: 810-425-2256; Empl.: 130

SYMBICON, 89 Route 101A, Amherst, NH 03031, Tel: 603-673-8898, TELEX: 272934 SYMB UR; *Sls. Mgr.:* S. Harrington; *Dist. Mgr.:* S. Buzzell

SYM-TEK SYS., INC., 3912 Calle Fortunada, San Diego, CA 92123, Tel: 619-569-6800, TELEX: 249036; Empl.: 250

Local Sales Offices & Reps

AZ	Chandler, Sym-Tek Sys., Inc.	602-786-8809
AZ	Phoenix, Scientific Dvs.	602-957-0401
CA	Huntington Beach, Scientific Dvcs.	714-840-3501
CA	San Diego, Scientific Dvcs.	619-268-9635
CA	San Jose, Scientific Dvs.	408-554-0455
CA	Santa Clara, Sym-Tek Sys., Inc.	408-748-7611
CO	Broomfield, Scientific Dvcs.	303-469-5145
FL	Longwood, Richard Schoonover, Inc.	305-788-3344
FL	Orlando, Sym-Tek Sys., Inc.	306-658-1260
GA	Marietta, MoRe	404-992-5172
IL	Elmhurst, Sector Engrg. Sls.	312-530-7850
IN	Indianapolis, Sector Engrg. Sls.	317-842-1120
MA	Berlin, ATE Entprs., Inc.	617-838-2141
MA	Waltham, Sym-Tek Sys., Inc.	619-899-7170
NJ	Marlton, Javie Bickel, Inc.	609-596-6900
NM	Albuquerque, Scientific Dvcs.	505-883-3668
NY	E. Northport, LSC Assocs., Inc.	516-266-5020
NC	Bellmont, MORE	704-825-9187
OH	Brecksville, WRR Assocs.	216-526-2023
TX	Arlington, Alphatech, Inc.	817-265-8455
TX	Austin, Alphatech, Inc.	512-458-9179
TX	Austin, Sym-Tek Sys., Inc.	512-837-9311
WA	Redmond, Scientific Dvcs.	206-885-0004
WI	Milwaukee, Sector Engrg. Sls.	414-352-8280
Can	Montreal, Interfax Sys., Inc.	514-336-0392

SYMTRON CORP., 2415 E. Charleston Rd., Mountain View, CA 94043, Tel: 415-965-4500, TWX: 910-379-5002; Empl.: 350; *Sls. Mgr.:* Don Atkins

SYNEKTRON
THE MOTION CONTROL COMPANY

FAX: 503-639-5453

SYNEKTRON CORPORATION, 12000 S. W. Garden Place, Portland, OR 97223, Tel: 503-684-3090, TELEX: 517441; Empl.: 60 ..... **B•1264-1265**

SYNTEL DIV., Tegam, Inc., 7230 North Ridge Rd., Madison, OH 44057, Tel: 216-428-7505; Empl.: 15

SYNTEST CORP., 40 Locke Dr., Marlboro, MA 01752-9973, Tel: 508-481-7827, FAX: 508-481-5769; Empl.: 26; *Sls. Mgr.:* Curtis P. Hoffman ..... **D•1106**

Local Sales Offices & Reps

FL	Altamonte Springs, Carter Assocs.	305-260-5566
IL	Arlington Heights, Coombs Assocs.	312-439-9810
MA	Marlboro, Data Reps.	617-481-0333
MI	Rockford, Hal C. Heym Assocs.	616-874-7443
NY	Canandaigua, Mamula Sls.	716-394-5560
NY	White Plains, Channel Corp.	914-694-9234
OH	Centerville, EMA Inc.	513-433-2800
PA	Montgomeryville, Eastern Sci. Mktg.	215-368-4570
WA	Beaverton, Seltech Elctrns.	503-629-9254

Local Distributors

WV	Ravenswood, Valtronics, Inc.	304-273-5356

SYNTRONIC INSTRUMENTS, INC., 100 Industrial Rd., Addison, IL 60101, Tel: 312-543-6444, FAX: 312-543-0287; FSC No.: 99409; Empl.: 125; *Sls. Mgr.:* Paul Evans

SYRACUSE ELCTRNS., P.O. Box 4770, Syracuse, NY 13221, Tel: 315-488-4911, TELEX: 937-232; Empl.: 150

SYRACUSE ELECTRONICS, Pass & Seymour, Inc., P.O. Box 4822, Syracuse, NY 13221, Tel: 315-468-6211, TELEX: 93-7232; *Sls. Mgr.:* Kenneth Hooper

SYSCON INTL., INC., 1108 So. High St., So. Bend, IN 46618-1096, Tel: 219-232-3900, TWX: 810-299-2523, FAX: 219-287-5916; Empl.: 60; *Sls. Mgr.:* Les Barney

SYSTEK, 1027 N. Kellogg St., Kennewick, WA 99336, Tel: 509-735-1200; Empl.: 7

SYSTEMS DATA, INC., 2830 Copley Road, P.O. Box 4297, Akron, OH 44321, Tel: 216-666-0085; Empl.: 12; *Sls. Mgr.:* John C. Hall

SYSTEMS PLUS, 500 Clyde Ave., Mtn. View, CA 94043, Tel: 415-969-7047, TWX: 910-373-2096; Empl.: 20

SYSTEMS RESEARCH LABOROTORIES, Arvin/Calspan, 2800 Indian Ripple Rd., Dayton, OH 45440, Tel: 513-426-6000, TWX: 810-450-2621; FSC No.: 14590; Empl.: 1300

SYSTONICS, INC., Box 121, Winchester, MA 01890, Tel: 617-729-4439, TELEX: 951131 HQBSN; Empl.: 11

SYSTRON-DONNER INERTIAL DIV., 2700 Systron Dr., Concord, CA 94518, Tel: 415-671-6400, TWX: 910-481-9478; Empl.: 370; *Sls. Mgr.:* G. W. Felsing

SYSTRON-DONNER INSTRUMENT DIV., 2727 Systron Dr., Concord, CA 94518, Tel: 415-676-5000, TELEX: 171996, TWX: 910-481-9479; FSC No.: 52542; Empl.: 100; *Sls. Mgr.:* N. J. Susner, Gen. Mgr.

SYSTRON-DONNER MICROWAVE DIV., 14844 Oxnard St., Van Nuys, CA 91409, Tel: 818-786-1760, TWX: 910-495-1786; Empl.: 160; *Sls. Mgr.:* Ashvin K. Sheth

TAB BOOKS, Blue Ridge Summit, PA 17294-0850, Tel: 717-794-2191, TELEX: 820562, TWX: 717-794-2080; Empl.: 185; *Sls. Mgr.:* John P. Bohman

TACHONICS CORPORATION, Grumman Corp., 107 Morgan Ln., Plainsboro, NJ 08536, Tel: 609-275-2550, FAX: 609-275-2591; Empl.: 56; *Sls. Mgr.:* Bill Koehn; *Dist. Mgr.:* Bill Koehn

TADIRAN ELEC. INDS. INC., 40 Seaview Blvd., Port Washington, NY 11050, Tel: 516-621-4980, TWX: 230-697-3370, FAX: 516-621-4517; Empl.: 6300; *Dist. Mgr.:* Avi Timor

TAFA, INC., 146 Pembroke Rd., Concord, NH 03301, Tel: 603-224-9585, TELEX: 94-3424, FAX: 603-225-4342; Empl.: 50; *Sls. Mgr.:* Bob Unger; *Dist. Mgr.:* Leon Grant

TA INSTRUMENT CO., 4625 Alger St., Los Angeles, CA 90039, Tel: 818-242-8855, TWX: 910-497-4780; Empl.: 60

TAIYO YUDEN (USA) INC., 714 W. Algonquin Rd., Arlington Heights, IL 60005-4493, Tel: 312-364-6104, FAX: 312-870-7828; Empl.: 63; *Sls. Mgr.:* Mikio Hasunuma

TALEMA ELECTRONIC INC
301 N. Hwy. 63
Rolla, Missouri 65401
Telephone 314-364-0882
Fax 314 364-6320

FAX: 314-364-6320

TALEMA ELECTRONIC, INC., 301 N. Highway 63, Rolla, MO 65401, Tel: 314-364-0882, TELEX: 442353; Empl.: 27; *Sls. Mgr.:* Fred Tetley ..... **A•2390-2392**

Local Sales Offices & Reps

AL	Huntsville, Naylor Assocs., Inc.	205-881-5955
AZ	Scottsdale, Harris & Croy	602-951-9121
AZ	Tucson, Harris & Croy Mfg. Reps.	602-575-5109
CA	Newark, Jacobson & Assocs.	415-791-2336
CO	Englewood, Dynatech, Inc.	303-773-2830
FL	Boca Rotan, Naylor Assocs., Inc.	305-482-5649
GA	Stone Mountain, Naylor Assocs., Inc.	404-299-9701
IL	Wheaton, Archie Joyner Assocs., Inc.	312-665-6222
IN	Columbus, John H. Weaver Co.	812-372-3625
IN	Indianapolis, John H. Weaver Co.	317-257-7661
KS	Wichita, Buckman & Assocs.	316-267-2052
MD	Durham, Naylor Assocs. Inc.	919-544-6630
MA	Billerica, Dynamic Engrg.	617-667-0111
MA	Chelmsford, Dynamic Engrg.	617-250-0200
MI	Plymouth, Leading Edge Sls.	313-420-3344
MN	Minneapolis, RK Sls. Assocs., Inc.	612-571-1001
MO	St. Charles, Buckman & Assocs.	314-946-6201
NY	Commack, R.C. Engrg. Sls.	516-543-3325
NC	Huntersville, Naylor Assocs. Inc.	704-892-1366
OH	Cincinnati, John O. Olsen Co.	513-922-8885
OH	Cleveland, John O. Olsen Co.	216-662-3454
OH	Garfield Hgts., John O. Olsen Co.	216-662-3454
OR	Beaverton, Luscombe Engrg.	503-636-6664
PA	Rydal, Espy Sls. Co.	215-576-0780
SC	Greenville, Naylor Assocs., Inc.	803-297-9969
TX	Lewisville, Electrn. Prod. Reps.	214-436-4772
UT	Layton, Dynatech, Inc.	801-546-4837
WA	Bellevue, Whisler Sls.	206-223-1541
Can	Mississauga, Ont., Intrepid Sls. & Mktg. Ent.	416-671-4488

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FAX: 213-638-9956

TAMURA CORPORATION OF AMERICA, 1150 Dominguez St., Carson, CA 90746-3518, Tel: 213-638-1790; *Sls. Mgr.:* Doug Henderson ..... **A•1291-1293, 1695-1697, 2304, 2395-2403; D•1983-1991**

Local Sales Offices & Reps

AL	Huntsville, Hughes Assocs.	205-533-9108
AZ	Scottsdale, E.D.P. & Assocs.	602-991-6119
CA	Irvine, Groh Assocs.	714-837-9871
CA	Mtn. View, Thorson West	415-964-9300
CO	Golden, J. F. Hurlbut Co.	303-279-7796
CT	Hamden, Datcom Inc.	203-288-7005
FL	Maitland, Hughes Assocs.	305-629-5933
GA	Norcross, Hughes Assocs.	404-662-1587
IL	Mt. Prospect, Interep Inc.	312-577-8899
IN	Kokomo, Schillinger Assocs.	317-455-2708
KS	Kansas City, Delltron Co., Inc.	816-436-6445
MD	Annapolis, Parogem, Inc.	301-269-1898
MA	Waltham, Datcom Inc.	617-891-4600
MI	Grand Rapids, DEM Sls.	616-364-4024
MI	St. Clair Shores, DEM Sls.	313-777-1750
MN	Bloomington, Horizon Technlg. Inc.	612-884-6515
MN	Minneapolis, DeBeck-Hays Assocs.	612-835-3610
MS	Corinth, Hughes Assocs.	601-287-2915
MO	Florissant, Delltron Co., Inc.	314-839-0033
NJ	Lodi, TRC Elec. Inc.	201-779-8282
NC	Cary, Hughes Assocs.	919-467-7029
OH	Cleveland, Comps. Inc.	216-243-9200
OR	Beaverton, Advanced Power Prods.	503-646-0994
PA	Box Spring House, QED Elec. Inc.	215-643-9200
TN	Nashville, Hughes Assocs.	615-871-0908
TX	Richardson, Barry Sls.	214-234-0255
VA	Lynchburg, Parogem, Inc.	804-528-0681
WA	Redmond, Advanced Power Prods.	206-885-0881
WI	Milwaukee, Interep Inc.	414-774-1100
Can	Pointe Claire, Que., A. R. Gray & Assocs.	514-694-6378

Local Distributors

MA	Lowell, Power Assocs., Inc.	617-459-0700
NJ	Lodi, TRC Elec. Inc.	201-779-8282
OR	Beaverton, Micro Power Elctrn.	503-694-5353

T&W SYSTEMS, INC., See Versacad Corp.

TANE ALARM PRODUCTS, 247-40 Jericho Tpke., Floral Park, NY 11001, Tel: 516-328-3351, FAX: 516-326-9125; Empl.: 5; *Sls. Mgr.:* Tab Hauser; *Dist. Mgr.:* Sam Lurie

TANSITOR ELECTRONICS, West Rd., P.O. Box 230, Bennington, VT 05201, Tel: 802-442-5473, TELEX: 954007, FAX: 802-447-1297; FSC No.: 030266626; Empl.: 308; *Sls. Mgr.:* Dan Perreault; *Dist. Mgr.:* Dave Latchum

TAPECON, INC., 10 Latta Rd., Rochester, NY 14612, Tel: 716-621-8400; Empl.: 80

TAPESWITCH CORP. OF AMERICA, 100 Schmitt Blvd., Farmingdale, NY 11735, Tel: 516-694-6312, TELEX: 144611, FAX: 516-694-6304; Empl.: 100; *Sls. Mgr.:* Thomas Polistina

TAPPAN WIRE & CABLE, 256 Oak Tree Rd., Tappan, NY 10983, Tel: 914-359-9300; FSC No.: 2G330; Empl.: 20; *Sls. Mgr.:* Mike Ressa

TAUBER ELECTRONICS

FAX: 619-274-2220

TAUBER ELCTRNS. INC., 4901 Morena Blvd., Bldg. 314, San Diego, CA 92117, Tel: 619-274-7242; Empl.: 22; *Sls. Mgr.:* Bob Tauber; *Dist. Mgr.:* Pat Hoscoe ..... **D•1493**

Local Sales Offices & Reps

AL	Huntsville, Macro-Marketing	205-883-9630
AZ	Phoenix, MacDonald & Assocs.	602-998-1848
CA	Fullerton, AB Sls.	714-667-0177
CA	Northridge, Tauber & Assocs.	213-416-9000
CA	San Jose, Tauber & Assocs.	408-737-9408
IL	Wheeling, Ed Joyner & Co.	312-520-1200
NV	Reno, Connie Dunning	702-849-0722
OR	Portland, Frank Jackson Assocs.	503-292-2638
WA	Redmond, Frank Jackson Assocs.	206-881-7277

TAURUS COMPUTER PRODUCTS, DY-4 Systems Inc., 110-1140 Morrison Dr., Ottawa, Ont., Canada K2H 8S9, Tel: 613-596-3910, FAX: 613-596-0574; Empl.: 13; *Sls. Mgr.:* David Murray; *Dist. Mgr.:* David Murray

TAURUS CORPORATION, See Signal Research Inc.

TAU-TRON, INC., A Unit of General Signal, 10 Lyberty Way, Westford, MA 01886, Tel: 617-692-5100, TELEX: 750245; Empl.: 300; *Sls. Mgr.:* Tom Lillard, Gen Sls. Mgr.

TAYLOR ELECTRONICS, INC., 401 West Orion, Tempe, AZ 85283, Tel: 602-838-4523; Empl.: 25; *Sls. Mgr.:* Sharon F. Hansen

T-bar INCORPORATED

FAX: 203-929-6408

T-BAR INCORPORATED, Data Switch Corporation, 1 Enterprise Dr., Shelton, CT 06484, Tel: 203-926-1801, TWX: 710-463-3210; Empl.: 140; *Sls. Mgr.:* Gerard F. Ryan ..... **B•1804**

Local Sales Offices & Reps

AZ	Tempe, Can Tec Sls.	602-345-1276
CA	Arcadia, Van Gott & Assocs.	818-445-9728
CA	Palo Alto, Horne Electro Sls.	415-494-6777
FL	Clearwater, Tech-Rep Assocs.	813-577-9370
IL	Barrington, Perhats Assocs.	312-381-6360
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Westwood, Apex Assocs.	617-326-5042
NY	Rochester, Elctrn. Mktg. Assocs.	716-427-8115
OH	Cleveland, Carter, McCormic & Peirce	216-826-0400
PA	Horsham, Jacobsen Assocs.	215-674-2937
TX	Richardson, McCoy Assocs. Co.	214-864-1838
Can	Quebec, J. G. Weiss Co. Ltd.	514-337-5022

Local Distributors

IL	Chicago, Newark Elctrns.	312-784-5100
CT	Wallingford, Sager Elctrl. Supp. Co.	203-265-4600

T.D.I. BATTERY & CABLE, 2852 Hitchcock Ave., Downers Grove, IL 60515, Tel: 312-971-3460, TWX: 910-695-3222, FAX: 312-971-3903; Empl.: 80; *Sls. Mgr.:* Kurt Padera; *Dist. Mgr.:* Theresa Kanaga

TDJ CO., INC., 1154 Morena Blvd., San Diego, CA 92110, Tel: 619-276-5920; FSC No.: 60382; Empl.: 9; *Sls. Mgr.:* R. Scherr ..... **C•1104-1105**

TDK CORPORATION, Electronic Components & Material, 13-1, Nihonbashi, 1-Chome, Chuo-ku, Tokyo, Japan 103, Tel: (03) 278-5111, TELEX: J24270, TWX: J26937, FAX: (03) 278-5330; Empl.: 7,800; *Sls. Mgr.:* Motoyuki Kurihara; *Dist. Mgr.:* Tadashi Enami (TDK Corporation of America) ..... **A•1176-1179, 1294, 1322-1327, 1619, 1698-1699; D•1060, 1992**

Local Sales Offices & Reps

AL	Huntsville	205-539-4551
CA	San Jose	408-437-9585
CA	Torrance	213-539-6631
IL	Mt. Prospect	312-803-6100
IN	Indianapolis	317-872-0370
MI	Southfield	313-353-9393
NJ	New Jersey, M & H Intl. Corp.	201-891-8800
NJ	W. Orange	201-736-0023
NY	Pt. Washington	516-625-0100
NC	Greensboro	919-292-0012
TX	Irving	214-506-9800
Can	Ontario, M & H Intl. Corp.	416-676-9401

TEAL ELECTRONICS CORPORATION, 7020 Carroll Rd., San Diego, CA 92121, Tel: 619-458-9522, 800-621-0852 (ext. 590); Empl.: 50; *Sls. Mgr.:* Bill Carpenter, VP Mktg.

TEC, 2727 N. Fairview, Box 5646, Tuscon, AZ 85703, Tel: 602-792-2230, TWX: 910-952-1377, FAX: 602-882-7472; Empl.: 275; *Sls. Mgr.:* Barry Hamilton; *Dist. Mgr.:* Barry Hamilton

TECA, THERMOELECTRIC COOLING AMERICA CORP., 448 N. Halsted St., Chicago, IL 60622, Tel: 312-666-1600, FAX: 312-666-3964; Empl.: 50 ..... **C•1696-1697**

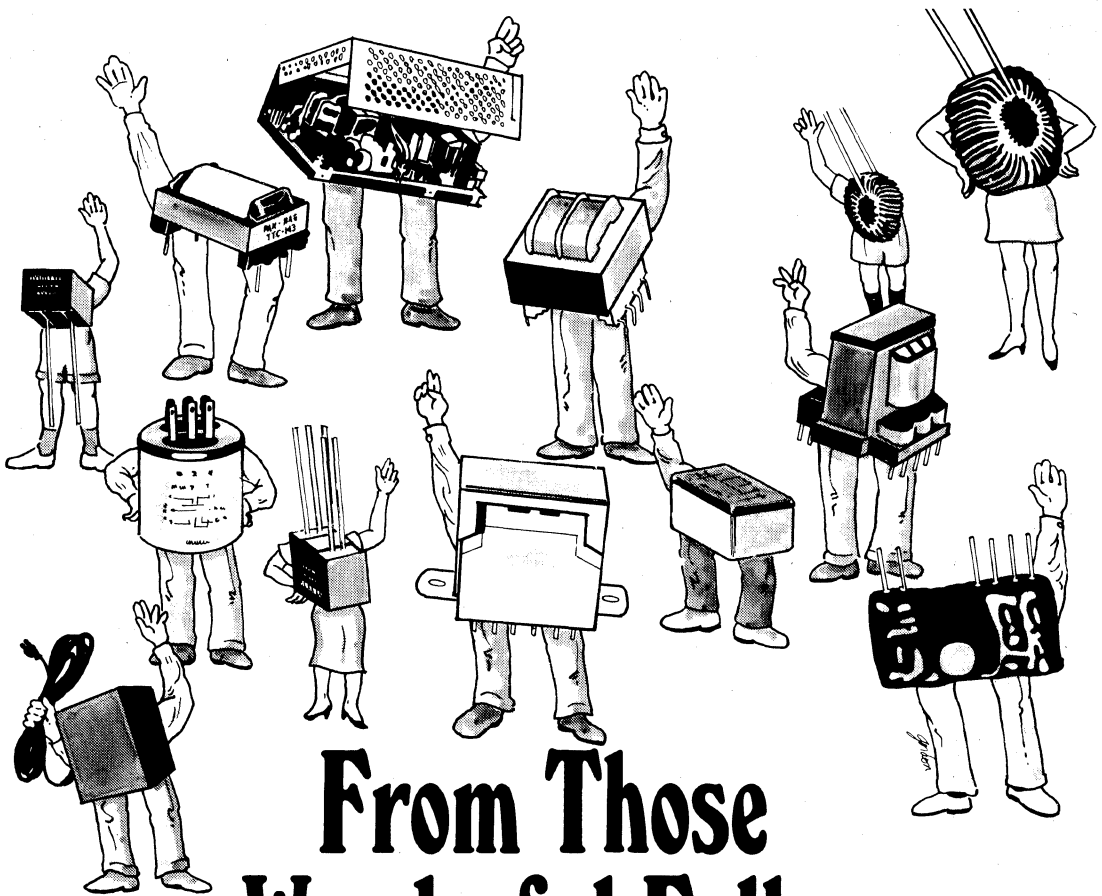
TECCOR ELECTRONICS, INC.

FAX: 214-550-1309

TECCOR ELECTRONICS, INC., 1801 Hurd Dr., Irving, TX 75038, Tel: 214-580-1515, TELEX: 79-1600, TWX: 910-860-5068; Empl.: 1000; *Sls. Mgr.:* Gerry Wiley ..... **A•2146-2149**

Local Sales Offices & Reps

AL	Huntsville, Interep Assocs.	205-533-1730
AL	Mobile, Interep Assocs. Inc.	205-478-1036



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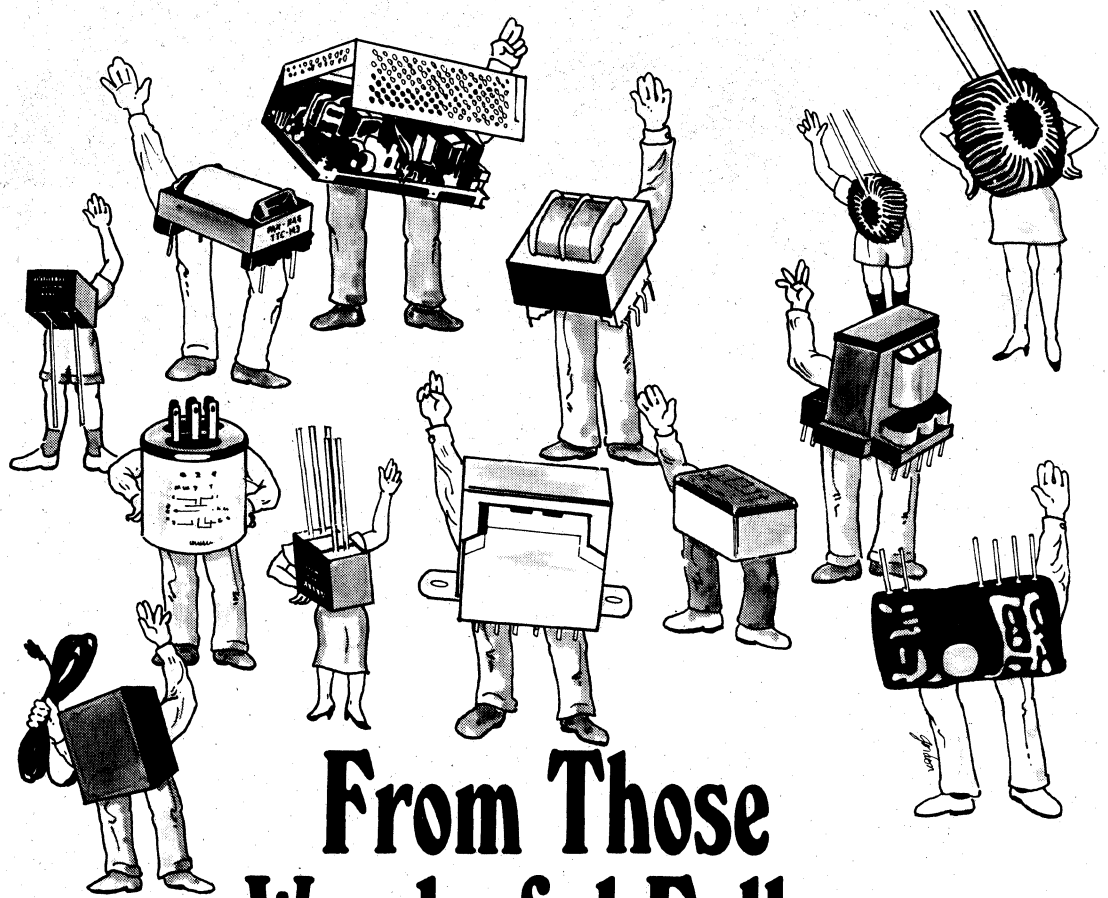

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AZ Tempe, System Sls. of Ariz. 602-829-9338
CA San Diego, O'Donnell Assocs. 619-578-1645
CA San Jose, O'Donnell Assocs. 408-432-1940
CA Torrance, O'Donnell Assocs. 213-539-9664
CO Englewood, Romulus Elctrns. Ltd. 303-770-4888
CT Meriden, Advanced Comp. Sls. (ACS) 203-238-6891
FL Boca Raton, Perrott Assocs. Inc. 305-483-2358
FL Clearwater Beach, Perrott Assocs. 813-443-5214
FL Orlando, Perrott Assocs. 305-298-7748
GA Norcross, Interep Assocs. 404-449-8680
IL Arlington Heights, MSI Micro Sls. 312-956-1000
IN Indianapolis, Elctrn. Rep, Inc. 317-894-1414
IN Mishawaka, Elctrn. Rep, Inc. 219-259-9365
IA Des Plains, SPS Assocs. Ltd. 515-225-0607
KS Olathe, SPS Ltd. 913-764-4460
MA Walpole, JEF Components 617-668-6695
MI Southfield, Rathsburg Assocs. 313-559-9700
MN Minneapolis, Electric Comp. Sls. 612-933-2594
MO Earth City, SPS Assocs. Ltd. 314-291-0520
NJ Mt. Laurel, S-J South Assocs. 609-866-1234
NM Albuquerque, Sys. Sls. of Arizona Inc. 505-889-2901
NM Corrales, Sys. Sls. of Arizona Inc. 505-889-2901
NY Canandaigua, Bensman/Upstate Assocs. 716-396-2498
NY Jamaica, S-J Assocs. Inc. 718-291-3232
NC Raleigh, Godwin Assocs. 919-878-8000
OH Cleveland, Del Steffen & Assocs. 216-461-8333
OH Dayton, Del Steffen & Assocs. 513-293-3145
OH Lexington, Del Steffen & Assocs. 419-884-2313
PA Carnegie, Del Steffen & Assocs. 412-276-7366
TN Greeneville, Interep Assocs. Inc. 615-639-3491
TX Irving, Davis, Don 214-580-1515
UT Salt Lake City, Electrodyne 801-264-8050
VA Falls Church, S-J Chesapeake 703-573-1188
WA Redmond, Quadra Sls. 206-883-3550
WI Wauwatosa, Larsen Assocs. 414-258-0529
Can Concord, Ont., Astec Comps. 416-669-4022
Can St. Laurent, Que., Astec Comps. 514-744-5465

Local Distributors

AL Huntsville, Hammond Elctrns. 205-830-4764
AZ Phoenix, Arizona Comp. Co. 602-269-5655
AZ Tempe, Insight Elctrns. 602-829-1800
CA Agoura, Insight Elctrns. Inc. 818-707-2100
CA Costa Mesa, Insight Elctrns. Inc. 714-556-6890
CA Hayward, Electro Comp. Distrs. 415-783-5800
CA San Diego, Insight Elctrns. 619-587-0471
CA Santee, Mouser Elctrns. 619-449-2220
CA Tustin, Added Value Elec. Dist. Inc. 714-259-8258
CT East Haven, JV Elctrns. 203-469-2321
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
GA Norcross, Hammond Elctrns. 404-449-1996
IL Rosemont, Advent Elctrns. 312-298-4210
IN Indianapolis, Advent Elctrns. 317-872-4910
IA Cedar Rapids, Advent Elctrns. 319-363-0221
LA Baton Rouge, Indl. Elctrns. Supp. 504-357-4249
LA Shreveport, Indl. Elctrns. Supp. 318-222-9459
MD Savage, Pyttronic Inds. 301-953-9650
MA Woburn, ACI Elctrns. 617-935-7230
MI Farmington Hills, Advent Elctrns. 313-477-1650
MN Minneapolis, Stark Elctrns. 612-332-1325
MN Thief River Falls, Digi-Key 800-344-4539
NE Lincoln, Scott Elctrns. 402-466-8221
NJ Bloomfield, Solid State Inc. 201-429-8700
NM Albuquerque, Bell Inds. 505-292-2700
NY Buffalo, Summit Distrs. 716-887-2800
NY Plainview, ACI Elctrns. 516-293-6630
NY Rochester, Simcona Elctrns. 716-328-3230
NC Greensboro, Hammond Elctrns. 919-275-6391
OR Portland, Radar Elc. Co. 503-232-3404
PA Export, Advacom Inc. 412-733-5400
PA Mc Kean, Advacom 814-476-7774
PA Montgomeryville, Pyttronic Inds. 215-643-2850
SC Greenville, Hammond Elctrns. 803-233-4121
TX Corpus Christi, Douglas Elctrns. 512-883-5103
TX Dallas, Omni Pro Intl. Inc. 214-233-9368
TX Mansfield, Mouser Elctrns. 817-483-4422
UT West Valley City, Aved-Rocky Mtn. Inc. 801-975-9500
WA Richland, Radar Elec. 509-943-8336
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Radar Elec. 509-747-3053
WI Milwaukee, Marsh Elctrns. 414-475-6000
Can Burnaby, BC, RAE Indl. Elctrns. Ltd. 604-291-8866
Can Calgary, Alberta, Cardinal Inds. 403-259-6817
Can Edmonton, Alberta, Cardinal IND Elctrns. 403-483-6266
Can London, Ont., CM Peterson Co. 519-434-3204
Can Mississauga, Ont., Preico Elctrns. 416-678-0401
Can Montreal, Que., Preico Elec. Ltd. 514-389-8051
Can Saskatoon, Sask., Cardinal Inds. 306-934-3443
Can Willowdale, Ont., Electro Sonic Inc. 416-494-1666

Tech-Etch

FAX: 617-746-9639

TECH-ETCH, INC., 45 Aldrin Rd., Plymouth, MA 02360, Tel: 617-747-0300, TELEX: 989997; Empl.: 280; *Sls. Mgr.:* P. A. Thomas ..... **C•1755**

TECH LABS., INC., 500 10th St., Palisades Pk., NJ 07650, Tel: 201-944-2221, TELEX: 322 532; FSC No.: 83332; Empl.: 31; *Sls. Mgr.:* George Morrow ..... **B•1805**

Local Sales Offices & Reps

CA Granada Hills, C & W Comps. Sls. 818-368-4032
CA Santa Clara, Mollard Mktg. 408-866-5950
GA Atlanta, Grady Duckett Sls. 404-451-3529
IL Glenview, Crimson Engrg. Co. 312-470-0024
KS Lenexa, Midtec Assocs. 913-541-0505
MA Norwood, Comps. Mktg. Svc. 617-762-4339
MI Jackson, N. Scroggs Co. 517-750-1170
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Haddonfield, Gray Assocs. 609-953-9109
NJ Whippany, Ken L. Love Assocs. 201-540-0204
NY Fairport, Net Sls. 716-223-1030
NY Hempstead, Ken L. Love Assocs. 516-681-3155
OH Cincinnati, Patco 513-931-3311
PA Pittsburgh, VerHill Assocs. 412-241-5202
TX Dallas, Southwest Elctrns. 214-690-9881
TX Houston, Southwest Elctrns. 713-729-1670
WA Seattle, SPS Elctrns. 206-323-4140
Can Montreal, Solid State Elctrns. 514-481-3313

TECHLAND BLUELYNX, 112 Main St., Newmarket, NH 03857, Tel: 603-659-6035,800-832-4526, TELEX: 961-134; *Sls. Mgr.:* Janine Filion

TECHMAR CORP., 2232 S. Cotner Ave., Los Angeles, CA 90064, Tel:23-478-0046, 800-TECHMAR, 800-CHASSIS(CA); FSC No.:32597; Empl.:12; *Sls. Mgr.:* Grant Reisfelt..... **C•1106-1109**

TECHNAR, INC., See TRW Technar, Inc.

TECHNIC, INC., Box 965, Providence, RI 02901, Tel: 401-781-6100, TELEX: 927514; Empl.: 125; *Sls. Mgr.:* Andrew T. Ferris

TECHNICAL DEVICES, 560 Alaska Ave., Torrance, CA 90503, Tel: 213-618-8437; FSC No.: 04772; Empl.: 21; *Sls. Mgr.:* D. Murrin; *Dist. Mgr.:* D. Murrin

TECHNICAL MARKING SYS., See Autoroll Machine Corp.

TECHNICAL MATERIALS, INC., Sub. of Brush Wellman, Inc., 5 Wellington Rd., Lincoln, RI 02865, Tel: 401-333-1700, TWX: 710-384-0600, FAX: 401-333-2848; Empl.: 200; *Sls. Mgr.:* Kenneth Bennett

TECHNICAL PANELS, INC., 9162 La Rosa Dr., Temple City, CA 91780, Tel: 818-285-3105; Empl.: 14; *Sls. Mgr.:* Norman J. Towne

TECHNICAL RESEARCH & MFG., INC., See TRM, Inc.

TECHNIPOWER, A PENRIL CO., P.O. Box 222, Commerce Pk., Danbury, CT 06813, Tel: 203-748-7001, TWX: 710-456-9280; FSC No.: 13850; Empl.: 135; *Sls. Mgr.:* I. Bourgain (Variac); *Dist. Mgr.:* James McCarty ..... **A•2405; D•1993**

Local Sales Offices & Reps

AL Huntsville, Remco 205-533-3763
AZ Scottsdale, Williams Assocs. 602-947-4297
CA Los Alamitos, Power Specialists 213-594-9418
CA Santa Clara, Sourcetronics 408-988-8801
CO Commerce City, Williams Assocs. 303-289-5647
FL Treasure Island, Hi-Tek Sls. 813-360-2816
IL Godfrey, D.B. Entprs. 619-466-2329
IL Medinah, Gentry Technlgs. 312-893-9352
MA Wayland, High Tech Sls. 617-360-2816
MI Jackson, T.P.S. & Assocs. 517-784-3462
MN Burnsville, Electromec Sls., Inc. 612-894-8200
NY Pennsauken, Ar-Jay Tech. 609-663-4260
OR Lake Oswego, Syntek Synergistics Technlgs. 503-636-6793
TX Houston, Scientific Sls. 713-460-9170
TX Richardson, Scientific Sls. Co. 214-231-6541
VA Fairfax, Schibley Assocs. 703-591-3008
WA Kirkland, Syntek Synergistic Technlgs. 206-488-0394
Can Guelph, Ont., Victrix, Ltd. 518-836-1480

Local Distributors

CA Los Angeles, Cal-State Elctrns. 213-933-8187
CA Oakland, N. A. D'Arcy 415-638-7773
IL Chicago, Delta Tech. Prods. Co. 312-478-1134
MA Woburn, Abbott Elctrns. Co. 617-935-2040
MI Dearborn, Indl. Temperature & Control 313-278-2210
MN St. Paul, Gopher Elctrns. Co. 612-483-3322
MO St. Louis, Olive Elctrns., Inc. 314-426-4500
NY Albany, Adirondack Elctrns., Inc. 518-456-0203
NY Farmingdale, Midway Indl. Elctrns. 516-293-6800
NC Charlotte, Jenkins Elec. Co. 704-392-7371
OK Tulsa, Inotek 918-627-1500
PA Philadelphia, PEI/Genesis 215-568-7400
TX Dallas, Inotek 214-243-7000
TX Houston, Inotek 713-688-4494
Can Guelph, Ont., Victrix, Ltd. 519-836-1480

TECHNIQUES, INC., 235 Jackson St., Englewood, NJ 07631, Tel: 201-569-5900; Empl.: 60

TECHNI-TOOL, 5 Apollo Rd., Box 368, Plymouth Meeting, PA 19462, Tel: 215-825-4990, TELEX: 834-763, FAX: 215-828-5623; FSC No.: 30239; Empl.: 80; *Sls. Mgr.:* W. Bezar

Technitrol, Inc.

FAX: 215-426-9105 (ext 102)

TECHNITROL, 1952 E. Allegheny Ave., Philadelphia, PA 19134, Tel: 215-426-9105, TELEX: 834245; FSC No.: 90095; Empl.: 350; *Sls. Mgr.:* G. Shilling ..... **A•1494, 1620-1628, 2407; B•1022-1025**

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Local Sales Offices & Reps

AZ	Phoenix, Integrated Sys. & Dev. Sls.	602-971-6250
CA	Torrance, Detomasi & Grupp, Inc.	213-618-8898
CT	New London, Technitrol Sls. Off.	203-442-1141
IL	Wauconda, Cudahy Sls.	312-526-2484
MD	Baltimore, Callas Elctrns.	301-744-7711
NM	Albuquerque, Syntech	505-266-7951
NY	Fairport, TAC Assoc.	716-377-2250
NY	Jericho, J. Square Mktg.	516-935-3200
OH	Akron, Augnat Assocs.	216-239-2499
FL	Seminole, Q-Rep	813-393-6393
PA	Easton, The Kendon Co.	215-253-3100
TX	Dallas, M-Rep	214-484-5711
TX	Houston, M-Rep	713-261-0798
WA	Redmond, General Technlg., Inc.	206-881-6456

TECHNO
SFERNICE, INC.

FAX: 818-781-8647

TECHNO, INC., 7803 Lemona Ave., Van Nuys, CA 91405, Tel: 818-781-1642; FSC No.: 05347; Empl.: 150; *Sls. Mgr.:* Joe Catrambone; *Dist. Mgr.:* Danny Jagirdar ..... **A•1848, 2026, 2099; B•1870-1871**

Local Sales Offices & Reps

AZ	Tempe, Semper Fi Sales, Inc.	602-730-9553
CA	Chatsworth, Raltech	818-700-0933
CA	Del Mar, Chapman & Chapman	619-755-0412
AZ	Tempe, Semper Fi Sls., Inc.	602-730-9553
CA	Glendale, Mission Mktg. Grp.	818-247-9110
IL	Downers Grove, Richmar Elctrns. Corp.	312-968-0118
IA	Hiawatha, Ard Sls.	319-393-6392
CA	Santa Clara, I Squared, Inc.	488-988-3400
CO	Denver, West, Inc.	303-477-8180
MD	Timonium, Zebra Elctrn.	301-252-6576
CT	Bloomfield, F. S. I.	203-243-3122
MA	Lowell, Astrorep of New England	617-459-7399
MI	Jackson, T.P.S. & Assocs.	517-783-1722
MN	Minneapolis, Dunlop Consits.	612-544-1070
FL	St. Petersburg, J.C.J. Assocs.	813-343-2679
NJ	Piscataway, R. P. Luce & Co.	201-752-8750
NY	Chappaqua, Micrel, Inc.	914-238-4961
IN	Ft. Wayne, Denton Mktg.	219-486-0665
NY	New Hyde Pk., R. P. Luce & Co.	516-437-4550
NY	Rochester, Fritz Dasson	716-338-1699
OH	Wooster, T.P.S. & Assocs.	216-264-0971
PA	Wynnewood, Metz-Benham Assocs., Inc.	215-896-7300
TX	Richardson, Pro Comp. Sls. Co.	214-669-1500
UT	Salt Lake City, West, Inc.	801-466-5739
WA	Bellevue, Olson Tech. Sls. Corp.	206-883-7792
WI	Butler, Richmar Elctrns. Corp.	414-781-1730
Can	Manitoba/Winnipeg, Smith-Paterson & Assoc.	204-885-1376
Can	Ont./Mississauga, Sourcer Elctrns.	416-676-0830
Can	Ont./Rexdale, Bestec Elctrns.	416-674-1330

Local Distributors

CA	Chatsworth, Peteli/Passive Comp., Inc.	818-341-1745
CA	Chatsworth, Shelley Ragon	818-988-3333
CA	San Diego, Neumann Elec.	619-695-3005
CA	Westlake Village, Distel, Inc.	805-495-9998
CA	Yorba Linda, Zeus Comp.	714-921-9000
CO	Denver, IEC Integrated Elctrn.	303-292-6121
FL	Oviedo, Aztech Elctrn.	305-365-2241
FL	Tampa, Impala Elctrns.	813-885-4747
IL	Hoffman Estates, IEC Integrated Elctrn.	312-843-2040
MD	Columbia, Aztech Elctrns	301-995-6800
MA	Burlington, TLC Elctrns.	617-273-0140
NJ	clifton, J-Mar Electro	201-772-6400
NY	Bohemia, Justin Elec.	516-589-4000
NY	Hauppauge, Jaco, Inc.	516-273-5500
NY	Melville, SAI, Inc.	516-293-2710
NY	N. Syracuse, Andco Elctrns	315-699-2660
NY	Port Chester, Zeus Comp.	914-937-7400
NY	Valley Stream, L & S Elec.	516-561-2474
OH	Cincinnati, Eclipse of Ohio	513-661-7733
OH	Dayton, Televox, Inc.	513-454-1225
OR	Beaverton, IEC Integrated Elctrn.	503-641-1690
TX	Fort Worth, Patco Supply	817-429-8596
TX	Richardson, Jaco, Inc.	214-235-9575
WA	Bellevue, IEC Integrated Elctrns.	206-455-2727

TECHNO, A DSG Company, 2101 Jericho Tunpike, New Hyde Park, NY 11040, Tel: 516-328-3970, TWX: 510-223-0642, FAX: 516-326-8827; Empl.: 85 ..... **B•1266**

TECHNOLOGY DYNAMICS inc.

FAX: 201-385-0702

TECHNOLOGY DYNAMICS INC., 100 School St., Bergenfield, NJ 07621, Tel: 201-385-0500; Empl.: 50; *Sls. Mgr.:* James C. Logan ..... **D•1994**

Local Sales Offices & Reps

CA	Lennox, Dae Joon Elctrns.	213-674-0219
MD	Hagerston, Stinson Assocs., Inc.	301-790-1193
MA	Littleton, Caldwell Assocs.	617-369-2475
NY	Rochester, A.J. Electro Mktg.	716-426-3598
VA	Reston, Stinson Assocs., Inc.	703-620-0088

TECHNOLOGY PRODUCTS, INC., 8900 Eton Ave., Canoga Park, CA 91304, Tel: 213-998-8555; FSC No.: 8K984; *Sls. Mgr.:* N. Lerman

TECHNOLOGY SYSTEMS DIVISION, Krug International, P.O. Box 3036, Overlook Branch, Dayton, OH 45431-0036, Tel: 513-426-2405, TWX: 810-450-2620; FSC No.: 23978; Empl.: 150; *Sls. Mgr.:* William O. Murphy, Reg. Sls. Mgr.

TECHRON

FAX: 1-219-294-8329

TECHRON DIV., Crown Intl., Inc., 1718 W. Mishawaka Rd., Elkhart, IN 46517, Tel: 219-294-8300, TWX: 810-294-2160; FSC No.: 06306; Empl.: 400; *Sls. Mgr.:* Howard King ..... **D•1019-1023**

Local Sales Offices & Reps

CA	Manhattan Bch., Basic Trade, Inc.	714-634-2629
CA	Milpitas, IFM Inc.	408-945-5920
CO	Commerce City, Williams Assocs.	303-289-5647
CT	Woodbridge, Electronic Marketing Assoc.	203-397-1461
FL	Melbourne, Reynolds & Assocs., Inc.	305-259-7000
IL	Chicago, Berndt Assocs.	312-283-0713
IA	Cedar Rapids, MAI Assocs.	319-396-8030
MI	Livonia, Lowell-Wendt Mktg. Co.	313-464-2722
MN	St. Paul, Timewave Technlgy., Inc.	612-451-7575
NJ	Wayne, Ramapo, Inc.	201-839-6767
NY	Syracuse, Labtronics Inc.	315-455-7314
OH	Brecksville, Audio Mktg. Assoc.	216-526-2426
PA	Montogomeryville, Eastern Sci. Mktg.	215-368-4570

TECH SPRAY, INC., Box 949, Amarillo, TX 79105, Tel: 806-372-8523, TELEX: 738450, FAX: 806-372-8750; Empl.: 48; *Sls. Mgr.:* 738450; *Dist. Mgr.:* Jack Swanson

TECHTROL CYCLONETICS, INC., 815 Market St., New Cumberland, PA 17070, Tel: 717-774-2746, TWX: 510-650-7003, FAX: 717-774-6799; FSC No.: 58792; Empl.: 25; *Sls. Mgr.:* James M. Griffith .... **A•1476-1477**

Local Sales Offices & Reps

AL	Huntsville, Gentry Assocs., Inc.	205-837-0692
CA	Buena Pk., West Tech Microwave	714-739-5553
CA	San Jose, MC Microwave, Inc.	408-446-4100
CA	Westlake VI, West Tech Microwave	818-991-9219
FL	Tampa, Gentry Assocs., Inc.	813-886-0720
GA	Atlanta, Gentry Assocs., Inc.	404-998-2828
MD	Laurel, CSDS, Inc.	301-490-3800
MA	Chelmsford, Matrix Sls. Inc.	617-459-4000
NJ	Teaneck, Sci. Dvcs. East	201-837-1004
PA	Horsham, Penn, Scientific Dvcs.	215-956-0700
TX	Austin, Airep Elctrns.	512-327-0778
TX	Dallas, Airep Elctrns.	214-349-4360
EXP	Palo Alto, CA, Radar Sys., Inc.	415-424-0661

TECKNIT® a TWP company
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TECKNIT (EASTERN FACILITY), 129 Dermody St., Cranford, NJ 07016, Tel: 201-272-5500, TELEX: 6853079 TCKNT; FSC No.: 07700; Empl.: 300; *Sls. Mgr.:* Thomas McCreery ..... **C•1756**

Local Sales Offices & Reps

AL	Huntsville, Dixie Tech. Mktg.	205-830-0808
AZ	Tempe, Elctrn. Dev. & Sls.	602-438-1547
CA	Anaheim, Westrep	714-527-2822
CA	Granada Hills, C & W Comp. Sls.	818-368-4032
CA	San Diego, Westrep	619-566-6580
CA	Santa Barbara, Tecknit (Western Facility)	805-963-5811
CA	Santa Clara, Nova-Tronix	408-727-9530
FL	Boca Raton, Lawrence Assocs. Inc.	305-368-7373
FL	Casselberry, Lawrence Assocs.	305-339-3855
GA	Duluth, Dixie Tech. Mktg., Inc.	404-381-5592
IL	Palatine, Technlg. Sls., Inc.	312-991-6600
IA	Marion, Ensco-Rep Inc.	319-377-3026
KS	Wichita, Ensco-Rep Inc.	316-683-1070
MD	Rockville, Mechtronics Sls. Inc.	301-340-2130
MN	St. Paul, Repco	612-642-2828
MO	Maryland Heights, Ensco-Rep, Inc.	314-423-3935
NH	Hudson, EMC Sales	603-889-5751
NJ	Cranford, Tecknit Inter-Connection Prods.	201-272-3850
NY	Binghamton, Empire Tech. Assocs., Inc.	607-772-0651
NY	Great Neck, Trionics Assocs.	516-466-2300
OH	Broadview Hgts., Jay Engrg.	216-838-4840
OH	Dayton, Jay Engrg.	513-253-2151
OR	Beaverton, Quest Mktg.	503-641-7377
PA	Huntingdon Valley, Omega Elctrn. Sls. Inc.	215-947-4135
TX	Austin, Kruvand Assocs.	512-441-6777
TX	Dallas, Kruvand Assocs.	214-437-3355
WA	Bellevue, Quest Mktg.	206-747-9424
WI	Milwaukee, Technlg. Sls. Inc.	414-786-5015
Can	Montreal, Que., Norgay Entprs., Ltd.	514-932-3233
Can	Ottawa, Ont., Norgay Entprs., Ltd.	613-723-1858
Can	Toronto, Norgay Entprs. Ltd.	416-259-9663

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TECKNIT INTERCONNECTION PRODUCTS, 135 Bryant Ave., Cranford, NJ 07016, Tel: 201-272-3850, TELEX: MCI6853079 TCKNT; FSC No.: 07700; Empl.: 40; *Sls. Mgr.:* Robert T. Bjornsen ..... **C•1564**

Local Sales Offices & Reps

AZ	Tempe, E.D.S.	602-438-1547
CA	Grenada Hills, C & W Comp. Sls.	818-368-4032
CA	San Diego, Mesa Engrg.	619-278-8021
CA	Santa Clara, Nova-Tronix	408-727-9530
CO	Longmont, Butler Tech. Sls.	303-651-7703
FL	Maitland, E.I.R., Inc.	305-660-9600
MI	Livonia, Luebbe Sls. Co.	313-477-3131
MN	Eden Prairie, E.I.I. Elctrn. Innovators	612-941-0830
NJ	Union, Meridian Entprs.	201-687-6220
NY	Clarence, R. W. Mitscher Co., Inc.	716-759-2350
TX	Dallas, Blackburn Assocs., Inc.	214-750-8484
WA	Bellevue, Quest Mktg.	206-747-9424
Can	Toronto, Norgay Entprs.	416-259-9663

TECMAR, INC., 6225 Cochran Rd., Solon, OH 44139, Tel: 216-349-0600; Empl.: 600; *Sls. Mgr.:* Tim Mahoney

TECNETICS, See Computer Products, Inc.

TECNETICS, Computer Products/Tecnetics, 6287 Arapahoe Ave., Boulder, CO 80306, Tel: 303-442-3837, FAX: 303-444-9437 ..... **D•1671-1674**

Refer to Computer Products, Inc., Pompano Beach, FL for sales offices, Reps. and Distributors.

TECO CORP., Bay Rd., P. O. Box A, Winnisquam, NH 03289, Tel: 603-524-1998, FAX: 603-524-1899; Empl.: 40-50; *Sls. Mgr.:* Sandra Murphy

TECOM INDUSTRIES, INC., 9324 Topanga Canyon Blvd., Chatsworth, CA 91311, Tel: 818-341-4010, TELEX: 69 8476; FSC No.: 59850001; Empl.: 165

Local Sales Offices & Reps

CA	Mountain View, Disman - Bakner	415-969-3010
CT	Norwalk, Nemarco Assocs.	203-852-9117
FL	Orlando, W. A. Brown Instrs.	305-648-9660
IL	Lake Zurich, Wave Mktg.	312-934-8008
IA	Cedar Rapids, Feller Assocs.	319-364-0566
MD	Severna Pk., Delmarva Engrg.	301-647-8007
MO	Leasburg, EIR Co.	314-895-4100
PA	Lafayette Hill, M. Lader Co.	215-825-3177
TX	Arlington, John Houston Assocs.	817-265-2931
TX	Dallas, Data Mktg. Assocs.	214-661-0300
Can	Ottawa, Ont., Gigatron Assocs.	613-225-4090

TECTROL, INC., 39 Kodiak Cres., Downsview, Ontario, Canada M3J 3E5, Tel: 416-630-8108, FAX: 416-638-0553; Empl.: 320; *Sls. Mgr.:* Len Klebanoff

TED CORP., 11415 Johnson Dr., Shawnee Mission, KS 66203, Tel: 913-631-6211; FSC No.: 05209; Empl.: 48; *Dist. Mgr.:* Carol Smith

TEDEA INC., 8606 Wilbur Ave., Northridge, CA 91324, Tel: 818-349-6116, TELEX: 499-8137, TWX: 910-240-0598; Empl.: 16; *Sls. Mgr.:* Tony Smalarz

TEGAL SCIENTIFIC, INC., Box 5905, Concord, CA 94524, Tel: 415-827-1054, TELEX: 380053, FAX: 415-827-1189; *Sls. Mgr.:* L. Rigali

TEGAM, INC., 7230 N. Ridge Rd., Madison, OH 44057, Tel: 216-428-7505, TELEX: 205188 TEGAM MSON, FAX: 216-428-1068; Empl.: 25; *Sls. Mgr.:* Robert A. Rodella

TEKA INTERCONNECTION SYSTEMS, 45 Salem, Providence, RI 02907, Tel: 401-785-4110, TWX: 710-381-1606, FAX: 401-461-2310; Empl.: 89; *Sls. Mgr.:* John Stiness; *Dist. Mgr.:* John Stiness ..... **C•1565-1567**

Local Sales Offices & Reps

CA	Downey, Management Mktg. & Sls.	213-560-5584
CA	Sunnyvale, W. W. Posey Co.	408-746-0771
CO	Boulder, R.G. Entprs., Inc.	303-447-9211
FL	Tarpon Springs, L.P. Sls.	813-934-4744
IL	St. Charles, May Assocs., Inc.	312-377-2320
MA	Waltham, Newport Tech. Sls.	617-890-7255
MN	Wayzata, Cardinal Sls.	612-475-0041
NJ	Pompton Plains, T. A. Adamo Sls.	201-835-5344
TX	Houston, Mil-Rep Assocs.	713-444-2557
WA	Bothell, A/D Elctrns.	206-481-8555

Local Distributors

CA	Hayward, KEA Elctrns.	415-887-2900
CA	Irvine, Mann Southwest	714-380-4170
CA	Santa Ana, Norstan Elctrns.	800-854-8344
CA	Santa Clara, Cypress Elctrns.	408-980-2500
MA	Andover, Aved Elctrns.	617-688-3800
MA	Canton, E.P.C., Inc.	617-821-2111
MI	Roseville, Madsion Elctrns.	313-778-7640
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2844
NY	Farmingdale, Pride Elctrns.	516-293-4020
NY	Ronkonkoma, Conco Elctrns.	516-467-8200
NC	Raleigh, Resco Raleigh	919-781-5700
OH	Centerville, I.P.D., Inc.	513-435-2086
TX	Allen, Prime Distbn.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435
WA	Seattle, Shelley Ragon, Inc.	206-241-1980

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TELMOS, INC., Universal Semiconductor, Inc., 1925 Zanker Rd., San Jose, CA 95112, Tel: 408-436-1906, TWX: 910-338-7617, FAX: 408-436-1125; Empl.: 65; *Sls. Mgr.:* Stephen Pass; *Dist. Mgr.:* Stephen Pass

TELONIC/BERKELEY, Berkeley Inds. Inc., P.O. Box 277, Laguna Beach, CA 92652, Tel: 714-494-9401, FAX: 714-497-7331; FSC No.: 04423; Empl.: 50; *Sls. Mgr.:* Christopher Chrissie

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TELTONE, 10801-120 Ave. NE, Kirkland, WA 98033, Tel: 206-827-9626, TWX: 910-449-2862; Empl.: 450; *Sls. Mgr.:* D. E. Johnson; *Dist. Mgr.:* Mike Arndt

TELTRON, INC., 2 Riga Lane, Birdsboro, PA 19508, Tel: 215-582-2711, TELEX: 4990805, FAX: 215-582-0851; FSC No.: 28287; Empl.: 20

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TEN-TEC, INC., Industrial Park, Sevierville, TN 37862, Tel: 615-453-7172, TELEX: 261337 ACTAUR; Empl.: 110; *Sls. Mgr.:* Joe Redwine

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TERMINAL DATA CORP., 15733 Crabbs Branch Way, Rockville, MD 20855, Tel: 301-921-8282; Empl.: 18

TERMINAL SYS., See A & B Technical Services

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NY Syracuse, M.J. Seavy & Sons, Inc. 315-488-0084
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TX San Antonio, R. D. Erb Co., Inc. 512-734-8221
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Can Que./Montreal, Les Ventes ELBY 514-367-2097

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TEXAS INSTRUMENTS, Data/Image Sensing (Opto), P.O. Box 655474 MS 8206, Dallas, TX 75265, Tel: 214-995-6611, TWX: 910-867-4702; Empl.: 80,000 Worldwide; *Sls. Mgr.:* Tom Lantzsch; *Dist. Mgr.:* Mike Fletcher

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Can	Ottawa, R. H. Nichols Co. Ltd.	613-238-7077
Can	Sweden/Skarholmen, Amerikanska Teleprod	87 100620/109950
Can	Toronto, R. H. Nichols Co. Ltd.	416-851-8871

TEXSCAN INSTRUMENTS, Texscan Corporation, 3169 N. Shadeland, Indianapolis, IN 46226, Tel: 317-545-4196, TELEX: 27-2110, TWX: 810-341-3184, FAX: 317-547-2496; FSC No.: 23042; Empl.: 160; *Sls. Mgr.:* John Shaw, Sls./Mktg. Mgr.; *Dist. Mgr.:* John Shaw

TEX-TECHS CONNECTORS, Norwesco, 2633 Plastics Dr., Gastonia, NC 28053, Tel: 704-866-9161, FAX: 704-867-0577; Empl.: 150; *Sls. Mgr.:* R. Prindle; *Dist. Mgr.:* R. Prindle

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TEXTRO, P.O. Box 381, Greer, SC 29652-0381, Tel: 803-879-0752; Empl.: 15; *Sls. Mgr.:* Frank Pellatt

T-F ELECTRONICS, 4903 Commercial Park Dr., Austin, TX 78724-2638, Tel: 512-928-8926, TELEX: 988 306, FAX: 512-928-8210; FSC No.: 50307; Empl.: 6

THALER CORP., 10940 N. Stallard Pl., Tucson, AZ 85737, Tel: 602-742-5572, TELEX: 825193; FSC No.: 70770; Empl.: 7; *Sls. Mgr.:* Monika Olschewski

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FL	Maitland, EIR, Inc.	305-660-9600
GA	Norcross, Montgomery Mktg., Inc.	404-447-6124
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Elk Grove Village, Oasis Sls. Corp.	312-640-1850
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IN	Kokomo, R.O. Whitesell & Assocs.	317-457-9127
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AZ	Phoenix, Hall-Mark	602-437-1200
AZ	Tempe, Time Elctrns.	602-967-2000
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CA San Diego, Hall-Mark 619-268-1201
CA San Diego, Marshall Elctrns. 619-578-9600
CA San Diego, Time Elctrns. 619-586-1331
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FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Hall-Mark 305-855-4020
FL Orlando, Time Elctrns. 305-841-6565
FL Pompano Bch., Hall-Mark 305-971-9280
GA Atlanta, Time Elctrns./Atlanta 404-448-4448
GA Norcross, Hall-Mark 404-447-8000
GA Norcross, Marshall Elctrns. 404-923-5750
IL Chicago, Hall-Mark 312-860-3800
IL Elk Grove Vl, Pioneer 312-437-9680
IL Schaumburg, Marshall/Chicago 312-490-0155
IL Wood Dale, Time/Chicago 312-350-0610
IN Indianapolis, Pioneer/Indiana 317-849-7300
KS Lenexa, Hall-Mark/Kansas City 913-888-4747
MD Columbia, Hall-Mark 301-988-9800
MD Columbia, Time Elctrns. 301-964-3090
MD Gaithersburg, Marshall Inds. 301-840-9450
MD Gaithersburg, Pioneer 301-921-0660
MA Boston, Hall-Mark Elctrns./Boston 617-935-9777
MA Boston, Marshall Elctrns. 617-658-0810
MA Peabody, Time Elctrns. 617-532-6200
MI Grand Rapids, Pioneer 618-698-1800
MI Livonia, Marshall/Michigan 313-525-5850
MI Livonia, Pioneer/Michigan 313-525-1800
MI Minneapolis, Hall-Mark/Minnesota 612-941-2600
MN Minnetonka, Pioneer 612-944-3355
MO St. Louis, Hall-Mark 314-291-5350
MO St. Louis, Time Elctrns. 314-391-6444
NJ Fairfield, Hall-Mark 201-575-4415
NJ Mt. Laurel, Hall-Mark 609-235-1900
NJ Pinebrook, Time Elctrns. 201-882-4611
NY Farmingdale, Iris Elctrns. 516-420-8400
NY Hauppauge, Time Elctrns. 516-273-0100
NY Johnson City, Marshall Inds. 607-798-1611
NY Mt. Vernon, QAR Indl. Elctrns. 914-699-2224
NY Rochester, Marshall Inds. 716-235-7620
NY Rochester, Simcona Elctrns. 716-328-3230
NY Syracuse, Time Elctrns. 315-432-0355
NC Charlotte, Pioneer 704-527-8188
NC Charlotte, Time Elctrns. 704-522-7600
NC Raleigh, Hall-Mark 919-872-0712
OH Cleveland, Hall-Mark 216-349-4632
OH Cleveland, Pioneer 216-587-3600
OH Dayton, Marshall Inds. 513-898-4480
OH Dayton, Pioneer 513-236-9900
OH Solon, Marshall Inds. 216-248-1788
OH Worthington, Hall-Mark 614-888-3313
OK Broken Arrow, Hall-Mark 918-251-1108
OR Beaverton, Almac Elctrns. 503-629-8090
OR Portland, Time Elctrns. 503-684-3780
PA Horsham, Pioneer 215-674-4000
PA King of Prussia, Time Elctrns. 215-337-0900
PA Pittsburgh, Pioneer 412-782-2300
TX Austin, Hall-Mark 512-258-8848
TX Austin, Pioneer 512-835-4000
TX Carrollton, Marshall Inds. 214-233-5200
TX Dallas, Hall-Mark 214-553-4300
TX Dallas, Pioneer 214-386-7300
TX Houston, Hall-Mark 713-781-6100
TX Houston, Pioneer 713-988-5555
TX Stafford, Southwest Elctrns. 713-240-4000
UT Salt Lake City, Marshall Inds. 801-485-1551
UT Salt Lake City, Time Elctrns. 801-973-8181
UT W. Valley, Hall-Mark 801-268-3779
WA Bellevue, Almac Elctrns. 206-643-9992
WA Bellevue, Marshall Inds. 206-747-9100
WA Spokane, Almac Elctrns. 509-924-9500
WI Milwaukee, Hall-Mark 414-797-7844

THOMAS ELECTRONICS, INC., 100 Riverview Dr., Wayne, NJ 07470, Tel: 201-696-5200, TWX: 310-685-3326, FAX: 201-696-8298; FSC No.: ;01852; Empl.: 380; *Sls. Mgr.:* Bruce Piaget, VP Sls.

THOMSON ELECTRON TUBES & DEVICES CORP., Thomson CSF, 550 Mount Pleasant Avenue, Dover, NJ 07801, Tel: 201-328-1400, TWX: 710-987-7901; *Sls. Mgr.:* Victor Pastore

THOMSON ELECTRON TUBES & DEVICES CORP., Special Products Div., 550 Mount Pleasant Ave., Dover, NJ 07801, Tel: 201-328-1400, TWX: 510-601-3852, FAX: 201-328-1747; *Sls. Mgr.:* Patrick Stromboni

THOMSON PASSIVE COMPONENTS CORP., 6203 Variel Ave., Unit A, Woodland Hills, CA 91367, Tel: 818-887-1010, TELEX: 3719759, TWX: 310-371-9759; Empl.: 150; *Sls. Mgr.:* Geoff Edge

THORDARSON MEISSNER, Components Corp. of Amer., Electronic Center, Mt. Carmel, IL 62863, Tel: 618-262-5121, TWX: 510-525-2254; FSC No.: 96256; Empl.: 600; *Sls. Mgr.:* Ken Harris

THOR ELECTRONICS, 321 Pennsylvania Ave., Linden, NJ 07036, Tel: 201-486-3300, TELEX: 138 968, FAX: 201-486-0923; Empl.: 50; *Sls. Mgr.:* Jack Rose

THORN EMI GENCOM INC., 23 Madison Rd., Fairfield, NJ 07006, Tel: 201-575-5586, TELEX: RCA 221236 TEGI, FAX: 201-575-8717; Empl.: 25; *Sls. Mgr.:* Michael R. Avery

THORN EMI TECHNLG. INC., 8601 Dunwoody Pl., Atlanta, GA 30350, Tel: 404-587-0017, 800-243-2572, FAX: 404-587-3791 ..... **D•1329**

Local Sales Offices & Reps
CA Irvine 714-261-0141
MA Framingham 617-875-5858
NM Albuquerque 505-884-0541
OH Columbus 614-459-2890
PA Philadelphia 609-428-6060
TX Dallas 817-481-4087
VA Manassas 703-631-1766

3M CO., see listing under letter "M"

THUNDER SCIENTIFIC CORP., 623 Wyoming S.E., Albuquerque, NM 87123, Tel: 505-265-8701, 800-872-7728; Empl.: 26; *Sls. Mgr.:* J. L. Bennewitz

TIDEWATER TECHNOLOGICAL, INC., 611 Industrial Pk. Dr., Newport News, VA 23602, Tel: 804-874-2800, FAX: 804-874-7890; Empl.: 30

TIF INSTRUMENTS, INC., 9101 N.W. 7th Ave., Miami, FL 33150, Tel: 305-757-8811; Empl.: 500; *Sls. Mgr.:* Tom Wolff; *Dist. Mgr.:* Jim Hilfinger

TII INDUSTRIES INC., 1385 Akron St., Copiague, NY 11726, Tel: 516-789-5000, TELEX: 144631, FAX: 516-789-5063; *Sls. Mgr.:* Jim Roach

TIL-TEK LIMITED, 500 Van Buren St., P.O. Box 550, Kemptville, Ontario, Canada K0G 1J0, Tel: 613-258-5928, TELEX: 0534370 OTT; *Sls. Mgr.:* Steve Tilston

TIMBER-TOP, Hopkins Rd., Box 517E, Watertown, CT 06795, Tel: 203-274-6706; FSC No.: 06773; Empl.: 5; *Sls. Mgr.:* W. E. Fischer

TIMECO, INC., 1035 - 26th St., P.O. Box 8038, Huntington, WV 25705, Tel: 304-523-5149; Empl.: 7; *Sls. Mgr.:* James E. Myers

TIME LOCK, INC., 87 Water Mill Lane, Great Neck, NY 11021, Tel: 516-487-0690, FAX: 516-487-0927; Empl.: 6; *Sls. Mgr.:* Ernie Odierna

TIMEPLEX, INC., 400 Chestnut Ridge Rd., Woodcliff Lake, NJ 07675, Tel: 201-930-4600, TELEX: 178200, TWX: 710-990-7270; FSC No.: 7035-0001; Empl.: 1500ò; *Sls. Mgr.:* Rick MacPherson

TITAN AC POWER SYSTEMS, See Compact Power Co.

TITAN TECHNOLOGIES, INC., 310 W. Ann, Ann Arbor, MI 48104, Tel: 313-662-7777, TELEX: 757689; *Sls. Mgr.:* Rob Risser

TITCHENER, E. H., & CO., 1 Titchener Pl., Binghamton, NY 13902, Tel: 607-772-1161, TWX: 510-252-1985; Empl.: 235

TIW SYSTEMS, INC., 1284 Geneva Drive, Sunnyvale, CA 94089, Tel: 408-734-3900, TELEX: 346352, FAX: 408-734-9012; Empl.: 100

TMC SYSTEMS (ARIZ.) INC., See Dale Electronics, Inc.

Distributor

TNR TECHNICAL, INC., 45 Jefryn Blvd. West, Deer Park, NY 11735, Tel: 516-242-4800; Empl.: 35; *Sls. Mgr.:* Jerrold Lazarus 766, 777

TNR TECHNICAL, INC., 402-S. N. Lake Blvd., Altamonte Springs, FL 32701, Tel: 305-767-2411, FAX: 305-767-2414; Empl.: 6; *Sls. Mgr.:* Wayne Thaw

TOBE DEUTSCHMANN LABS., INC., 550 Turnpike St., Canton, MA 02021, Tel: 617-828-3366, TELEX: 92-4427; FSC No.: 21966; Empl.: 30; *Sls. Mgr.:* T. Deutschmann, Jr.

TOCOS AMERICA

FAX: 312-364-7317

TOCOS AMERICA, INC., Tokyo Cosmos Electric Co., Ltd., 565 West Golf Road, Arlington Heights, IL 60005, Tel: 312-364-7277, TELEX: 62932147; Empl.: 2,000; *Sls. Mgr.:* Joseph D. Tanney ..... **A•2100-2101**

Local Sales Offices & Reps
AL Huntsville, Electramark, Inc. 205-539-7040
CA Santa Clara, Synelect Mktg. Co. 408-244-9900
CT Washington, Tri-Com Assocs. 203-868-7027
FL Altamonte Springs, Semtronic Assocs., Inc. 305-831-8233
FL Altamonte Springs, Semtronics Assocs., Inc. 305-831-8233,800-432-0200
FL Clearwater, Semtronic Assocs. Inc. 813-461-4675
FL Clearwater, Semtronics Assocs., Inc. .. 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs. Inc. 305-731-2484
FL Ft. Lauderdale, Semtronics Assocs., Inc. 305-731-2484
GA Norcross, Electramark, Inc. 404-446-7915
IL Downers Grove, Momak Sls. 312-963-6400
IN Indianapolis, DM Assocs. 317-842-4424
IA Cedar Rapids, Cahill, Schmitz & Howe, Inc. 319-377-8219
MA Burlington, Tri-Com Assocs. 617-272-8163
MA Framingham, Gallagher Assocs., Inc. .. 617-626-2346
MI Grand Rapids, Miltimore Sls. 616-942-9721
MI Grand Rapids, Miltimore Sls., Inc. 616-942-9721
MI Novi, Miltimore Sls. 313-349-0260
MI Novi, Miltimore Sls., Inc. 313-349-0260
MN Minneapolis, Northstar Comps. 612-553-1888
MN Minneapolis, Northstar Comps., Inc. 612-553-1888
NJ Medford, Delaware Valley Elctrns. 609-654-6028
NY Endwell, Reagan/Compar Albany, Inc. 607-754-2171
NY Islandia, Schmitt Indl. Mktg. Corp. 516-582-5888
NY Rochester/Buffalo, Reagan/Compar 716-271-2230
NY Syracuse, Reagan/Compar 315-732-3775
OK Tulsa, B & R Elctrns. 918-865-7666
OR Portland, Harry Levinson Co. 503-245-1902
TX Houston, B & R Elctrns. 713-682-5448
TX Plano, B & R Elctrns. 214-985-0028
WA Seattle, Harry Levinson Co. 206-382-1300
Can Islington, Ont., Pipe Thompson Ltd. ..: 416-236-2355
Can Montreal, Que., Versatech Electronique, Inc. 514-481-0196

Local Distributors
CA Van Nuys, EW Elctrns. 818-782-9020
FL Ft. Lauderdale, Reptron Elctrns., Inc. .. 305-735-1112
FL Tampa, Reptron Elctrns., Inc. 813-855-4656
GA Norcross, Reptron Elctrns., Inc. 404-446-1300
IL Schaumburg, QPS Elctrns., Inc. 312-884-6620
IL Schaumburg, Reptron Elctrns., Inc. 312-882-1700
IN Indianapolis, MAR Elctrns. 317-633-6699
MI Livonia, Reptron Elctrns., Inc. 313-525-2700
MN Minneapolis, K & H Elctrns. Distbg. Corp. 612-553-1312,800-328-8515
MN Minneapolis, K & H Elctrns. Distr. Co. 612-553-1312
MN Minnetonka, Reptron Elctrns. 612-938-0000
MN Minnetonka, Reptron Elctrns., Inc 612-938-0000
NJ Kenilworth, Ventronics, Inc. 201-272-9262
NJ Whippany, ADI-American Dists., Inc. ... 201-428-0510
NY Buffalo, Summit Dists. 716-887-2800
NY Hempstead, Davis Elctrns. 516-483-9200
OH Worthington, Reptron Elctrns., Inc. 614-436-6675
TX Austin, Southwest Elctrns., Inc. 512-837-8971
TX Dallas, Off the Shelf Comps. 214-247-0052, 800-231-8057
TX Dallas, Southwest Elctrns., Inc. 214-234-3050
TX Ft. Worth, C & W Elctrn. Supp. Co. 817-831-0395
TX Richardson, Comp. Technlg. Corp. 214-437-2211
TX Richardson, Off the Shelf Comps. 214-238-0808, 800-648-5387
TX Stafford, Southwest Elctrns., Inc. 713-240-4000
WI Mequon, Lake-View Elctrns. Corp. 414-377-5590

TODD PRODUCTS CORP.

FAX: 516-231-3473

TODD PRODUCTS CORP., 50 Emjay Blvd., Brentwood, NY 11717, Tel: 516-231-3366, TWX: 510-227-4905; Empl.: 250 ..... **D•1995-2022**

Local Sales Offices & Reps

AL	Huntsville, R. W. Mitscher Co.	205-882-6050
AZ	Scottsdale, Thorson Desert States	602-998-2444
CA	Calabasas, QuadRep Southern	818-887-3711
CA	Irvine, QuadRep Southern	714-261-8141
CA	San Diego, QuadRep Southern	619-560-8330
CA	San Jose, Quantum Coefficient Sys.	408-942-1070
CO	Englewood, Thorson Rocky Mtn. Inc.	303-799-3435
FL	Boca Raton, R.W. Mitscher Co.	305-368-3841
FL	Largo, R. W. Mitscher Co.	813-581-1588
FL	Sanford, R.W. Mitscher Co.	305-322-7141
GA	Lawrenceville, R. W. Mitscher Co.	404-923-3239
IL	Arlington Heights, Coombs Assocs.	312-439-9810
IN	Indinapolis, JFCO	317-576-9363
MD	Glen Burnie, Third Wave Solutions Inc.	301-787-0222
MA	Hingham, Northeast Reps.	617-749-8700
MI	Grand Rapids, JFCO	616-949-1020
MI	Lake Orion, JFCO	313-693-2053
MN	Minneapolis, R. K. Sales Assocs.	612-571-1001
NH	Nashua, Northeast Reps.	603-880-8199
NJ	Princeton, Murtronic Assocs.	609-394-3737
NM	Albuquerque, Thorsen Desert States, Inc.	505-293-8555
NC	Charlotte, R. W. Mitscher Co.	704-366-9131
NY	Melville, Comtronic Assocs.	516-249-0505
NY	Syracuse, T-Squared Elctrns. Co.	315-463-8592
NY	Victor, T-Squared Elctrns. Co.	716-924-9101
NC	Raleigh, R. W. Mitscher Co.	919-848-0941
OH	Cleveland, JFCO	216-398-6300
OH	Dayton, JFCO	513-890-8322
OH	Gahanna, JFCO	614-476-3310
PA	Pittsburgh, JFCO	412-823-5400
TN	Johnson City, R. W. Mitscher Co.	615-929-7258
TX	Houston, AID Elctrns. Inc.	713-955-6204
TX	Irving, AID Elctrs. Inc.	214-790-4761
UT	Salt Lake City, Thorson Rocky Mtn. Inc.	801-973-7969
WI	Milwaukee, Coombs Assocs.	414-351-6123
Can	Surrey, BC, Enerlec Sls. Ltd.	604-888-1667

TODD SYSTEMS, INC., 50 Ash St., Yonkers, NY 10701, Tel: 914-963-3400, FAX: 914-963-3506; Empl.: 45; *Sls. Mgr.:* S. Edwards ..... **A•2408-2411**

Local Distributors

AL	Mobile, Kretzer's Inc.	205-438-5611
CA	San Francisco, Aris Corp.	415-550-8605
CA	San Francisco, Delray Distr.	415-777-4405
CT	Norwalk, Park Distr.	203-853-2010
FL	Miami, Gay Mar, Inc.	305-371-0765
FL	Miami Bch., B. Frank Inc.	305-861-8227
GA	Macon, Giga Corp.	912-745-2897
IL	Skokie, Sargent Welch Inc.	312-677-0600
LA	New Orleans, Bailey Distr.	504-943-2461
MD	Bethesda, Albee Sls.	301-897-8088
MA	Revere, Sozio's	617-547-6900
NJ	Newark, Cotrapex, Inc.	201-589-1416
NJ	Newark, Pinto Trading	201-344-7748
NY	Long Island City, H. L. Dalis, Inc.	212-361-1100
NY	New York, Gelb Sls.	212-475-7940
NY	New York, Rosetta Elec.	212-233-9088
OH	Dayton, K. Elctrns.	513-426-1877
PA	Philadelphia, H & Z Sls.	215-912-2500
TX	Houston, Cross & Co.	713-673-3100
TX	Houston, Western Sls.	713-869-6671
VA	Bailey's Crossroads, Arya Corp.	703-845-0800
WA	Seattle, ForeignN Elctrns.	206-682-2761
WA	Seattle, Pearl Elctrns.	206-622-6200
EXP	NY, New York, Able Intl., Ltd.	212-696-5300

TOKIN AMERICA, INC., 155 Nicholson Ln., 95134, CA 95131, Tel: 408-432-8020, FAX: 408-434-0375; Empl.: 10; *Sls. Mgr.:* Anthony R. Costarella; *Dist. Mgr.:* S. Numata ..... **A•1295, 1329, 1700; B•1926; D•1108**

Local Sales Offices & Reps

AZ	Scottsdale, Mactronix	602-998-1848
CA	Mission Viejo, Angel Assocs.	714-582-8858
CA	Mountain View, Griffith, Nuniey & Hobbs, Inc.	415-961-6740
CA	San Diego, Angel Assocs.	619-581-2211
CA	San Jose, Tokin America, Inc.	408-946-4887
CA	Spring Valley, Griffith, Nuniey & Hobbs, Inc.	209-772-2696
CO	Broomfield, Mactronix	303-469-4350
MN	Minnetonka, JPM & Assoc.	612-593-5460
NJ	Monmouth Junction, S.E.A. Co.	201-329-3636
TX	Austin, Coulomb Elec.	512-258-3002
TX	Dallas, Coulomb Elec.	214-406-1117
TX	El Paso, El Paso Elctrns.	910-855-3900
TX	Houston, Coulomb Elctrns.	713-820-3210
WA	Seattle, LD Elctrns.	206-364-0200
Can	Ontario, Har-Tech Elec.	416-665-7773

TOKO AMERICA, INC., 1250 Feehanville Dr., Mt. Prospect,, IL 60056, Tel: 312-297-0070, FAX: 312-699-7864; Empl.: 75; *Sls. Mgr.:* Jim Onodera; *Dist. Mgr.:* John Manders ..... **A•1296-1297, 1629, 1701; D•2023**

Local Sales Offices & Reps

AL	Huntsville, Toko America, Inc.	205-830-0952
CA	Campbell, Kottmeier Assocs.	408-371-8700
CA	Cupertino, Toko America, Inc.	408-996-7575
CA	Irvine, Mission Ridge Mktg.	714-253-4626
CA	San Diego, Varigon-San Diego	619-576-0100
CT	Danbury, Toko America, Inc.	203-748-6871
IL	Mt. Prospect, Toko America, Inc.	312-297-0070
MA	Needham Hgts., The Newscott Co., Inc.	617-444-1923
MA	Newton, Elctrn. Comp. Mktg.	615-828-4243
TN	Rutledge, E.C.M.	615-828-5741

Local Distributors

CA	Orange, Inductor Supp.	714-978-2277
MA	Plainville, J & W Elctrns.	800-227-8529
MN	Thief River Falls, Digi-Key Corp.	800-344-4539

TOKYO ELEC. CO., LTD., 1-1 Nishiki-Cho, Kanda, Chiyoda-Ku, Tokyo, 101, Japan, Tel: (03) 292-1011, TELEX: 0222-3575, TWX: S

TOPAZ®

FAX: 619-569-8427

TOPAZ, INC., 9192 Topaz Way, San Diego, CA 92123-1165, Tel: 619-279-0831, TWX: 910-335-1556; FSC No.: 06049; Empl.: 350; *Sls. Mgr.:* Dan Mathews, Dir. of Sls.; *Dist. Mgr.:* Dan Mathews, Dir. of Sls. ..... **D•2156-2157**

Local Sales Offices & Reps

AL	Birmingham, Sesco	205-988-8304
CA	San Diego, Power West, Inc.	619-299-7007
CA	Torrance, Power West, Inc.	213-328-9411
LA	Baton Rouge, Sesco	504-928-4951
PA	Valley Forge, J. E. Cuesta & Co.	215-935-0400
TX	Austin, Sesco	512-892-2490
WA	Bellevue, Underwood-Hanify Assocs.	206-643-1793

Please refer to Topaz' sales representatives for distributor information.

TOPFLIGHT, 160 East 9th Ave., York, PA 17404, Tel: 717-843-9901, 800-233-9386, TWX: 510-657-4849; Empl.: 250; *Sls. Mgr.:* Bill Ciabattoni

TOPWARD INSTRUMENTS, Div. of Hauman, Inc., 2031 Ringwood Avenue, San Jose, CA 95131, Tel: 408-434-0888, TWX: 510-101-2820, FAX: 408-434-9832; Empl.: 1000; *Dist. Mgr.:* Thomas C. Trieu

TORAD COIL CO., INC., 283 Linden Rd., Wayne, NJ 07470, Tel: 201-835-6195; *Sls. Mgr.:* Dan Gupta

TORELCO, INC., 14 Paine Ave., P. O. Box 560, Irvington, NJ 07111, Tel: 201-374-8641; Empl.: 20; *Sls. Mgr.:* Stewart H. Cook

TOREMA U.S.A., INC., 6699 Portwest Dr., No. 130, Houston, TX 77024, Tel: 713-861-6643, FAX: 713-861-7344; FSC No.: QB2R8; Empl.: 5; *Sls. Mgr.:* David P. Snelling

Toroid®
SUPERIOR TRANSFORMERS

FAX: 301-464-4657

TOROID CORP. OF MARYLAND, 6000 Laurel-Bowie Rd., Bowie, MD 20715-4037, Tel: 301-464-2100, TWX: 710-826-0414; *Sls. Mgr.:* Lennart Elmlund ..... **A•1298, 2412-2416**

Local Sales Offices & Reps

CA	San Jose, Texel North	408-272-6836
CA	Seal Beach, Texel	213-596-9411
IL	Wheeling, Ed Joyner & Co.	312-520-1200
MA	Southboro, Sullivan Tech. Sls.	617-485-2215
PA	Huntingdon Valley, Ed Leiby & Assocs.	215-659-8938
VA	Alexandria, Ed Leiby & Assocs.	703-360-9039

TOROTEL PRODUCTS INC.

FAX: 816-763-2278

TOROTEL PRODS. INC., 13402 S. 71 Hwy., Grandview, MO 64030-3199, Tel: 816-761-6314; Empl.: 250; *Sls. Mgr.:* H. Foland ..... **A•1300-1315, 2418-2423**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Redwood City, Hickey Ind. Sls.	415-368-3849
CA	Santa Ana, California Elctrn. Mktg.	714-835-2702
FL	Orlando, Perrott Assocs.	305-298-7748
IA	Hiawatha, Gassner & Clark Co.	319-393-5763
MD	Towson, Dickison Sls. Co.	301-823-0923
MA	Weston, John Goode Assocs.	617-235-3900
MO	St. Louis, Abrams & Assocs.	314-569-0447
NY	New Hyde Park, R. P. Luce & Co., Inc.	516-437-4550
NY	Syracuse, Rep, Tech, Inc.	315-437-2845
NC	Raleigh, L & D, Inc.	919-876-5301
OH	New Lebanon, J. N. Bailey & Assocs.	513-687-1325
CO	Boulder, Stratford Grp.	303-530-3194

TOROTRON CORP., 519 South Fifth Ave., Mt. Vernon, NY 10550, Tel: 914-664-2050; Empl.: 14; *Sls. Mgr.:* Miriam Zanger ..... **D•1331**

TORQ CORP., 32 W. Monroe St., Bedford, OH 44146, Tel: 216-232-4100, FAX: 216-232-4104; Empl.: 50; *Sls. Mgr.:* Lee Seabeck

TORWICO ELECTRONICS INC

FAX: 201-363-6234

TORWICO ELCTRNS. INC., 410 Oberlin Ave. South, Lakewood, NJ 08701, Tel: 201-364-1800, TWX: 710-723-8343; Empl.: 200 ..... **A•2424-2425**

Local Sales Offices & Reps

CA	Burlingame, Long and Assocs.	415-342-6544
CA	El Cajon, KCE Corp.	619-588-1198
FL	Orlando, Gra-Mar	305-658-1971
IN	Noblesville, Patco & Assocs.	317-877-5986
IA	Blue Grass, Ensco Rep	319-381-1466
IA	Marion, Ensco Rep	319-377-8551
KS	Countryside, Ensco rep	913-384-0840
KS	Wichita, Ensco Rep	316-683-1070
MD	Riderwood, W. S. Warrington & Assoc.	301-823-8759
MA	Hingham, N.E. Reps.	617-749-8700
MO	Maryland Heights, Ensco Rep	314-423-3935
NJ	Marlton, BGR Assocs.	609-983-1020
NY	Albany, Lynn Assocs.	518-459-1239
NY	Buffalo, Lynn Assocs.	716-631-0054
NY	Great Neck, Trionic	516-466-2300
OH	Akron, Eljay Assoc.	216-666-3774
OR	Portland, Abacus Sls.	503-777-8111
PA	Pittsburgh, Lynn Assocs.	412-935-1466
TX	Irving, Kite Elctrns. Sls. Co.	214-986-0321

TOTAL POWER INTERNATIONAL, INC., 418 Bridge St., Lowell, MA 01850, Tel: 617-453-7272, ESYLNK: 948617, FAX: 617-453-7395; Empl.: 15 ... **D•2024-2026**

Local Sales Offices & Reps

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CO	Longmont, Piper Sls.	303-433-5337
CT	Avon, Power Mark, Inc.	203-678-0123
FL	Orlando, Gra-Mar	305-658-1971
GA	Lilburn, The Phillip Matthews Corp.	404-381-1662
IL	Schaumburg, Delta Tech. Sls.	312-310-0280
MD	Ellicott City, Techlg. Sls. Assocs.	301-461-7802

MA Framingham, JDS Reps. 617-872-5876
MI Brighton, A.P. Assocs. 313-229-6550
MN Minneapolis, Tecteam Sls. 612-854-6616
NJ Mtn. Lakes, Comps. for Elctrns. 201-334-2921
NJ Pine Hill, Delta Mktg., Inc. 609-784-7718
NM Albuquerque, Piper Sls. 505-828-1300
NY Albany, Lynn Assocs., Inc. 518-459-1239
NY Buffalo, Lynn Assocs., Inc. 716-631-0054
NC King, The Phillip Matthews Corp. 919-983-9790
OH Columbus, Scientific Sys. 614-861-0129
OR Beaverton, Blair Hirsh Co., Inc. 503-641-1875
PA Hatboro, Delta Mktg., Inc. 215-675-0343
PA Penndel, Delta Mktg., Inc. 215-750-1440
PA Wexford, Lynn Assocs. 412-935-1466
TX Dallas, Rem-Air Comp Corp. 214-234-1069
TX Houston, Rem-Air Comps. Corp. 713-729-1670
UT Salt Lake City, Piper Sls. 801-466-9336
WA Lynnwood, Blair Hirsh Co., Inc. 206-774-8151
WI Brookfield, Delta Tech. Sls. 414-781-4775
WI Mequon, Delta Tech. Sls. 414-241-9243

Local Distributors
FL Orlando, GMI Dists. 305-658-1082

TOWER ELECTRONICS, INC., 281 S. Commerce Circle, Fridley, MN 55432, Tel: 612-571-3737; *Sls. Mgr.:* Blase Des Marais

TOYO COMM. EQUIP. CO., LTD., 20-4, Nishi-Shimbashi, 3-Chome Minato-Ku, Tokyo, Japan 105, Tel: 03-459-7320/03-459-7310, TELEX: 02423115 Toyocoj; FSC No.: 03-436-1434; Empl.: 1800; *Sls. Mgr.:* T. Nagai/S. Nakagome

TRACEWELL ENCLOSURES, INC., 567 Enterprise Dr., Columbus, OH 43081, Tel: 614-846-6175, 800-848-4525, FAX: 614-846-4450; Empl.: 30 ..... **C•1111-1113**

TRACK EQUIPMENT, Div. of Entec Corp., 32 Daniel Webster Hwy., Merrimack, NH 03054, Tel: 603-882-7743; Empl.: 12; *Sls. Mgr.:* Barry D. Moskowitz

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TRACOR PAKTRONICS, Westronics, Inc., 2441 Northeast Pkwy., Ft. Worth, TX 76106, Tel: 817-625-2311, 800-433-2880, TELEX: 629 00631, FAX: 817-625-1068; Empl.: 30; *Sls. Mgr.:* W. C. Preston

FAX: 813-886-2794

TRAK MICROWAVE CORP., 4726 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140; FSC No.: 12855; *Sls. Mgr.:* Toby Gant ..... **A•1839-1843**

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CA Mountain View, Disman Bakner 415-969-3010
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Howard Assocs. 303-841-5755
GA Lawrenceville, M. Lader Co. 404-985-8057
IN Ft. Wayne, TX Sls. Indiana 219-489-4447
IA Cedar Rapids, J.R. Sls. Engrg. 319-393-2232
MD Columbia, M. Lader Co. 301-381-1550
MD Conowingo, M. Lader Co. 301-378-3449
MA Andover, Bee Assoc. 617-975-1229
NY Liverpool, R&D Assocs. 315-457-0100
NY New Rochelle, Ascor Elctrns. 914-235-8838
NC Raleigh, M. Lader Co. 919-848-3253
PA Lafayette Hill, M. Lader Co. 215-825-3177
TX Austin, Thorson Co. 512-345-1985
TX Dallas, Thorson Co. 214-233-5744
TX Houston, Thorson Co. 713-558-8205
UT Salt Lake City, Effective Sls. 801-266-9617
WA Seattle, Datacom Assocs. 206-285-2525
Can Nepean, Ont., Norgay Entprs. 613-723-1858
Can Toronto, Ont., Norgay Entprs. 416-259-9663
Can Westmount, Que., Norgay Entprs. 514-932-3233

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IL Des Plaines, Compucon Distr., Inc. 312-827-9444
MA Reading, Compucon Distr., Inc. 617-944-6875
NY Ronkonkoma, Compucon Distr., Inc. 516-499-1211
PA Lafayette Hill, MLC Distrs., Ltd. 215-825-3177

TRAK MICROWAVE LTD., TRAK Microwave Corp., 3/4 Lindsay Court, Dundee Technlg. Pk., Dundee, Scotland DD2 1TY, Tel: 44-382-561509, TELEX: 76266, FAX: 44-382-562643; Empl.: 30

TRAK SYSTEMS, Div. TRAK Microwave Corp., 4722 Eisenhower Blvd., Dept. E-8, Tampa, FL 33634-6391, Tel: 813-884-1411, TELEX: 52-827, TWX: 810-876-9140, FAX: 813-886-2794; FSC No.: 11165; *Sls. Mgr.:* Thomas L. Roberts ..... **D•1179-1183**

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CA San Diego, L. L. Stoakes, Inc. 619-452-1600
CO Parker, Howard Assocs. 303-841-5755
FL Sarasota, Bass Assocs. 813-922-9538
GA Atlanta, Magaro & Assocs. 404-451-8862
IN Ft. Wayne, TX Sls. Indiana 219-489-4447
MD Annapolis, Blackwood Assocs. 301-268-3669
MA Wayland, High-Tech Sls., Inc. 617-653-3838
NM Albuquerque, J. Smith Assocs. 505-345-6501
NC Raleigh, M. Lader Co. 919-848-3253
PA Huntingdon Valley, Rabal Assocs. 215-947-4825
TX Arlington, J. T. Houston Assocs. 817-265-2931
WA Bellevue, Tasco, Inc. 206-453-1414
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TRANS AMERICAN TRANSFORMER, 142 Peconic Ave., Medford, NY 11763, Tel: 516-654-1880, FAX: 516-654-1936; FSC No.: 61619; Empl.: 30 ..... **A•2426**

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FAX: 203-481-8937

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IN Indianapolis, Marsland Assocs., Inc. ... 317-293-5437
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MI Mt. Clemens, O'Hara Assocs. 313-791-7140
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MO St. Louis, Marsland Assocs. 314-991-1399
NJ Cherry Hill, Markey Instrmn. 609-667-3809
NJ Hillsdale, CB Assocs., Inc. 201-644-6230
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NY Schenectady, TAE-REP, Inc. 607-692-3705
NY Whitney Point, TAE-REP, Inc. 607-692-3705
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OH Stow, Rixan Assocs., Inc. 216-686-2909
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TX Lewisville, Electric Control Assocs. 214-221-3143
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TRANSDUCER SYSTEMS, INC., 1510 Delp Dr., Kulpsville, PA 19443, Tel: 215-256-4611, FAX: 215-256-4214; Empl.: 310

TRANSDUKTOR, INC., See Ulveco, Inc.

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TRANSFORMER TECHNOLOGIES, INC., 52 Putnam St., Mt. Vernon, NY 10550, Tel: 914-668-1600, FAX: 914-668-4794; Empl.: 10; *Sls. Mgr.:* Thomas Quaglieri ..... **A•2427**

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TRANSISTOR DEVICES, INC., 274 S. Salem St., Randolph, NJ 07869, Tel: 201-361-6622; Empl.: 410; *Sls. Mgr.:* J. A. Gilson ..... **D•1332-1335**

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AL Huntsville, Hughes Assocs., Inc. 205-533-9108
AZ Scotsdale, Dave Menegay & Assocs. 602-994-9519
AR El Dorado, Kemp Engrg. Co. Inc. 918-663-4501
CA Campbell, SMA 408-370-6900
CA Costa Mesa, FLW Inc. 714-751-7512
CO Denver, Elcom, Inc. 303-337-2300
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GA Warner Robins, Hughes Assocs., Inc. 912-477-1889
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KS Shawnee Mission, The Beams Co. 913-631-0200
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MA Lexington, E. F. Delfino, Inc. 617-862-1118
MI Union Lake, SKM Ashby Assocs., Inc. 313-363-1100
MN Minneapolis, Integrated Peripherals Sys., Inc. 612-831-0349
MS Corinth, Hughes Assocs., Inc. 601-287-2915
MO St. Louis, The Beams Co. 314-434-8448
NJ Franklin Lakes, Hansen & Hughes Assocs. 201-848-8900
NM Albuquerque, RepTronix, Ltd. 505-292-1718
NY Clinton, Advanced Comps. Corp. 315-853-6438
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NY North Syracuse, Advance Components 315-699-2671
NY Rochester, Advanced Comps. Corp. ... 716-544-7017
NY Scottsdale, Advanced Comps. Corp. .. 716-889-1429
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TN Jonesboro, Hughes Assocs. 615-753-2719
TN Nashville, Hughes Assocs. 615-871-0908
TX Lewisville, J. Hughes Co. 817-430-1683
TX Stafford, Jim Hughes Co. 713-343-0673
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VA Alexandria, Dyna-Rep Co. 703-354-1222
EXP NY, New York, Roburn Agencies, Inc. 212-989-5939

TRANSKINETIC SYS., 110 Shawmut Rd., Canton, MA 02021, Tel: 617-828-3000; Empl.: 17; *Sls. Mgr.:* D. Pettijohn

TRANSMAGNETICS, 210 Adams Blvd., Farmingdale, NY 11735, Tel: 516-293-3100, TWX: 510-224-6420, FAX: 516-293-3793; FSC No.: 17755; Empl.: 40; *Sls. Mgr.:* Fred Haber ..... **D•1184-1185**

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TX Carrollton, Seaton Corp. 214-380-0414
WA Bellevue, Scientific Dvcs. NW 206-747-5169

TRANSMET CORP., 4290 Perimeter Dr., Columbus, OH 43228, Tel: 614-276-5522, 800-245-5253, TWX: 810-493-2368, FAX: 614-276-FAXX; *Sls. Mgr.:* Ronald A. Crossman; *Dist. Mgr.:* Amy L. Holbrook

TRANS METRICS, INC., P. O. Box 178, Chagrin Falls, OH 44022, Tel: 216-248-2229, TWX: 810-427-2059, ESYLNK: 620 332 14; FSC No.: 6625; Empl.: 20

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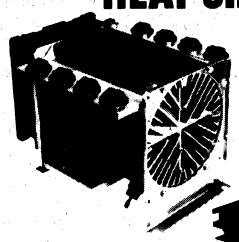

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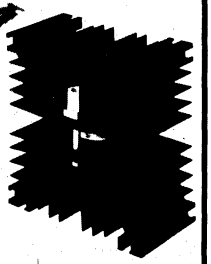

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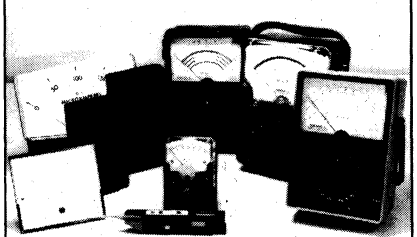

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GA	Atlanta, Russell Assocs.	404-255-8422
IN	Ft. Wayne, Scott Elctrns, Inc.	219-489-5690
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MD	Bel Air, Russell Assocs.	301-879-9180
MA	Wakefield, H.C. Jappe Co.	617-245-9359
PA	Westchester, Russell Assocs.	215-696-0700
NY	Bay Shore, Russell Assocs.	516-666-6500
NY	Morrisville, Naylor Elec. Co.	315-684-9620
OH	Cleveland, D. Steffen & Assocs.	216-461-8333
TX	Dallas, Russell Assocs.	214-699-0383
WA	Bellevue, Russell Assocs.	206-455-3694

TREND CIRCUITS, 44358 Old Warm Springs Blvd., Fremont, CA 94536, Tel: 415-651-1150; Empl.: 35; *Sls. Mgr.:* Mike Gunion

TRENT, INC., 201 Leverington Ave., Philadelphia, PA 19127, Tel: 215-482-5000; Empl.: 55

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TRICON INDUSTRIES, INC., Electromechanical Division, 2325 Wisconsin Avenue, Downers Grove, IL 60515-4076, Tel: 312-964-2330, FAX: 312-964-5179; Empl.: 250; *Sls. Mgr.:* Robert Stevens

TRIDAK, 1120 Federal Rd., Brookfield, CT 06804, Tel: 203-775-1287, TWX: 710-456-1372, ESYLNK: 62009593, FAX: 203-775-4376; Empl.: 20; *Sls. Mgr.:* F. C. Herot

TRI-DATA SYSTEMS, INC., 1450 Kifer Road, Sunnyvale, CA 94086-5306, Tel: 408-746-2900, TELEX: 172282, FAX: 408-746-2074; Empl.: 90

TRIDYNE PROCESS SYSTEMS, DBI Industries, 80 Allen Rd., So. Burlington, VT 05401, Tel: 802-863-6873; Empl.: 35; *Sls. Mgr.:* Jean Garin

TRILOBYTE COMPUTER CORPORATION, 14477 Catalina St., San Leandro, CA 94577, Tel: 415-895-1100, TWX: 910-350-0171, FAX: 415-895-2244; Empl.: 15

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CA	Orange, XBX Sls.	714-998-8200
CA	Santa Clara, C. B. King & Assocs.	408-988-7551
CO	Englewood, Frontier Reps.	303-799-6063
FL	Plantation, EMS, Inc.	305-587-7146
IL	Arlington Hgts., Coombs Assocs., Inc.	312-439-9810
KS	Overland Pk., EPI, Inc.	913-642-9118
MD	Lisbon, S. K. MacDonald, Inc.	301-982-1088
MS	Jackson, EPI, Inc.	601-856-6251
MO	St. Louis, EPI, Inc.	314-962-1411
NH	Nashua, Bell Controls	603-882-6984
OH	Beachwood, Elctrn. Sismasters	216-831-9555
OK	Tulsa, Cunningham Comps.	918-665-3562
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PA	Monroeville, S. K. MacDonald Inc.	412-373-1723
PA	Willow Grove, S. K. MacDonald, Inc.	215-659-4414
TX	Austin, Cunningham Comps.	512-258-1744
TX	Dallas, Cunningham Comps.	612-454-3086
TX	Houston, Cunningham Comps.	713-461-4197
UT	Hooper, Frontier Reps.	801-546-4029
WI	Milwaukee, Coombs Assocs., Inc.	414-351-6123

TRIMM, INC., Div. of Newton Instr. Co., 400 W. Lake St., Box 489, Libertyville, IL 60048, Tel: 312-362-3700, TELEX: 728452, FAX: 312-680-3888; Empl.: 70; *Sls. Mgr.:* Nancy Calkins

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CA San Diego, Knight Co. 619-571-7903
CA Santa Clara, ISG 408-980-1166
CO Denver, Aztec Entprs. 303-779-5285
CT Wethersfield, Underwood Sls. 203-563-3046
FL Melbourne, Currie, Peak & Frazier 305-724-6795
FL Orlando, Currie, Peak & Frazier 305-855-0843
FL Tampa, Currie,Peak, & Frazier 813-963-1076
GA Norcross, Currie, Peak & Frazier 404-449-7662
IL Chicago, Berndt Assocs. 312-283-0713
IN Carmel, Berndt Assocs. 312-844-0114
KS Wichita, Baka 316-682-4811
MD Lanham, Sel-Tronics 301-731-8080
MA Lowell, Underwood Sls. 617-256-8191
MN Edina, Engineering Prods. Assoc. 612-835-9022
MO Crev Coeour, Baka 314-878-4242
NJ Elmwood Park, L & M Assoc. Eng. Rep. 201-797-0441
NM Albuquerque, Aztec Entprs. 505-262-1688
NY New York, L & M Assocs. Eng. Rep. .. 212-243-6155
NY Rochester, T A E Reps. 716-586-8710
NY Whitney Point, T.A.E. Reps. 607-692-3705
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
NC Mathews, Currie, Peak & Frazier 704-846-1702
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OR Beaverton, Evergreen Mktg. Co. 503-643-8020
PA Allison Park, Geotronix 412-487-1770
PA Andalusia, L & M Assocs. 215-245-6658
TN Smyrna, Currie, Peak & Frazier 615-459-0743
TX Argyle, Milestek 817-455-7444
TX Spring, Milestek 713-376-6776
UT Ogden, Aztec Entprs. 801-621-1655
WA Seattle, Evergreen Mktg. 206-633-3160
WI Milwaukee, Berndt Assocs. 414-545-8400
Can Markham, Ont., Components, Ltd. 416-479-7200
Can St. Laurent, Que., Componetics, Ltd. ... 514-331-1498

Local Distributors
CA Los Angeles, Knight Co. 213-670-2833
CA Santa Clara, ISG Sls. 408-980-1166
MD Lanham, Sel-Tronics 301-731-8080
MA Lowell, Underwood Sls. 617-256-8191
MN Minneapolis, Bortech Sls. 612-835-9005
NJ Elmwood Pk., L & M Assocs. 201-797-0441
TX Argyle, Milestek 817-455-7444

TRONTECH, INC., 63 Shark River Rd., Neptune, NJ 07753, Tel: 201-922-8585, TELEX: 132445, FAX: 201-922-3903; Empl.: 40

TRUE DATA, 17092 Pullman St. 6B, Irvine, CA 92714, Tel: 714-261-9281, TWX: 910-595-1917; Empl.: 60; *Sls. Mgr.:* Jack Gaushell, VP Sls.

TRULINE CORPORATION, P.O. Box 1469, Visalia, CA 93279-1469, Tel: 209-747-1261, FAX: 209-747-0280; Empl.: 85; *Sls. Mgr.:* R. W. Aubery

TRW CAPACITOR DIV., 301 West "O" St., Ogallala, NE 69153, Tel: 308-284-3611, TELEX: 484 533; *Sls. Mgr.:* Dennis Lienemann

TRW CONNECTOR DIV., TRW Electronic Components Grp., 1501 Morse Ave., Elk Grove Village, IL 60007, Tel: 312-981-6000, TWX: 910-222-1796; *Sls. Mgr.:* B. Walthall; *Dist. Mgr.:* Jim Hartranft Jr.

TRW, Dynalco Controls Div., 5200 NW 37th, P.O. Box 8187, Ft. Lauderdale, FL 33310, Tel: 305-739-4300, TELEX: 514833; Empl.: 125; *Sls. Mgr.:* Kurlin Wilson; *Dist. Mgr.:* Joe Stephens

TRW ELECTRONIC COMPONENTS GRP., 2525 E. El Segundo Blvd., El Segundo, CA 90245, Tel: 213-536-0600

TRW FIBER OPTIC PRODS., CONNECTOR DIV., TRW Elctrn. Comps. Grp., 401 N. Broad St., Philadelphia, PA 19108, Tel: 215-922-8900; TWX: 710-670-2286; *Sls. Mgr.:* Harry Saleker

TRW LSI PRODUCTS DIVISION, PO Box 2472, La Jolla, CA 92038, Tel: 619-457-1000, TELEX: 697957, TWX: 910-335-1571, FAX: 619-455-6314; Empl.: 330; *Sls. Mgr.:* Doug Turnage, Dir., Sls.; *Dist. Mgr.:* Ron Courtois

TRW MICROWAVE, See FEI Microwave

TRW OPTOELECTRONICS DIV., 1215 W. Crosby Rd., Carrollton, TX 75006, Tel: 214-323-2200, TELEX: 215849, FAX: 214-323-2396; Empl.: 1400; *Sls. Mgr.:* Bob Taber; *Dist. Mgr.:* Robert Linker

TRW RESISTIVE PRODUCTS DIV., See International Resistive Co.

TRW, RF Devices Div., 14520 Aviation Blvd., Lawndale, CA 90260, Tel: 213-536-0888, TWX: 910-325-6206; Empl.: 1000; *Dist. Mgr.:* G. Vegvari

TRW TECHNAR, INC., TRW, Inc., 5462 Irwindale Ave., Irwindale, CA 91706, Tel: 818-334-0250, FAX: 818-969-4781; Empl.: 225; *Sls. Mgr.:* George R. Downs

TS PRODUCTS, INC., 12455 Branford St., Bldg. 22, Arleta, CA 91331, Tel: 818-896-6676; Empl.: 12; *Sls. Mgr.:* Ron Zettelmier; *Dist. Mgr.:* Ron Zettelmier ..... **D•2175**

Local Sales Offices & Reps
CA Los Angeles, TS Products, Inc. 818-896-6676
CA Montebello, TUCUL Engrg. 213-728-7397
CA San Marino, Motion Control, Inc. 818-796-0189

FAX: 213-312-1055

TTE, INCORPORATED, 11652 W. Olympic Blvd., Los Angeles, CA 90064, Tel: 213-478-8224, TELEX: 3725291; FSC No.: 07766; *Sls. Mgr.:* S. J. Sodaro ..... **A•1706-1713, 2433**

Local Sales Offices & Reps
MA Woburn, Cygnus Sls., Inc. 617-935-1395
PA Hatboro, Delta Mktg., Inc. 215-675-0343
PA Langhorne, Delta Mktg., Inc. 215-750-1440
MD Laurel, CSDS, Inc. 301-953-7884
IL Northfield, Feller Assocs., Inc. 312-446-8065
IA Cedar Rapids, Feller Assocs., Inc. 319-364-0566

TTS-TELECOM TERMINAL SYSTEMS, Box 66369, Los Angeles, CA 90066, Tel: 213-390-9494, TELEX: 3715831; Empl.: 18; *Sls. Mgr.:* L. Winters

TUCKER ELECTRONICS, Box 461966, Garland, TX 75046, Tel: 214-348-8800, 800-527-4642, TELEX: 79-1726, TWX: 62812862; Empl.: 43; *Sls. Mgr.:* Don Stabeno

TUNGSTONE BATTERIES, INC., 18 Billings St., Sharon, MA 02067, Tel: 617-784-2000, TELEX: 951908; Empl.: 23; *Sls. Mgr.:* William O'Connell

FAX: 602-744-6155

TUSONIX, INC., 7741 N. Business Park Drive, P. O. Box 37144, Tucson, AZ 85740-7144, Tel: 602-744-0400, TELEX: 102-299640, TWX: 310-299640; FSC No.: 59660; Empl.: 800; *Sls. Mgr.:* Robert H. Jones; *Dist. Mgr.:* John H. Ohlrich ..... **A•1181, 1714**

Local Sales Offices & Reps
AZ Tucson, Tusonix, Inc. 602-744-0400
CA San Jose, Tusonix, Inc. 408-922-0350
CA Santa Ana, Tusonix, Inc. 714-633-3257
FL Coral Springs, Tusonix, Inc. 305-952-7050
MD Pasadena, Tusonix, Inc. 301-360-0100
NY Ontario, Tusonix, Inc. 315-524-7147
NC Greensboro, Tusonix, Inc. 919-292-4286
TX Plano, Tusonix, Inc. 214-985-9335

Local Distributors
AZ Phoenix, TTI 602-861-0222
CA Chatsworth, TTI 818-709-1010
CA Milpitas, TTI 408-946-5577
CA San Diego, TTI 619-587-4888
CO Denver, TTI 303-429-6806
CT Stratford, TTI 203-375-1400
FL Orlando, TTI 305-859-1000
GA Norcross, TTI 404-662-0911
IL Chicago, Newark Elctrns. 312-638-4411
MD Beltsville, Resco 301-937-9100
MD Columbia, TTI 301-995-1331
MD White Marsh, Resco 301-529-0500
MA Wilmington, TTI 617-658-4700
MN Eden Prairie, TTI 612-944-5080
NY Hauppauge, Fairmont Elctrn. Sls. 516-231-3313
NY Ronkonkoma, TTI 516-737-2000
NC Raleigh, Resco 919-781-5700
OH Columbus, TTI 614-848-5770
TX Fort Worth, TTI 817-595-3100
WA Redmond, TTI 206-882-0291

TUSTIN ELECTRONICS CO., 1580 N. Kellogg Drive, Anaheim, CA 92807, Tel: 714-777-5800, FAX: 714-777-5814; FSC No.: 7025-0010; *Sls. Mgr.:* Saul Tunkelrott

TWP, INC., 2133 4th St., Berkeley, CA 94710, Tel: 415-548-4434, TELEX: 171-267, FAX: 415-548-3073; Empl.: 10; *Sls. Mgr.:* G. Reed

TYCO INSTR. DIV., See Data Instrs.

TYCOR ELECTRONIC PRODUCTS LTD., 6107-6 Street S.E., Calgary, Alberta, Canada T2H 1L9, Tel: 403-259-3200, TELEX: 03 825842, ESYLNK: 1-800-661-8263, FAX: 403-253-0663; *Sls. Mgr.:* Scott Lee

TYTON CORP., Box 23055, 7930 N. Faulkner Rd., Milwaukee, WI 53223, Tel: 414-355-1130, TWX: 910-262-3094; *Sls. Mgr.:* Terry Morgan

UCCEL CORPORATION, P. O. Box 660054, Dallas, TX 75266, Tel: 214-353-7100, TWX: 910-861-4990; Empl.: 1350

UCE, INC., 35 Rockland Rd., Norwalk, CT 06854, Tel: 203-838-7509, FAX: 203-838-2566; Empl.: 20; *Sls. Mgr.:* D. Schmidt

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AZ Tempe, Semper Fi Sls., Inc. 602-730-9553
CA Chatsworth, Raltech 818-700-0933
CA Del Mar, Chapman & Chapman 619-755-0412
CA Glendale, Mission Mktg. Grp. 818-247-9110
CA Santa Clara, I Squared Inc. 408-988-3400
CO Denver, West Inc. 303-477-8180
CT Bloomfield, F. S. I. 203-243-3122
FL St. Petersburg, J.C.J. Assocs. 813-343-2679
IL Downers Grove, Richmar Elctrn. 312-968-0118
IN Ft. Wayne, Denton Mktg. 219-486-0665
IA Hiawatha, Ard Sls. 319-393-6392
MA Lowell, F. S. I. 617-459-7399
MI Jackson, T.P.S. & Assocs. 517-783-1722
MN Minneapolis, Dunlop Consits. 612-544-1070
MO St. Louis, S. W. Wollard Co. 314-576-1130
NJ Piscataway, R. P. Luce & Co. 201-752-8750
NY Chappaqua, Micrel, Inc. 914-238-4961
NY New Hyde Pk., R. P. Luce & Co. 516-437-4550
NY Rochester, Fritz Dasson 716-338-1699
OH Wooster, T.P.S. & Assocs. 216-264-0971
PA Wynnewood, Metz-Benham Assocs., Inc. 215-896-7300
TX Richardson, Pro Comp. Sls. Co. 214-669-1500
UT Salt Lake City, West, Inc. 801-292-8787
WA Bellevue, Olson Tech. Sls. Corp. 206-883-7792
WI Butler, Richmar Elctrn. 414-781-1730
Can Manitoba/Winnipeg, Smith-Paterson & Assoc. 294-885-1376
Can Ont./Mississauga, Source Elctrn. 416-675-6235

Local Distributors
CA Chatsworth, Petell/Passive Comp., Inc. 818-341-1745
CA San Diego, Neumann Elec. 619-695-3005
CA San Jose, Zeus Comps. 408-998-5121
CA Westlake Vl, Distel, Inc. 805-495-9998
CO Denver, IEC Integrated Elctrn. 303-843-2040
FL Oviedo, Zeus Comp. 305-365-3000
FL Tampa, Impala Elctrns. 813-885-4747
MD Columbia, Aztech Elctrns. 301-995-6800
MD Columbia, Zeus Comps. 301-997-1118
MA Burlington, TLC Elctrns. 617-273-0140
MA Lexington, Zeus Comps. 617-863-8800
NY Bohemia, Justin Elec. 516-589-4000
NY Hauppauge, Jaco, Inc. 516-273-5500
NY Melville, SAI, Inc. 516-293-2710
NY Port Chester, Zeus Comps. 914-937-7400
NY Valley Stream, L & S Elec. 516-561-2474
OH Cincinnati, Eclipse of Ohio 513-661-7733
OH Cincinnati, G & A Sls. 513-521-8800
OH Dayton, Televox, Inc. 513-454-1225
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ULVAC NORTH AMERICA CORPORATION, P.O. Box 799, 105 York Street, Kennebunk, ME 04043, Tel: 207-985-2973, TELEX: 46-9045, FAX: 207-985-4459; Empl.: 50; *Sls. Mgr.:* Susan Zilaro; *Dist. Mgr.:* Harold Baum

Local Sales Offices & Reps
CA San Jose, Process Physics, Inc. 408-435-1611
GA La Grange, J.B. Systems 404-884-3006
MA Boxford, Lanyi Equip. 617-887-8860

FAX: 415-573-7562

ULVECO, INC., 323 Vintage Park Drive, Foster City, CA 94404, Tel: 415-574-1100, TWX: 856446 ULVECO; *Sls. Mgr.:* Michael Szulborski ..... **A•2430-2432**

Local Sales Offices & Reps
CA Arcadia, Van Gott & Assocs. 818-445-9728
CA San Diego, Van Gott & Assocs. 619-566-5320
CA Santa Clara, Gagner-Toomey Assocs., Inc. 408-244-2200
CO Littleton, MRC 303-794-4684
CT Avon, Tom Maguire Assocs. 203-673-3019
CT Glastonbury, Tom Maguire Assocs. 203-659-1649
MA Norwood, Tom Maguire Assocs. 617-551-0500
MN Minneapolis, Electro-Serv Co. 612-338-3475
NY Clark Mills, KLM Garner 315-853-6126
NY Pittsford, KLM Garner 716-381-8350
NY Plainview, Robert Smith Assocs. 516-681-3155
OR Beaverton, Evergreen Mktg. Corp. 503-643-8020
PA Exton, Linear Sls. 215-524-8080
WA Richmond, Glassock Assocs. 804-740-0063
WA Seattle, Evergreen Mktg. Grp. 206-633-3160
Can Markham, Ont., Stetron Intl, Inc. 416-475-6202

UNGAR, Div. Eldon Inds., Inc., 100 W. Manville St., Compton, CA 90224-6005, Tel: 213-774-5950, TELEX: 4720750 Eldon; FSC No.: 78976; Empl.: 140; *Sls. Mgr.:* Richard Shivers

UNHOLTZ-DICKIE CORP., 6 Brookside Dr., Wallingford, CT 06492, Tel: 203-265-3929, TELEX: 643802, FAX: 203-265-2690; Empl.: 49

UNIBOX, Div. of Amerex, P.O. Box 2815, Riverside, CA 92516, Tel: 714-686-1400; *Sls. Mgr.:* Roger Orton ..... **C•1014**

UNICO, 3725 Nicholson Rd., Franksville, WI 53126-0505, Tel: 414-886-5678, TWX: 910-271-2385, FAX: 414-886-8396; Empl.: 250; *Sls. Mgr.:* Joseph Glover

FAX: 201-674-3803

UNICORP, 291 Cleveland St., Orange, NJ 07050, Tel: 201-674-1700; FSC No.: 04729; Empl.: 82; *Sls. Mgr.:* B. Levine ..... **C•1710-1711**

UNILATOR TECHNICAL CERAMICS INC., 6290 Sunset Blvd., Ste. 1126, Los Angeles, CA 90028-8770, Tel: 213-463-5618, TWX: 910 321-2903; *Sls. Mgr.:* Norman R. Sutherland

UNIMAX SWITCH CORP., See C & K/Unimax, Inc.

UNIMEASURE, INC., 7055 N.W. Grandview Dr., Corvallis, OR 97330, Tel: 503-757-3158

UNION CARBIDE CORPORATION, Industrial Chemicals Div., Crystal Products Dept., 9320 Chesapeake Dr., Ste. 216, San Diego, CA 92123, Tel: 619-279-4500, TELEX: 695-465; Empl.: 125; *Sls. Mgr.:* J. J. Beeman

UNI-POWER HYBRIDS INTERNATIONAL, See Hybrids Intl. Ltd., Thick Film Div., and Hi-Q Crystals, Hybrids Intl. Ltd.

UNIQUE OPTICAL CO., Diversified Optical Corp., P.O. Box 585, Farmingdale, NY 11735, Tel: 516-420-0288, TWX: 510-224-6598; Empl.: 28; *Sls. Mgr.:* James A. Greene

UNIT DESIGN, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-526-0800, TWX: 910-250-0136, FAX: 714-871-4164; Empl.: 8; *Sls. Mgr.:* M. Konrad

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UNITED CHEMI-CON INC., 9801 W. Higgins Rd., Rosemont, IL 60018, Tel: 312-696-2000, TELEX: 28-3557, TWX: 910-253-2964; Empl.: 50; *Sls. Mgr.:* R. Donham ..... **A•1182-1183**

Local Sales Offices & Reps
NJ Bellmawr, TAI Corp. 609-933-2600
AL Huntsville, R. D. Whitesell 205-883-5110
CA El Toro, English/Damco Sls. 714-837-3801
CA Mountain View, Straube Assocs. 415-969-6060
CO Westminster, Straube Assocs. Mountain States, Inc. 303-426-0890
FL Altamonte Springs, Semtronic Assocs., Inc. 305-831-8233
FL Clearwater, Semtronic Assocs., Inc. ... 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs., Inc. 305-731-2484
GA Norcross, R. O. Whitesell 404-449-9190
IL Chicago, M. Gottlieb Assocs. 312-775-1151
IN Fort Wayne, R. O. Whitesell 219-432-5591
IN Indianapolis, R. O. Whitesell 317-359-9283
IN Kokomo, R. O. Whitesell 317-457-9127
KS Shawnee Mission, Lowell Kangas & Assocs., Inc. 913-631-3515
KY Peewee Valley, R. O. Whitesell 502-241-1441
MD Columbia, Pro-Rep, Inc. 301-653-3600
MA Hingham, Northeast Reps. 617-749-8700
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MI Southfield, R. O. Whitesell 313-559-5454
MI St. Joseph, R. O. Whitesell 616-983-7337
MN Eden Prairie, Twist Co. 612-941-2040
NY N. Bellmore, Aurora Mktg. 516-221-0764
NY New York, Caravan Sls., Corp. 212-734-5800
NY Pittsford, Franklin Sls. Corp. 716-248-8251
NC Greensboro, Caravan Sls. 919-294-1500
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OR Portland, Earl & Brown 503-245-2283
PA Pittsburgh, R. O. Whitesell 412-963-6161
TN Knoxville, M. Gottlieb Assocs. 615-966-1314
TN Knoxville, R. O. Whitesell 615-694-9476
TX Austin, Mil-Rep 512-346-0331
TX Houston, Mil-Rep 713-444-2557
TX Richardson, Mil-Rep 214-644-6731
UT Salt Lake City, Straube Assocs. Mountain States, Inc. 801-263-2640
WA Redmond, Earl & Brown 206-885-5064
WI Brookfield, Twist Co. 414-782-2670
Can Toronto, Renmark Elctrns. 416-494-5445

Local Distributors
AZ Tempe, Bell Inds. 602-966-7800
AZ Tempe, Elctrn. Supp. 602-258-4769
AZ Tempe, Time Elctrns. 602-967-2000
CA Agoura Hills, Time Elctrns. 818-707-2890
CA Anaheim, Time Elctrns. 714-937-0911
CA Chatsworth, Passive Comps. 818-341-1745
CA Chatsworth, Time Elctrns. 818-998-7200
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CT Cheshire, Time Elctrns. 203-271-3200
FL Altamonte SPrings, S.A.I. 305-831-6201
FL Ft. Lauderdale, Hammond Elctrns. 305-973-7103
FL Ft. Lauderdale, Reptron Elctrns. 305-735-1112
FL Ft. Lauderdale, Time Elctrns. 305-974-4800
FL Orlando, Hammond Elctrns. 305-849-6060
FL Orlando, Time Elctrns. 305-841-6565
FL Tampa, Reptron Elctrns. 813-855-4656

GA	Atlanta, Time Elctrns.	404-984-0126
GA	Norcross, Hammond Elctrns.	404-449-1996
GA	Norcross, Reptron Elctrns.	404-446-1300
GA	Norcross, Time Elctrns.	404-448-4448
IL	Chicago, Nep Elctrns.	312-625-8400
IL	Elk Grove Vl, RM Elctrns.	312-869-2080
IL	Northbrook, Classic Comps.	312-272-9650
IL	Schaumburg, Reptron Elctrns.	312-882-1700
IL	Wood Dale, Time Elctrns.	312-350-0610
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MI	Livonia, Reptron Elctrns.	313-525-2700
MN	Bloomington, Time Elctrns.	612-944-9192
MN	Hopkins, Joel Co.	612-935-6202
MN	Minnetonka, Reptron Elctrns.	612-938-0000
MO	St. Louis, Time Elctrns.	314-391-6444
NJ	Clifton, J-Mar Elctrns.	201-772-6400
NM	Albuquerque, Bell Inds.	505-292-2700
NY	E. Syracuse, Time Elctrns.	315-432-0355
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Hauppauge, Time Elctrns.	516-273-0100
NY	Melville, S.A.I.	516-293-2710
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Ronkonkoma, Prime Comps.	516-737-1730
NC	Charlotte, Time Elctrns.	704-522-7600
NC	Greensboro, Hammond Elctrns.	919-275-6391
NC	Raleigh, Service Plus	919-850-9550
OH	Dublin, Time Elctrns.	614-761-1100
OH	Worthington, Reptron	614-436-6675
OR	Lake Oswego, Bell Inds.	503-241-4115
OR	Portland, Time Elctrns.	503-684-3780
PA	Exton, VSH	215-363-2250
PA	King of Prussia, Time Elctrns.	215-337-0900
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VT	Rutland, S.A.I.	802-775-7126
WA	Bellevue, Bell Inds.	206-747-1515
WA	Redmond, Time Elctrns.	206-882-1600
WI	New Berlin, Classic Comps.	414-786-5300
WI	New Berlin, Nep Elctrns.	414-785-9100

UNITED DETECTOR TECHNOLOGY, 12525 Chadron Ave., Hawthorne, CA 90250, Tel: 213-978-0516, TELEX: 18-2458; FSC No.: 50486; Empl.: 150; *Sls. Mgr.:* Alfred Seck

UNITED ELECTRIC CONTROLS, 85 School St, Watertown, MA 02172, Tel: 617-WA6-1000, TELEX: 92 2445, FAX: 617-926-2568; Empl.: 420; *Sls. Mgr.:* Dave Williams; *Dist. Mgr.:* George Miller

UNITED FOAM PLASTICS, 172-Q E. Main St, Georgetown, MA 01833, Tel: 617-352-2200, TWX: 710-347-0315, FAX: 617-352-7169; FSC No.: 55900; Empl.: 200; *Sls. Mgr.:* Richard L. Corrigan

UNITED SOLDER WRAP INC., See Vector Elctrn. Co., Solderwrap of CA, Inc.

UNITED STATES CRYSTAL CORP., 3605 McCart St, Fort Worth, TX 76110, Tel: 817-921-3014, TWX: 910-893-4084, FAX: 817-923-0424; FSC No.: 52847; Empl.: 75; *Sls. Mgr.:* Jan Henderson

UNITED STATES SOFTWARE CORP., 14215 N.W. Science Pk. Dr., Portland, OR 97229, Tel: 503-641-8446, TWX: 4993875 U S SOFTWARE; *Sls. Mgr.:* Donald L. Dunstan

UNITED SUPERTEK, INC., 118 Charcot Ave., San Jose, CA 95131-1101, Tel: 408-922-0730, FAX: 408-922-0534; Empl.: 40; *Sls. Mgr.:* Ms. Jo-Ann Ricci

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UNITED TRANSFORMER CORPORATION, Sub. of OPT Industries, 300 Red School Lane, Phillipsburg, NJ 08865, Tel: 201-454-2600, TWX: 710-581-2722; Empl.: 200; *Sls. Mgr.:* A. Profeta ..... **A•1479, 2428-2429**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-997-8899
CA	Anaheim, Westrep	714-527-2822
CA	San Diego, Westrep	619-566-6580
CA	Santa Clara, Westrep	408-988-8833
CO	Westminster, Straube Assocs.	303-426-0890
FL	Orlando, OPT	305-658-6020
ID	Boise, N. R. Schultz	208-377-8686
KS	Lenexa, Midtec Assocs.	913-541-0505
MD	Columbia, L. D. Lowery	301-381-0225
MD	Columbia, L. D. Lowery	301-964-9110
MN	Eden Prarie, The Twist Co.	612-941-2040
NM	Albuquerque, S.W. Sls.	505-883-1388
NY	E. Rochester, Lupton Assocs.	716-381-4800
NY	Melville, Comtronic Assocs.	516-249-0505
OR	Beaverton, N. R. Schultz	503-643-1644
PA	Broomall, L. D. Lowery	215-356-5300
TX	El Paso, S.W. Sls.	915-594-8259
WA	Bellevue, N. R. Schultz	206-494-0300
WA	Bellevue, N. R. Schultz Co.	206-454-0300
Can	Toronto, Ont., Renmark Assocs.	416-494-5445

Local Distributors

AL	Huntsville, Arrow Elctrns.	205-837-6955
AL	Huntsville, Hall-Mark Elctrns.	205-837-8700
AZ	Phoenix, Arrow	602-437-0750
AZ	Phoenix, Hall-Mark Elctrns.	602-437-1200
CA	Canoga Pk., Hall-Mark Elctrns.	818-716-7300
CA	Garden Grove, Bell Inds.	714-220-0681
CA	Gardena, Bell Inds.	213-515-1800
CA	Los Angeles, Arrow Elctrns.	818-701-7500
CA	Sacramento, Hall-Mark Elctrns.	916-722-9280
CA	San Diego, Arrow	619-565-4800
CA	San Diego, Hall-Mark	619-268-1201
CA	San Francisco, Arrow Elctrns.	408-745-6600
CA	San Jose, Hall-Mark	408-432-0900
CA	San Jose, Jaco	408-432-9290
CA	Sunnyvale, Bell Inds.	408-734-8570
CA	Thousand Oaks, Bell Inds.	818-340-1940
CA	Torrance, Hall-Mark Elctrns.	213-217-8400
CA	Tustin, Arrow Elctrns.	714-838-5422
CA	Tustin, Hall-Mark Elctrns.	714-669-4700
CA	Westlake, Jaco	805-495-9998
CO	Denver, Hall-Mark Elctrns.	303-790-1662
CO	Englewood, Arrow Elctrns.	303-790-4444
CT	Meriden, Jaco	203-235-1422
CT	Wallingford, Arrow	203-265-7741
CT	Wallingford, Hall-Mark Elctrns.	203-269-0100
FL	Ft. Lauderdale, Arrow Elctrns.	305-429-8200
FL	Ft. Lauderdale, Hall-Mark Elctrns.	305-971-9280
FL	Melbourne, Arrow Elctrns.	305-725-1480
FL	Orlando, Arrow Elctrns.	305-682-6923
FL	Orlando, Hall-Mark Elctrns.	305-855-4020
FL	Tampa, Hall-Mark Elctrns.	813-530-4543
GA	Atlanta, Arrow Elctrns.	404-449-8252
GA	Atlanta, Hall-Mark Elctrns.	404-447-8000
HI	Honolulu, Honolulu Elctrns.	809-949-5564
IL	Chicago, Arrow	312-250-0500
IL	Chicago, Hall-Mark Elctrns.	312-860-3800
IN	Indianapolis, Arrow	317-243-9353
IN	Indianapolis, Hall-Mark Elctrns.	317-872-8875
IA	Cedar Rapids, Arrow Elctrns.	319-395-7230
KS	Kansas City, Arrow Elctrns.	913-541-9542
KS	Kansas City, Hall-Mark Elctrns.	913-888-4747
MD	Baltimore, Hall-Mark	301-988-9800
MD	Columbia, Arrow Elctrns.	301-995-6002
MD	Columbia, Jaco	301-995-6620
MA	Boston, Arrow Elctrns.	617-935-5134
MA	Boston, Hall-Mark	617-935-9777
MA	Boston, Jaco	617-273-1860
MI	Detroit, Arrow Elctrns.	313-971-8220
MI	Grand Rapids, Arrow Elctrns.	616-243-0912
MI	Livonia, Hall-Mark	313-462-1205
MN	Minneapolis, Arrow Elctrns.	612-830-1800
MN	Minneapolis, Hall-Mark Elctrns.	612-941-2600
MO	St. Louis, Arrow Elctrns.	314-567-6888
MO	St. Louis, Hall-Mark Elctrns.	314-291-5350
NH	Manchester, Arrow Elctrns.	603-668-6968
NJ	Fairfield, Arrow	201-538-0900
NJ	Fairfield, Hall-Mark	201-575-4415
NJ	Mt. Laurel, Hall-Mark	609-235-1900
NJ	Totowa, Jaco	201-942-4000
NM	Albuquerque, Arrow Elctrns.	505-243-4566
NY	Hauppauge, Arrow Elctrns.	516-231-1000
NY	Hauppauge, Jaco Elctrns.	516-273-5500
NY	Lynbrook, Peerless Radio	516-593-2121
NY	Rochester, Arrow Elctrns.	716-427-0300
NY	Rochester, Hall-Mark	716-244-9290
NY	Ronkonkoma, Hall-Mark Elctrns.	516-737-0600
NC	Raleigh, Arrow	919-876-3132
NC	Raleigh, Hall-Mark	919-872-0712
NC	Winston-Salem, Arrow Elctrns.	919-725-8711
OH	Cleveland, Arrow Elctrns.	216-248-3990
OH	Cleveland, Hall-Mark Elctrns.	216-349-4632
OH	Columbus, Arrow Elctrns.	614-436-0928
OH	Columbus, Hall-Mark Elctrns.	614-888-3313
OH	Dayton, Arrow	513-435-5563
OH	Dayton, Pioneer	513-236-9900
OH	Westerville, Hall-Mark	614-891-4555
OK	Tulsa, Arrow Elctrns.	918-252-7537
OK	Tulsa, Hall-Mark Elctrns.	800-231-0253
OR	Portland, Arrow	503-645-6456
PA	Philadelphia, Arrow Elctrns.	215-928-1800
PA	Philadelphia, Hall-Mark Elctrns.	215-355-7300
PA	Pittsburgh, Arrow Elctrns.	412-856-7000
TX	Austin, Arrow	512-835-4180
TX	Austin, Hall-Mark	512-258-8848
TX	Dallas, Arrow Elctrns.	214-380-6464
TX	Dallas, Hall-Mark	214-553-4300
TX	Dallas, Jaco	214-235-9575
TX	Houston, Arrow Elctrns.	713-530-4700
TX	Houston, Hall-Mark Elctrns.	713-781-6100
UT	Salt Lake City, Arrow Elctrns.	801-973-6913
UT	Salt Lake City, Hall-Mark Elctrns.	801-972-1008
WA	Seattle, Arrow	206-575-4420
WI	Milwaukee, Arrow Elctrns.	414-792-0150
WI	Milwaukee, Hall-Mark Elctrns.	414-797-7844
PR	Hato Rey, Arrow Elctrns.	809-764-4384
Can	Montreal, Que., Arrow Elctrns.	514-735-5511
Can	Ottawa, Ont., Arrow Elctrns.	613-226-6903
Can	Quebec City, Que., Arrow Elctrns.	418-687-4231
Can	Toronto, Ont., Arrow Elctrns.	416-661-0220

UNITED WIRE & CABLE CORP., 425 Shrewsbury St, Worcester, MA 01604, Tel: 617-757-3872, FAX: 617-753-2173; FSC No.: 51348; Empl.: 10; *Sls. Mgr.:* T. P. Andrews

UNIT INDUSTRIES, 1140 E. Valencia Dr., Fullerton, CA 92631, Tel: 714-871-4161; Empl.: 40; *Sls. Mgr.:* R. Lisman

UNITRACK

FAX: 215-692-0801

UNITRACK INDUSTRIES, INC., 1372 Enterprise Dr., Goshen Corp. Pk., P.O. Box 1927, West Chester, PA 19380, Tel: 215-692-0800, TWX: 510-663-0000; *Sls. Mgr.:* Anna Orcutt ..... **C•1114-1117**

Local Sales Offices & Reps

AZ	Phoenix, Finn-Pat Co.	602-954-0301
CO	Denver, Delltron Co.	303-373-0300
GA	Atlanta, Magaro & Assocs.	404-451-8862
IL	Des Plaines, Lincoln, Hodges & Assocs.	312-297-3810
IN	Ft. Wayne, Aktron Corp.	219-747-3650
MA	Northboro, Henik Assocs.	617-393-3127
MI	Kentwood, C.A. Geer Co.	616-534-9449
MN	St. Paul, Countrymen Assocs.	612-645-9151
MO	Blue Springs, Cairns Sls. Co.	816-229-1404
NJ	Basking Ridge, Churchill Assocs.	201-204-0744
NY	Larchmont, Hingston Walsh Assocs., Inc.	914-834-5781
NY	Syracuse, Lenard Co.	315-479-9191
OH	Akron, Augnat Assocs.	216-273-1211
PA	Norristown, Rivco January	215-631-1414
TX	Wylie, Air Quip/Robleyco	214-442-3573
Can	Guelph, Ont., Hammond Mfg. Co., Ltd.	519-822-2960

Local Distributors

CA	Santa Ana, EL-COM	714-432-6630
CO	Denver, Integrated Elctrns.	303-292-6121
MA	Northboro, Papi Supp.	617-393-3127
MA	Winchester, Rush Inds.	617-729-5800
MI	Grand Rapids, S-F Elctrn. Supp. Co.	616-459-0216
NC	Winston-Salem, Kirkman Elctrns.	919-722-9131
OH	Dayton, Televox, Inc.	513-294-4499
OH	Warren, Rem Elctrns. Supp. Co., Inc.	216-373-1300
PA	Erie, Rem Elctrns. Supp. Co., Inc.	814-453-5625
TX	Wylie, Air Quip/Robleyco	214-442-3573

UNITRODE CORP., 580 Pleasant St, Watertown, MA 02172, Tel: 617-926-0404, TELEX: 92-2414, TWX: 710-326-6509; Empl.: 2,000; *Sls. Mgr.:* Leslie Wallace; *Dist. Mgr.:* Ron Myers

UNITRODE CORP., Capacitor Div., 11494 Sorrento Valley Road, San Diego, CA 92121, Tel: 619-453-8020

Unitron

FAX: 214-341-2099

UNITRON INC., 10925 Miller Rd., Dept. EE, Dallas, TX 75238, Tel: 214-340-8600, TELEX: 882511; FSC No.: 6130; Empl.: 75; *Sls. Mgr.:* R. L. Beutel ... **D•2158-2160**

Local Sales Offices & Reps

CA	Manhattan Bch., Unitron (Jim Houghten)	213-379-7901
CA	Sunland, Unitron (Jim Crevier)	818-352-7348
KS	Mission, Warren West & Assocs.	913-236-5356
MN	St. Paul, Power Mation	612-645-0781
MO	Ellisville, Maynard & Assocs.	314-256-6899
NC	Charlotte, Bruster Lawing & Assocs.	803-831-1205
SC	Mt. Pleasant, Bruster Lawing & Assocs.	803-884-5748
VA	Midlothian, Bruster Lawing & Assocs.	804-794-3879

UNITRONIX CORP., 50 County Line Rd., Somerville, NJ 08876, Tel: 201-231-9400, TELEX: 833184; Empl.: 35; *Sls. Mgr.:* Frank Zimmer; *Dist. Mgr.:* Joseph Murawski

UNIVERSAL AD-YU/D-F CORP., 2517 E. Norwich St., Milwaukee, WI 53207, Tel: 414-482-4100; FSC No.: 90101; Empl.: 10; *Sls. Mgr.:* Ronald Tessmer

UNIVERSAL DATA SYSTEMS, INC., Motorola Information Systems Group, 5000 Bradford Dr., Huntsville, AL 35805-1953, Tel: 205-721-8000, TELEX: 752602 UDS HTV; Empl.: 800; *Sls. Mgr.:* Ray Kelly; *Dist. Mgr.:* Ron Martin

Local Sales Offices & Reps

AL	Huntsville	205-721-8000
AZ	Meza	602-820-6611
CA	Mission Viejo	714-770-4555
CA	Mountain View	415-969-3323
CA	Van Nuys	818-891-3282
CO	Aurora	303-368-9000
FL	Brandon	813-684-0615
GA	Roswell	404-998-2715
IL	Glenview	312-998-8180
MD	Wheaton	301-942-8558
MA	Framingham	617-875-8868
MI	Livonia	313-522-4750
MN	Apple Valley	612-432-2344
MO	St. Louis	314-434-4919
NJ	East Brunswick	201-238-1515
NY	Uniondale	516-222-0918
NC	Winston-Salem	919-760-4184
OH	Westerville	614-895-3025
PA	Blue Bell	215-643-2336
TX	Houston	713-988-5506
TX	Richardson	214-680-0002

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UNIVERSAL INSTRS. CORP., MECHANIZED ELCTRN. ASSEMBLY (MEA) DIV., See Mechanized Elctrn. Assembly Div., Universa

UNIVERSAL VOLTRONICS, 27 Radio Circle Dr., Mt. Kisco, NY 10549, Tel: 914-241-1300, TWX: 710-571-2142; Empl.: 135; *Sls. Mgr.:* Bill Herndon ..... **D•2030**

Local Sales Offices & Reps

CA	Santa Clara, Sourcetronics	408-998-8801
MA	Whitinsville, Power Factor & Assocs.	617-234-6415
MN	Minneapolis, R.J. Sls.	612-866-3661
PA	Audubon, Holmes Assocs.	215-666-0636
VA	Fairfax, Schibley Assocs.	703-591-3008

UPSystems INC.

FAX: 213-634-0621

UPSYSTEMS, INC., 7801 E. Compton Blvd., Paramount, CA 90723, Tel: 213-634-0621, TWX: 910-346-7814; FSC No.: 3698; *Sls. Mgr.:* Dick Williams ..... **D•2161**

URBAN ELECTRONICS, P. O. Box 456, Dover, MA 02030, Tel: 617-329-4068, FAX: 617-235-5936; Empl.: 50; *Sls. Mgr.:* G. Urban

URDC, Acme Electric Corporation, 7915 South 1530 West, Box 10, West Jordan, UT 84084, Tel: 801-561-9385, FAX: 801-562-9004; *Sls. Mgr.:* Glenn Waterman

U S CAPACITOR CORP., See U S Microtek Components

U.S. COMPONENTS, INC., Unitech PLC., 35 Carlough Rd., Bohemia, NY 11716, Tel: 516-589-8080, TWX: 510-228-7886; Empl.: 90; *Sls. Mgr.:* J. Prideaux; *Dist. Mgr.:* J. Prideaux

DIGITAL

FAX: 213-594-6091

U. S. DIGITAL CORP., 12371 Kensington Rd., Los Alamitos, CA 90720, Tel: 213-594-0094 ..... **B•1928**

Local Distributors

NY	Clarks Mills, KLM Garner	315-853-6126

COOPER INDUSTRIES USD

FAX: 312-867-2211

USD PRODUCTS, Cooper Industries, 7300 W. Wilson Ave., Chicago, IL 60656, Tel: 312-867-4600, TELEX: 910-221-3474; Empl.: 200; *Sls. Mgr.:* Ron Pitchford; *Dist. Mgr.:* John Thielen ..... **B•1352-1353; C•1582-1583**

Local Sales Offices & Reps

AL	Decatur, El Tech, Inc.	205-353-7899
AR	Hot Springs, MYA, Inc.	501-262-1365
CA	Laguna Hills, Western Automation	714-859-6988
CO	Englewood, Harthun Assocs., Inc.	303-792-5050
FL	Stuart, Cahill Assocs., Inc.	305-288-3113
IL	Schaumburg, Tech Tron Sls., Inc.	312-843-7530
IN	Carmel, Fred A. Dorsey & Assocs., Inc.	317-844-4842
KS	Wichita, Thunderbird Tech. Sls., Inc.	316-684-3941
MA	Chelmsford, Marty Flynn Assocs.	617-649-3088
MI	Oak Park, A. Blumenberg Assocs., Inc.	313-968-3230
MN	Arden Hills, R. D. Schwen Engrg.	612-636-3088
MO	Florissant, Mid/West Co.	314-837-3361
NE	Lincoln, MYA-Midwest, Inc.	402-475-5298
NJ	Florham Park, Varrelman-Gorman Co.	201-822-9616
NY	Rochester, BKT Assocs., Inc.	716-586-5814
NC	Winston-Salem, L. G. White Southern, Inc.	919-725-3612
OH	Rocky River, Hiltebrant Indl. Sls.	216-333-5600
PA	Edgemont, White/Whiddett Co.	215-353-6343
TX	Lewisville, Texoma Tech. Sls., Inc.	214-434-2770
VA	Blacksburg, Candor Co.	703-953-2197
WA	Bothell, Temco Northwest	206-821-5434
WI	Franklin, WD Engrg. Sls., Ltd.	414-529-3772
Can	Mississauga, Ont., Andy Baumen Assocs., Ltd.	416-828-2600

Local Distributors

AZ	Tempe, Control Design	602-829-7981
CA	Anaheim, Control Design	714-821-1516
CA	Hayward, Electro Comps.	415-783-5800
CA	San Carlos, Control Design	415-592-4806
FL	Ft. Lauderdale, Bel Thermal Units, Inc.	305-566-0043
FL	Ft. Lauderdale, Control Design Supp.	305-788-3220
GA	Atlanta, Control Design Supp.	404-979-3500
GA	Norcross, A-A Electric	404-449-8670
IL	Genoa, Control Design Supp.	815-784-6515
IL	Wheeling, Connector Concepts	312-541-4020
IN	Indianapolis, Control Design	317-788-4559
IA	Marion, Control Design	319-373-2923
IA	W. Des Moines, Ramco Elec. Supp.	515-225-6933
MA	Boston, Control Design Supp.	617-932-9404
MA	Boston, Controller Svc. & Sls.	617-269-1300
MN	Minneapolis, Control Design	612-721-1628
MO	St. Louis, Control Design	314-426-3150
NH	Manchester, Controller Svc.	603-623-7255
NY	Rochester, R. Baker Elctrns.	716-586-9164
NC	Charlotte, Control Design Supp.	704-588-4410
OH	Cincinnati, Richards Elec. Supp.	513-242-8800
OH	Eastlake, Professional Elctrns.	216-946-3790
OH	Wickliffe, Gateway Megatech	216-944-7039
OK	Tulsa, Altair	918-252-5781
OR	Portland, Tek Elec. Control, Inc.	503-246-5451
PA	Philadelphia, Royal Elec. Supp.	215-221-1200
RI	Providence, Controller Svc. & Sls.	401-781-7100
TN	Nashville, Steinhouse Supp. Co.	615-254-1613
TX	Austin, Altair	512-837-4970
TX	Dallas, Control Design	214-358-1441
WA	Seattle, H. D. Campbell	206-433-1900
WI	Milwaukee, Control Design Supp.	414-784-1015
WI	Milwaukee, Standard Elec.	414-272-8100
Can	Toronto, Ont., GLE, Inc.	416-252-5301

USECO DIV., Litton Inds, 13536 Saticoy St, Van Nuys, CA 91409, Tel: 818-786-9388, FAX: 818-709-4510; FSC No.: 88245; Empl.: 100

U.S. INSTR. RENTALS, 2988 Campus Dr., San Mateo, CA 94403, Tel: 800-824-2873, TELEX: 349301 USIR SMT; Empl.: 500

U. S. LASER CORP., 825 Windham Court North, Wyckoff, NJ 07481, Tel: 201-848-9200; Empl.: 25; *Sls. Mgr.:* John Tobin

U S MICROTEK COMPONENTS CORP., Division of Unitrode Corp., 11144 Penrose St., Sun Valley, CA 91352, Tel: 818-767-6770, TWX: 910-498-4998; FSC No.: 59942; Empl.: 210; *Sls. Mgr.:* Donald F. Hosmer ..... **A•1184**

Local Sales Offices & Reps

AZ	Tempe, Gassner & Clark Co.	602-968-9037
CA	Cupertino, F & F Assocs.	408-446-2349
CA	Granada Hills, C & N Assocs.	818-895-2431
CO	Aurora, Key Specialties	303-690-6106
FL	Margate, EPM Corp.	305-977-0331
FL	Orlando, EPM Corp.	305-425-6149
IL	Elgin, Gassner & Clark	312-695-9540
IA	Marion, MSB Assocs., Inc.	319-377-6261
KS	Shawnee Mission, MSB Assocs., Inc.	913-432-2131
MD	Ellicott City, Thiem Assocs.	301-465-4776
MA	Randolph, Hatch Assocs.	617-963-3306
MO	St. Charles, MSB Assocs., Inc.	314-946-5577
NY	Albany, Reagan/Compar	518-489-7408
NY	Commack, Kaelber & Mack	516-499-2924
OH	Columbus, Baehr, Greenleaf & Assocs.	614-486-4046
OH	Dayton, Baehr, Greenleaf & Assocs.	513-439-0724
OH	Westlake, Baehr, Greenleaf & Assocs.	216-892-1770
PA	Broomall, Sapinosa Assocs.	215-353-7267
TX	Austin, OM Assocs., Inc.	512-388-1151
TX	Houston, OM Sales Co., Inc.	713-789-4426
TX	Richardson, OM Assocs., Inc.	214-690-6746
WA	Redmond, Gentech	206-881-6456
Can	Oakville, Ont., Haltronics	416-844-2121

U.S. POWER CONVERTING COMPANY/RELCO, Leonard V. Snow & Assocs., 21517 Ocean, Torrance, CA 90503, Tel: 213-316-9984, FAX: 213-374-2387; Empl.: 6; *Sls. Mgr.:* Jonathan Snow; *Dist. Mgr.:* Tom Clark ..... **C•1089; D•1950-1951**

Local Sales Offices & Reps
CA Torrance, U.S. Power Converting/L. Snow & Assocs. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

Local Distributors
CA Redondo Bch., U.S. Power Converting/L. Snow & Assocs. 213-318-9601
CA Torrance, U.S. Power Converting/L. Snow & Assocs. 213-316-9984
Can New Dundee, Ont., Ritz Elctrns. 519-696-2616

U.S. TERMINALS, 7502 Camargo Rd., Cincinnati, OH 45243, Tel: 513-561-8145, TWX: 810-461-2290; FSC No.: 12615; *Sls. Mgr.:* G.L. Stepp

FAX: 818-287-7350

U.S. TOYO FAN CORP., 4915 Walnut Grove Ave., San Gabriel, CA 91776, Tel: 818-287-5297, TWX: 910-589-1540; Empl.: 20; *Sls. Mgr.:* Bruce Rockwell; *Dist. Mgr.:* Bruce Rockwell ..... **C•1700-1701**

Local Sales Offices & Reps
AL Huntsville, Par Mktg. 205-859-5702
AZ Phoenix, Howe & Howe Sls. 602-264-7971
CA Oceanside, Noo Rep Tech Sls. 619-941-0558
CA San Gabriel, U.S. Toyo Fan Corp. 818-287-5297
CA San Jose, U.S. Toyo Fan Corp. 408-998-2808
CO Lakewood, Christee-Meade 803-232-0287
CT Bethel, Livera-Polk Assocs. Inc. 203-748-4639
FL Goldenrod, Sunland Assocs. 305-365-9533
GA Alpharetta, Par Mktg. 404-442-8858
IL Parcom Inc. 312-228-9046
IL Elk Grove, Parcom Inc. 312-228-9046
KS Lenexa, Midtec Assocs. 913-541-0505
MA Needham, Component Technlg. 617-449-8490
MI Farmington Hills, W. R. Hummon 313-474-0661
MN Osseo, Gaffney Sls. Co. 612-425-5484
MO St. Louis, Midtec Assocs. 314-275-8666
NJ Madison, Livera-Polk Assocs. 201-377-3220
NY Cooperstown, Fitzelle Assocs. 607-547-9333
NY Glen Head, Livera-Polk Assocs. 516-759-9300
OH Richfield, Geotronix 216-659-6100
OH Trotwood, Geotronix 513-252-6700
OR Beaverton, LD Elctrns. Inc. 503-568-0511
PA Allison Pk., Geotronix Inc. 412-487-1770
PA Telford, Dalbrook Corp. 215-723-3300
TX Houston, Zonk & Assocs. 713-895-9131
TX Richardson, Zonk Assocs. 214-238-7651
WA Snohomish, LD Elctrns. 206-568-0511
PR Santruce, SISCO 809-726-3137
Can Islington, Ont., Pipe-Thompson Ltd. ... 416-236-2355

Local Distributors
AZ Phoenix, Aero-Space Southwest 602-269-5655
CA Agoura Hills, Pacesetter Elctrns. 818-991-3984
CA Buena Park, Cypress Elctrns. 714-521-5230
CA Fremont, Terminal Sls. Corp. 415-656-7722
CA Santa Clara, Cypress Elctrns. 408-980-2500
CA Tustin, Added Value Elctrns. Distr. 714-259-8258
CO Arvada, Denver Beta Wintronics 303-431-7161
FL Largo, Lo-Dan Elctrns. 813-586-2851
FL Longwood, Intertec Comps. 305-834-7777
IL Elk Grove, Martec Assocs. 312-956-8090
MD Beltsville, Petricko Sls. 301-937-4960
MA Haverhill, Cord Elctrns. 617-374-0100
MI Farmington Hills, Versatron 313-474-0667
NV Las Vegas, Kiesub Corp. 702-733-3888
NJ Sicklerville, Index 609-629-3158
NM Albuquerque, Betatron 505-344-2381
NY Elmsford, Multimeterics 914-347-3666
NY Endwell, Pryme-Line Distr. 607-748-5200
OH Richfield, Alpha Distr. Corp. 216-659-7100
OR Beaverton, Hansen Elctrns. 503-642-4455
PA Harrisburg, Cumberland Elctrns. 717-233-5883
TX Dallas, Cypress Elctrns. 214-869-1435
TX Richardson, Zec Sls. 214-669-0895
WA Bothell, Cypress Elctrns. 206-483-1144

UTE MICROWAVE, 3500 Sunset Ave., Asbury Park, NJ 07712, Tel: 201-922-1009, TELEX: 13-2461, FAX: 201-922-0848; FSC No.: 23261; Empl.: 35

UTICA TOOL CO., INC., Cameron Rd., P.O. Box 1807, Orangeburg, SC 29115, Tel: 803-534-7010, TELEX: 57-3498

UTI INSTRUMENTS CO., 497 S. Hillview Dr., Milpitas, CA 95035, Tel: 408-945-1955, TWX: 910-339-9546; Empl.: 80; *Sls. Mgr.:* George Bunyard

UVP, INC., 5100 Walnut Grove Ave., P.O. Box 1501, San Gabriel, CA 91778, Tel: 818-285-3123, TELEX: 371 6381, FAX: 818-285-2940; Empl.: 100; *Sls. Mgr.:* Al Kovalsky

VACO PRODUCTS DIV., 7200 McCormick Blvd., Chicago, IL 60645, Tel: 312-677-9500, TELEX: 72-4431, FAX: 312-677-4476; Empl.: 250; *Sls. Mgr.:* Bill Redmond

VACTRONIC LAB. EQUIP. INC., 160 Wilbur Place, Bohemia, NY 11716, Tel: 516-567-0520, FAX: 516-567-0684; Empl.: 30

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VALHALLA SCIENTIFIC, 9955 Mesa Rim Rd., San Diego, CA 92121, Tel: 619-457-5576, TELEX: 181750 VALHALLA SDG; Empl.: 75; *Sls. Mgr.:* Stephen Merrill ..... **D•1336-1337**

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AL Huntsville, Currie, Peak & Frazier 205-536-1506
AZ Tempe, Barnhill Assocs. 602-820-8800
CA Costa Mesa, Cutlass Elctrns. 714-549-9358
CA San Diego, Mesa Engrg. 619-268-3500
CA San Jose, Scientific Dvcs. 408-554-0455
CA Torrance, Cutlass Elctrns. 213-324-7360
CO Englewood, Barnhill Assocs. 303-799-6999
FL Orlando, Currie, Peak & Frazier 407-855-0843
FL Tampa, Currie, Peak & Frazier 813-968-2480
FL W. Melbourne, Currie, Peak & Frazier 407-724-6795
GA Norcross, Currie, Peak & Frazier 404-449-7662
IL Arlington Hgts., Comtel Midwest Co. .. 312-392-4040
IN Indianapolis, Comtel Midwest Co. 317-253-1681
IA Cedar Rapids, Delltron Co., Inc. 319-393-0058
MD Lanham, Sel-Tronics 301-731-8080
MA Needham, Addelco 617-444-4754
MI Farmington Hills, Carter, McCormic & Peirce (CMP) 313-477-7700
MN Minneapolis, Sector Engrg. 612-593-1809
MO Florissant, Delltron Co., Inc. 314-839-0033
MO Kansas City, Delltron Co., Inc. 816-436-6445
NJ Union, Friedman Assocs., Inc. 201-964-6200
NM Albuquerque, Barnhill Assocs. 505-299-7658
NY Hamburg, Labtronics 716-648-0107
NY Ilion, Labtronics 315-895-7135
NY Kirkwood, Labtronics 607-775-3739
NY Syracuse, Labtronics 315-455-7314
NC Bakersville, Currie, Peak & Frazier 704-688-4371
NC Greensboro, Currie, Peak & Frazier ... 919-373-0380
NC Matthews, Currie, Peak & Frazier 704-846-1702
OH Berea, Carter, McCormic & Peirce (CMP) 216-826-0400
OH Englewood, Carter, McCormic & Peirce (CMP) 513-836-0951
OK Tulsa, Barnhill Assocs. 918-744-6535
OR Portland, Westcon, Inc. 503-283-0132
PA Philadelphia, Robert Meyers Assocs. .. 215-224-1663
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TX Houston, Barnhill Assocs. 713-444-1733
TX Houston, Barnhill Assocs. 713-580-8007
TX Richardson, Barnhill Assocs. 214-231-2573
TX San Antonio, Barnhill Assocs. 512-694-5575
UT Murray, Barnhill Assocs. 801-262-3000
VA Hampton, Sel-Tronics 804-827-6308
WI Milwaukee, Sector Engrg. 414-352-8280
WI New Berlin, Comtel Midwest Co. 414-544-6042

VALIDYNE ENGINEERING CORPORATION, 8626 Wilbur Ave., Northridge, CA 91324, Tel: 818-886-2057, TELEX: 65-1303, FAX: 818-886-6512; Empl.: 200

VALLEY ELECTROMAGNETICS, P.O. Box 131, Spring Valley, IL 61362, Tel: 815-664-2348, FAX: 815-663-1112; Empl.: 90; *Sls. Mgr.:* A. Petak

VALMARK INDUSTRIES INC., 1376 Borregas Ave., Sunnyvale, CA 94089, Tel: 408-734-4253, FAX: 408-734-0136; Empl.: 60; *Sls. Mgr.:* Roger Coil

VALOR

FAX: 619-458-0875

VALOR ELECTRONICS, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471, TELEX: 653406 VALORSD; FSC No.: 15003; Empl.: 600; *Sls. Mgr.:* Nick Freyling ..... **A•1630-1631; D•2031-2035**

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AL Madison, Benchmark 205-464-0033
AZ Scottsdale, American Mktg., Inc. 602-948-2778
CA Garden Grove, Elsco Elctrns. 714-891-4621
CA San Diego, Elsco Elctrns. 619-292-1771
CA Santa Clara, Fahrner-Miller Assocs. ... 408-727-9800
CO Denver, Moss Mktg. 303-455-7205
FL Altamonte Springs, Semtronic Assocs. 305-831-8233
FL Clearwater, Semtronic Assocs. 813-461-4675
FL Ft. Lauderdale, Semtronic Assocs. 305-731-2484
GA Norcross, Benchmark 404-446-1711
IL Rolling Meadows, Heartland Tech. Mktg. 312-577-9222
IA Cedar Rapids, Lorenz Sls. 319-377-4666
KS Merriam, Lorenz Sls. 913-384-6556
MD Annapolis, EES 301-269-4235
MA Topsfield, Whitehead Assocs. Inc. 617-887-0050
MI Ypsilanti, Techrep Inc. 313-572-1950
MN Minneapolis, DeBeck-Hays Assocs. Inc. 612-835-3610
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NC Charlotte, Benchmark 704-525-2131
OH Dayton, KW Elctrn. Sls. 513-890-2150
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PA Allison Pk., KW Elctrn. Sls. 412-487-4300
TX Austin, Kruvand 512-441-6777
TX Dallas, Kruvand 214-437-3355
TX Houston, Kruvand 713-956-6741
UT Salt Lake City, Moss Mktg. 801-363-5875
WA Seattle, Northmar Inc. 206-524-5170
WI Broomfield, Heartland Tech. Mktg. 414-796-1128
PR Hato Rey, Semtronic Assocs. 809-766-0700

Local Distributors

AL Huntsville, Hall-Mark Elctrns. Corp. 205-837-8700
AZ Phoenix, Hall-Mark Elctrns. Corp. 602-437-1200
CA Canoga Pk., FLW 818-719-0037,800-225-5359
CA Canoga Pk., Hall-Mark Elctrns. Corp. .. 818-716-7300
CA Carlsbad, FLW 619-434-5251
CA Citrus Hgts., Hall-Mark Elctrns. Corp. .. 916-722-8600
CA Costa Mesa, FLW 714-751-7512,800-225-5359
CA Hayward, FLW 415-786-9070
CA San Diego, Hall-Mark Elctrns. Corp. ... 619-268-1201
CA San Jose, Hall-Mark Elctrns. Corp. 408-432-0900
CA Torrance, Hall-Mark Elctrns. Corp. 213-217-8400
CA Tustin, Hall-Mark Elctrns. Corp. 714-669-4100
CO Englewood, Hall-Mark Elctrns. Corp. .. 303-790-1662
CT Cheshire, Hall-Mark Elctrns. Corp. 203-271-2844
FL Clearwater, Hall-Mark Elctrns. Corp. 813-530-4543
TX Dallas, TMMI 214-669-0331
TX Ft. Worth, Allied Elec. 817-336-5401
FL Orlando, Hall-Mark Elctrns. Corp. 305-855-4020
FL Pompano Bch., Hall-Mark Elctrns. Corp. 305-971-9280
CA San Jose, Sierra West 408-435-7477
GA Norcross, Hall-Mark Elctrns. Corp. 404-447-8000
IL Woodale, Hall-Mark Elctrns. Corp. 312-860-3800
IN Indianapolis, Hall-Mark Elctrns. Corp. 317-872-8875
KS Lenexa, Hall-Mark Elctrns. Corp. 913-888-4747
MD Columbia, Hall-Mark Elctrns. Corp. 301-988-9800
MA Billerica, Hall-Mark Elctrns. Corp. 617-935-9777
MI Livonia, Hall-Mark Elctrns. Corp. 313-462-1205
MN Eden Prairie, Hall-Mark Elctrns. Corp. 612-941-2600
MO Earth City, Hall-Mark Elctrns. Corp. 314-291-5350
NJ Fairfield, Hall-Mark Elctrns. Corp. 201-575-4415
NJ Mt. Laurel, Hall-Mark Elctrns. Corp. 609-235-1900
NM Albuquerque, Hall-Mark Elctrns. Corp. 505-344-7341
NY Rochester, Hall-Mark Elctrns. Corp. ... 716-244-9290
NY Ronkonkoma, Hall-Mark Elctrns. Corp. 516-737-0600
NC Raleigh, Hall-Mark Elctrns. Corp. 919-872-0712
OH Solon, Hall-Mark Elctrns. Corp. 216-349-4632
OH Worthington, Hall-Mark Elctrns. Corp. 614-888-3313
OK Tulsa, Hall-Mark 918-251-1108
TX Austin, Hall-Mark Elctrns. Corp. 512-258-8848
TX Dallas, Hall-Mark Elctrns. Corp. 214-553-4300
TX Houston, Hall-Mark Elctrns. Corp. 713-781-6100
UT West Valley City, Hall-Mark Elctrns. Corp. 801-972-1008
WI New Berlin, Hall-Mark Elctrns. Corp. .. 414-797-7844

FAX: 619-458-0875

VALOR POWER SYSTEMS DIV., Valor Electronics, 6275 Nancy Ridge Dr., San Diego, CA 92121-2245, Tel: 619-458-1471; FSC No.: 58999; Empl.: 350; *Sls. Mgr.:* Brad Rogers; *Dist. Mgr.:* Nick Freyling ..... **A•1630-1631; D•2031-2035**

VALPEY-FISHER, 75 South St, Hopkinton, MA 01748, Tel: 617-435-6831, TELEX: 94-8332, FAX: 617-435-5289; FSC No.: 5955; Empl.: 120; *Sls. Mgr.:* Donald Elliott; *Dist. Mgr.:* Saul Rubin

VAMISTOR CORP., 115 Industrial Pk, Sevierville, TN 37862, Tel: 615-453-0001, TWX: 810-570-4931, FAX: 615-453-0003; FSC No.: 56856; Empl.: 49; *Sls. Mgr.:* Richard Harburn; *Dist. Mgr.:* Richard Harburn

Local Sales Offices & Reps

IN Indianapolis, M & L Elctrn. Sls. 317-359-4742
TN Sevierville, Vamistor Corp. 615-453-0001

Local Distributors

CA Chatsworth, Passive Comps., Inc. 818-341-1745
CA Long Bch., El-Comp Sls. 213-421-7316
CT Fairfield, Sound Elctrns. 203-255-7957
FL Tampa, Passive Technlgs., Inc. 813-623-1935
MD Columbia, Jaco Elctrns. 301-995-6620
MD Timonium, Zebra Elctrns., Inc. 301-252-6576
MA Needham, Cronin Elctrns., Inc. 617-449-5000
NJ Moorestown, Marlac Elctrns. 609-234-4200
NY Bohemia, Justin Elctrns. 516-589-4000
NY Hauppauge, Fairmont Elctrns. 516-231-3313
NY Hauppauge, Jaco Elctrns. 800-645-5112
NY Hauppauge, Sherburn Elctrns. 516-231-4300
NY Lynbrook, Patriot Elctrns. 516-579-4000
NY Ronkonkoma, M-Tron Comps. 516-467-5100
NY Valley Stream, L & S Elctrns., Inc. 516-561-2474

VANGUARD ELECTRONICS CO., 1480 W. 178th St, Gardena, CA 90248, Tel: 213-323-4100, FAX: 213-329-8427; FSC No.: 03550; Empl.: 250; *Sls. Mgr.:* T. A. Crawford; *Dist. Mgr.:* T. A. Crawford

VANGUARD RELAY CORP., 333 Strawberry Field Rd, Warwick, RI 02886, Tel: 401-732-0700; *Sls. Mgr.:* Fred Pestana

VANN INSTRUMENTS, 1046 Vassar N.E., Albuquerque, NM 87106, Tel: 505-265-2498; *Sls. Mgr.:* Michael E. Vann

VARIAN ASSOCS., Indl. Equip. Grp., 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TWX: 910-373-1731; Empl.: 1500

VARIAN ASSOCS., Instr. Grp., 220 Humboldt Ct, Sunnyvale, CA 94089, Tel: 408-734-5370, TWX: 910-339-9331

VARIAN ASSOCIATES, Electron Device Group, 611 Hansen Way, Palo Alto, CA 94303, Tel: 415-493-4000, TELEX: 910-373-1731; Empl.: 11,000; *Sls. Mgr.:* J. Driscoll

VARIAN CANADA, INC., Microwave Div., 45 River Drive, Georgetown, ON, Canada L7G2J4, Tel: 416-877-0161, TELEX: 069-7502, TWX: 610-492-2641; FSC No.: 02845; Empl.: 350; *Sls. Mgr.:* George C. Plhak

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VARO, INC., Electron Devices Div., 2203 W. Walnut St, Garland, TX 75046, Tel: 214-487-4129, TWX: 910-860-5093, FAX: 214-487-4265; FSC No.: 27777;Multiple; Empl.: 600; *Sls. Mgr.:* Russ Lyons

VARO QUALITY SEMICONDUCTOR, 1000 N. Shiloh Rd., Garland, TX 75040, Tel: 214-487-4300, TELEX: 6829276, FAX: 214-487-0406; Empl.: 550; *Sls. Mgr.:* Charlie Merz; *Dist. Mgr.:* Mike Hawkins

VARTA BATTERIES, INC., 300 Executive Blvd, Elmsford, NY 10523, Tel: 914-592-2500, TELEX: 996-548; *Sls. Mgr.:* Paul Silliman ..... **D•1494**

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AL Athens, EMF 205-233-2947
AZ Scottsdale, Harris & Croy Inc. 602-575-5109
CA Norwalk, Ed Rivers Assocs. 213-868-1471
CA San Mateo, Stewart Fullerton Assocs. 415-570-7666
CO Parker, Parker-Webster Co. 303-841-4888
CT Cheshire, Sci. Comps. 203-272-2963
FL Maitland, EIR, Inc. 305-660-9600
KS Shawnee Mission, Microtronics 913-262-1444
MD Ellicott City, Technlg. Sls. 301-461-7802
MO St. Charles, Livera-Polk 314-946-8500
NJ Madison, Livera-Polk 201-377-3239
NY Glen Head, Livera-Polk 516-759-9300
NC Lillington, EMF 919-893-3650
OH Beachwood, Thompson & Assocs. 216-831-6277
OH Dayton, Thompson & Assocs. 513-435-7733
OH Lexington, Del Steffen & Assocs. 419-884-2313
OR Portland, WMI 503-252-5197
PA Carnegie, Del Steffen & Assocs. 412-276-7366
PA West Chester, TCA Assocs. 215-353-2022
TX Richardson, Comp. Technlg. 214-783-8831
UT Bountiful, Moss Mktg. 801-292-8660
UT Murray, Parker Webster 801-266-9959
WA Redmond, VMI 206-882-2999
Can Downsview, Ont., BD&D Power 416-663-9711
Can Mississauga, Ont., K.C. Sls. & Mktg. ... 416-826-5435
Can Mississauga, Ont., Nica Power Battery Corp. 416-828-7100

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AZ Phoenix, Specific Energy Corp. 602-433-0288
CA Hayward, Nicad Sys. 415-785-9391
CA La Mirada, Energy Dvcs. 213-921-8775
CA Mtn. View, Energy Sls. 415-969-0800
CA San Francisco, Varta Batteries 415-954-8516
CA San Jose, Rose Elctrns. 408-263-9700
CA Van Nuys, Nesco, Inc. 818-781-0505
CO Englewood, Indl. Elctrns. 303-694-9444
FL Altamonte Springs, TNR Tech., Inc. ... 305-767-2411
GA Lithia Springs, EMF 404-948-6023
GA Marietta, Synergistic Batteries 404-973-2220
HI Honolulu, Pacific Energy Dvcs. 808-737-2021
IL Donwers Grove, Telecommunications Dvcs. 312-971-3460
IL Downers Grove, Jabro Batteries, Inc. 312-964-9358
IL Mt. Prospect, Johnson Assocs. 312-398-5159
IL Schaumburg, Varta Batteries 312-310-4437
MD Beltsville, Mark Elctrns. 301-595-5040
MA Sharon, Adcour 617-784-8123
MI Livonia, LWC Dists., Inc. 313-464-7700
NJ Butler, Access Distrs. 201-492-0808
NJ Clifton, Engrd. Assemblies 201-340-0600
NY Elmsford, Energex Sys. Corp. 914-631-1363
NY Mt. Kisco, Multiplier Inds. 914-699-0990
NC Winston-Salem, Progressive Technlgs. 919-761-1375
OR Aloha, Elctrn. Concept 503-642-9715
TX Spring, Battery Pak Sls. & Svc. 713-367-9393
TX Stafford, S.W. Elctrns. 713-240-4000
WA Redmond, Energy Sls., Inc. 206-883-2343
Can Mississauga, Ont., NICA Power Battery Corp. 416-828-7100

VCH INCORPORATED, Chicago Miniature, 1080 Johnson Drive, Buffalo Grove, IL 60089, Tel: 312-459-3400, TWX: 910-221-5445, FAX: 312-459-2708; FSC No.: 71744; Empl.: 52; *Sls. Mgr.:* Jim Flanagan

ELECTRONIC COMPANY

FAX: 818-365-5718

VECTOR ELECTRONIC CO., INC., 12460 Gladstone Ave., Box 4336, Sylmar, CA 91342, Tel: 818-365-9661, TELEX: 269303; FSC No.: 82893; Empl.: 95; *Sls. Mgr.:* Norm Brunell; *Dist. Mgr.:* D. Shelley-W ..... **C•1119, 1736-1737, 1740-1742; D•1115**

For Vector Elctrns.' sales offices and reps. in all other states- 800-423-5659.

Local Sales Offices & Reps

CA Garden Grove, Advanced Digital Grp. 714-735-0579
CA Los Angeles, Advanced Digital Grp. ... 213-598-9645
MD Ellicott, Technlg. Sls. Assocs. 301-461-7802
CA Advanced Digital Grp. 714-897-0319

Local Distributors

AL Huntsville, Allied Elctrns. Inc. 1-800-433-5700
AL Huntsville, Mock Elctrns. Inc. 205-539-2401
AZ Phoenix, Dalis Elctrns. 602-275-2626
AZ Phoenix, Elctrn. Supp. 602-276-1199
AZ Phoenix, Tri-Tek Inc. 602-371-0860
AZ Tucson, Inland Elctrns. 602-294-2628
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CA Anaheim, R&D Elctrns. 714-773-0240
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CA Burbank, Elctrn. City 818-842-5275
CA Canoga Pk., Sandy's Elec. Supp. 818-346-8353
CA Chatsworth, Priority 1 Elctrns. 818-709-5111
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CA Costa Mesa, Powell 714-754-1717
CA Cucamonga, Abletronics 714-987-7606
CA Fremont, Allied Elctrns. 415-770-0590
CA Fullerton, Orvac Elctrns. 714-871-1020
CA Gardena, Cal Switch 213-770-2330
CA Hollywood, Yale Elctrns. 213-465-3186
CA Huntsville, Powell Elctrns. 205-539-2731
CA Inglewood, Newark Elctrns. 213-670-0020
CA Irvine, Priority 1 Elctrns. 714-660-1411
CA Milpitas, Zack Elctrns. 408-942-5432
CA Oakland, Brill Elctrns. 415-834-5888
CA Pasadena, Empire Elctrn. Dist. 213-681-2711
CA Riverside, Elctrn. Supp. 714-787-9220
CA Sacramento, Zack Elctrns. 916-446-3131
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Elctrn. Supp. 619-693-8222
CA San Diego, Shanks & Wright 619-239-0176
CA San Francisco, Zack Elctrns. 415-626-1444
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CA San Jose, Powell Elctrns. 408-943-9020
CA San Jose, Quement Elctrns. 408-998-5900
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CA Santa Ana, Advanced Computer Prod. 714-558-8813
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CA Tustin, Allied Elctrns. Inc. 714-669-4190
CO Colorado Springs, Colorado Springs Walker Elctrns. 303-636-1661
CO Denver, Newark Elctrns. 303-757-3351
CO Englewood, Shelley/Ragon 303-762-0670
CT Bridgeport, Park Dists. 203-366-7200
CT Greenwich, Wise Comps. Inc. 203-531-4880
CT Hamden, Allied Elctrns. 203-248-8900
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CT S. Windsor, Car-Lac Elctrns. 203-282-0631
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FL Altamonte Springs, Pioneer-Orlando Techs. 305-834-9090
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HI Honolulu, Elctrl. Equip. Ltd. 808-533-3884
ID Boise, Kimball Elctrns. 208-342-3559
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IL Chicago, Newark Elctrns. 312-784-5100
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IL Elk Grove Vl., GBL Goold Elctrns. 312-593-3220
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IL Peoria, Klaus Radio 309-691-4840
IN Evansville, Hutch & Son Inc. 812-425-7201
IN Ft. Wayne, Bell Inds. 219-423-3422
IN Indianapolis, Bell Inds. 317-875-8200
IN Indianapolis, Meunier Elctrns. 317-635-3511
IA Cedar Rapids, Dee Elctrns., Inc. 319-365-7551
KY Louisville, Peerless Elec. Equip. 502-637-7674
LA New Orleans, Wm. B. Allen Supp. Co. Inc. 504-525-8222
MD Baltimore, ASI Elctrns. 301-265-5100
MD Baltimore, Resco/Baltimore 301-529-0500
MD Bethesda, Empire Elec. Supp. Co. 301-656-3300
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MA Lexington, Pioneer Inc. 617-861-9200
MA Lynn, Land Elctrn. Supp. 617-592-2220
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MA Needham, Cronin Elctrns. 617-449-5000
MA Needham, YDI Elctrns. Corp. 617-449-1005
MA Norwood, Gerber Elctrns. 617-769-6000
MA Woburn, Abbott Elctrns. Inc. 617-935-2040
MI Ann Arbor, Wedemyer Elect. Supp. 313-665-8611
MI Flint, Shand Elctrns. Inc. 313-743-8940
MI Livonia, Chelsa/RS Div. 313-525-1155
MI Oak Pk., Newark Elctrns. 313-967-0600
MI Southfield, Newark Elctrns. 313-557-8227
MN Minneapolis, Newark Elctrns. 612-331-6350
MN Minneapolis, Shelley/Ragon Inc. 612-642-2828
MN St. Paul, Gopher Elctrns. 612-483-3322
MO Kansas City, Elctrns. Supp. 816-931-1321
MO Maryland Hgts., Chelsea Elctrns. 314-426-4500
NE Lincoln, Scott Elec. Supp. 402-466-8221
NE Omaha, Radio Equip. 402-341-7700
NH Salem, Sager Elctrl. 603-898-1348
NJ Camden, GRS Co. 609-964-8560
NJ E. Hanover, State Elctrn. Parts Co. 201-887-2550
NJ Edison, William Elec. Supp. 201-985-3700
NJ Green Brook, Green Brook Elec. Inc. .. 201-968-3500
NJ Kenilworth, Federated Purchaser 201-272-0505
NJ Pennsauken, Resco 609-662-4000
NJ Pine Brook, Pioneer Stand. Elctrn. 201-575-3510
NJ Springfield, Rte. Elctrns., Inc. 201-379-7710
NM Albuquerque, Elctrn. Parts Co. 505-293-6161
NY Binghamton, Pioneer Elctrns. 607-722-9300
NY Bohemia, Car-Lac Elctrns. 516-567-4200, 800-645-1192
NY Buffalo, Summit Dists. Inc. 716-887-2800
NY Commack, Car-Lac Elctrns.;NY Branch Sls. Off. 516-493-0556
NY Elmsford, Laco Indl. Elctrns. 914-592-5058
NY Hauppauge, Broadline Elctrn. Dist. 516-231-4100
NY Hempstead, Davis Elctrns. 516-483-9200
NY L.I. City, H. L. Dalis 718-361-1100
NY Lynbrook, Peerless Radio Dist. Inc. ... 516-593-2121
NY Mineola, Allied Elctrns. Inc. 516-248-2360
NY Rochester, Simcona Elctrns. 716-328-3230
NY Rochester, Summit Dists. Inc. 716-334-8110
NY Ronkonkoma, Arrow Elctrns., Inc. 800-932-7769
NY Schenectady, Grimmer's Elec. Supp. Corp. 518-374-8480
NY Troy, Trojan Elctrns. 518-274-4481
NY Woodbury, Pioneer Stand. Elec. 516-921-8700
NC Raleigh, Allied Elctrns. Inc. 919-876-5845
NC Raleigh, Southeastern Elctrns. 919-828-2311
OH Akron, Akron Elect. Supp. Inc. 216-762-8818
OH Cincinnati, United Radio Inc. 513-761-4030
OH Cleveland, Pioneer Stand. Elec. 216-587-3600
OH Columbus, Hughes Peters Co. 614-294-5351
OH Dayton, Pioneer-Dayton 513-236-9900
OH Dayton, Stotts-Friedman Co. 513-298-5555
OK Tulsa, Radio Inc. 918-587-9123
OR Beaverton, Almac Elctrns. 503-629-8090
OR Beaverton, Norvac Elctrns. 503-644-1025
OR Portland, Radar Elec. Co. 503-232-3404
PA Drexel Hill, Kass Elctrn. Dist. 215-449-2300
PA Harrisburg, Cumberland Elect. Inc. 717-232-9715
PA McKean, Advacom, Inc. 814-476-7774
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PA Philadelphia, Powell Elctrns. Inc. 215-365-1900
PA Reading, Barbey Elctrns. 215-376-7451
PA Willow Grove, RESCO Elctrns. 215-659-4575
PA York, Elctrn. Comps. For Ind. (ECI) 717-846-5334
SC Columbia, Dixie Elctrns. 803-779-5332
TN Memphis, Bluff City Elctrns. 901-345-9500
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TX Austin, Whlsle. Elctrns. 512-478-4568
TX Dallas, Harrison Equip. Co., Inc. 214-239-2750
TX Dallas, Off-the-Shelf Comps. 214-247-0052
TX Dallas, Whlsle. Elect. Supp. 214-824-3001
TX El Paso, Ideal Indl. Elec. 915-779-6647
TX El Paso, Intl. Elctrns. 915-598-3406
TX Ft. Worth, Allied Elctrns. 817-336-5401
TX Ft. Worth, Whlsle. Elctrns. 817-336-0461
TX Garland, Newark Elctrns. 214-494-5911
TX Houston, Newark Elctrns. 713-782-4800
TX Irving, Powell Elctrns. 214-550-0547
TX Mansfield, Mouser Elctrns. 817-483-4422
TX Richardson, Off-the-Shelf Comps. 214-238-0808
TX Stafford, Harrison Equip. Co. 713-879-2600
UT Salt Lake City, Kimball Elctrns. Inc. 801-328-2075
UT Salt Lake City, Stand. Supp. 801-486-3371
VA Arlington, Arlington Elec. Whlslrs. 703-524-2412
VA Norfolk, Priest Elctrns. 804-855-0105
WA Bellevue, Almac Elctrns. 206-643-9992
WA Seattle, Radar Elec. Co. 206-282-2511
WA Spokane, Almac Elctrns. 509-924-9500
WA Spokane, Radar Elctrns. 509-747-3053
WI Milwaukee, Indl. Elctrns. 414-276-1212
WI Milwaukee, Marsh Elctrns. 414-475-6000

VECTOR ELECTRONIC CO., SOLERWRAP OF CALIFORNIA, INC., 12460 Gladstone Ave., Sylmar, CA 91342, Tel: 818-365-9661, FAX: 818-365-5718; Empl.: 95 ..... **C•1119, 1736-1737, 1740-1742**

VECTRONICS MICROWAVE CORP., 113 Lincoln Blvd., Middlesex, NJ 08846, Tel: 201-356-2377, TELEX: 833560; FSC No.: 32846; Empl.: 51; *Sls. Mgr.:* John G. Vogler

VECTRON LABORATORIES, INC., 166 Glover Ave., Norwalk, CT 06850, Tel: 203-853-4433, TWX: 710-468-3796, FAX: 203-849-1423; FSC No.: 27802; Empl.: 325; *Sls. Mgr.:* Larry Jawitz ..... **A•1480-1485**

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AL Huntsville, Saber Assocs. 800-327-0853
AZ Glendale, Fetty/Schoenduve 602-241-9009
CA El Segundo, Fetty/Schoenduve 213-322-4991
CA Mountain View, Fetty/Schoenduve ... 415-962-8330
CA San Diego, Fetty/Schoenduve 619-292-5136
CO Parker, Techn. Mktg. Assocs. 303-841-3435
CT Cheshire, Meco 800-225-3409
FL Melbourne, Saber Assocs. 800-432-6288
GA Norcross, Saber Assocs. 800-327-0853
IL Bannockburn, Heth, Inc. 312-295-8440
IN Greenwood, Valentine & Assocs. 317-888-2260
IN South Bend, Valentine & Assocs. 219-288-7070
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MO Independence, Engrg. Svcs. Co. 816-254-3600
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MI Detroit, R. P. Urban Assocs. 313-535-2355
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NY Great Neck, F & F Metro 516-482-4080
NM Albuquerque, J. Smith & Assocs. 505-265-3406
NY Great Neck, F & F Metro 516-482-4080
NY Syracuse, T–Squared Elctrns. 315-463-8592
NC Clayton, Saber Assocs. 800-327-0853
OH Englewood, A. Nace Co. 513-836-0931
OH Richfield, A. Nace Co. 216-659-7178
PA Newtown Sq., SWR Tech., Inc. 215-353-6639
TX Dallas, Texas Avionics 214-437-5677
UT Salt Lake City, Techn. Mktg. Assocs. .. 801-943-5609
VA Alexandria, Tech-Reps 703-370-2600
WA Seattle, Datacom 206-285-2525
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Can Nepean, Que., Soquelec, Ltd. 613-226-1696

VEECO INSTRUMENTS, INC., 830 Evelyn Ave., Sunnyvale, CA 94086, Tel: 408-733-3700, TWX: 910-339-9263; Empl.: 95; *Sls. Mgr.:* Fred Vanderlinde

VEECO INSTRUMENTS INC., Terminal Dr., Plainview, NY 11803, Tel: 516-349-8300; *Sls. Mgr.:* Robert Kase

VEECO INTEGRATED AUTOMATION, INC., Veeco Instruments Inc., 10480 Markison Rd., Dallas, TX 75238, Tel: 214-349-8482

VEEDER-ROOT, 70 Sargeant St., Hartford, CT 06102, Tel: 203-527-7201, FAX: 203-527-1479; Empl.: 1200; *Sls. Mgr.:* Alan Schoenhut; *Dist. Mgr.:* Alan Schoenhut

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MI Ann Arbor, Veeder-Root 313-971-7555
MI Detroit, Veeder-Root 313-961-2353
MO Kansas City, Veeder-Root Co. 816-761-1717
OH Worthington, Veeder-Root 614-433-0028
PA Willow Grove, Veeder-Root 215-887-0708
SC Greenville, Veeder-Root 803-288-2133
TX Dallas, Veeder-Root 214-252-3360
Can Toronto, Ontario, Veeder-Root of Canada Ltd. 416-239-3094

VEETRONIX

FAX: 308-324-4985

VEETRONIX, INC., Sub. Reach Electronics, Box 480, Lexington, NE 68850, Tel: 308-324-4600; Empl.: 25; *Sls. Mgr.:* Eddie Howerter ..... **B•1806-1807**

VEGA PRECISION LABS., 800 Follin La., Vienna, VA 22180, Tel: 703-938-6300, TELEX: 89-2521; FSC No.: 23115; Empl.: 350; *Sls. Mgr.:* Joe E. Bennett

VEKTREX ELECTRONIC SYSTEMS, INC., P.O. Box 490, Imperial Bch., CA 92032, Tel: 619-575-8181; Empl.: 5

VELMEX, INC., P. O. Box 38, East Bloomfield, NY 14443, Tel: 716-657-6151, 800-642-6446, FAX: 716-657-6153; Empl.: 30; *Sls. Mgr.:* R. Yurick

VELONEX, 560 Robert Ave., Santa Clara, CA 95050, Tel: 408-727-7370, FAX: 408-727-7370; Empl.: 40; *Sls. Mgr.:* Kevin M. Coffey ..... **D•1340-1341, 1405**

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CO Broomfield, Scientific Dvcs. 303-469-5145
CT Plainview, Addelco Corp. 203-747-9464
FL Melbourne, Saber 800-432-6288
GA Lawrenceville, Saber 800-327-0853
HI Honolulu, Scientific Dvcs. 714-840-3501
IL Schaumburg, K. W. Meyers Co. 312-882-4808
IN Indianapolis, K. W. Meyers Co. 317-783-1030
IA Cedar Rapids, K. W. Meyers Co. 319-363-8987
LA Gurley, Saber 800-327-0853
MA Needham, Addelco Corp. 617-444-4754
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NC Clayton, Saber 919-553-5564
OH Medina, McShane, Inc. 216-725-4568
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WI Brookfield, K. W. Meyers Co. 414-784-3790
Can Downview, Ont., Electrodesign Ltd. 416-665-4405
Can Lachine, Que., Electrodesign Ltd. 514-636-4838
Can Nepean, Ont., Electrodesign Ltd. 613-727-5220
Can Vancouver, BC, Interworld Elec. 604-984-4171

VEMALINE PRODS. DIV., 333 Strawberry Field Rd., P.O. Box 6979, Warwick, RI 02887, Tel: 401-739-7600, FAX: 401-732-6119; FSC No.: 08730; *Sls. Mgr.:* Paul Vamvaketis

VENABLE INDUSTRIES, INC., 3555 Lomita Blvd., Torrance, CA 90505, Tel: 213-539-2522, TELEX: 752421; Empl.: 20; *Sls. Mgr.:* Shelly Scott

VENT RAK, See General Devices

VENUS
SCIENTIFIC, INC.

FAX: 516-752-7976

VENUS SCIENTIFIC, INC., Ferranti, Dundee, 399 Smith St, Farmingdale, NY 11735, Tel: 516-293-4100, TWX: 510-224-6492; Empl.: 450; *Sls. Mgr.:* Peter Jazwinski ..... **D•2036-2037**

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AZ Scottsdale, Venus Scientific Inc. 602-991-9684
CA San Luis Obispo, Venus Sci., Inc. 805-528-2882
MA Norwood, MPS Electronics Inc. 617-769-8700
NY Hartsdale, Spectrum Sls. 914-472-8600
Can Nepean, Ont., Subtec Ltd. 613-723-7720

VERMONT AUTOMATION CO., INC., 18 Morse Dr., Essex Junction, VT 05452, Tel: 802-879-7571; Empl.: 7; *Sls. Mgr.:* G. Cox

VERMONT PRECISION RESISTOR, Codeco Corp. of Vermont, West Hill Road, P.O. Box 1207, Stowe, VT 05672-1170, Tel: 802-253-8567, FAX: 802-253-8005; Empl.: 8 ..... **A•2038-2039**

VERMONT RESEARCH CORP., Precision Pk, N. Springfield, VT 05150, Tel: 802-886-2256, TWX: 710-363-6533; Empl.: 100; *Sls. Mgr.:* Richard Simmons

VERNITECH, 300 Marcus Blvd., Deer Pk., NY 11729, Tel: 516-586-5100, TWX: 510-227-6079; FSC No.: 30223; Empl.: 225 ..... **A•2103; B•1030, 1267, 1929**

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AZ Fountain Hills, Halbar Assocs. 602-837-2464
CA Glendale, Halbar Assocs. 213-246-8263
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TX Dallas, Seaton Corp. 214-380-0414
UT Salt Lake City, Waugaman Assocs. 801-261-0802
VA Powhatan, R.P. Luce & Co. 804-598-4804
WA Mukilteo, Krippner & Assocs. 206-743-3579

VERNITRON CONTROLS, Vernitron Corporation, 1601 Precision Park La., San Diego, CA 92073, Tel: 619-428-5581, TWX: 910-322-1862, FAX: 619-428-5090; FSC No.: 10112; Empl.: 200; *Sls. Mgr.:* R. Campbell ..... **B•1268**

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IL Palentine, Technology Sls. 312-991-6600
MA Burlington, Kitchen & Kutchin 617-229-2660
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NJ Cherry Hill, Lanson Assocs. 609-424-4670
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NY Syracuse, T-Squared Elctrns., Inc. 315-463-8592
NY Victor, T-Squared Elctrns., Inc. 716-924-9101
OH Dayton, Rixan Assocs. 513-222-0011
OK Tulsa, Norcom, Inc. 918-832-7747
TX Austin, Norcom, Inc. 512-451-2757
TX Dallas, Norcom, Inc. 214-386-4888
TX Houston, Norcom, Inc. 713-778-0392
TX San Antonio, Norcom, Inc. 512-680-4513
UT Salt Lake City, Waugaman Assocs. 801-261-0802
VA Fredericksburg, Vernitron 703-752-4499

VERNITRON ELEC. COMPS., See Beau Prods. Div.

VERNITRON PIEZOELECTRIC DIV., 232 Forbes Rd., Bedford, OH 44146-5478, Tel: 216-232-8600, TWX: 810-427-2274, FAX: 216-232-8731; Empl.: 100; *Sls. Mgr.:* James Honvath ..... **A•1487**

Local Sales Offices & Reps

FL Orlando, B & M Sls. 305-855-2455
IL Des Plaines, ESCO Assoc. 312-298-5310

VERSACAD CORPORATION, Prime Computer, Inc., 2124 Main St., Huntington Bch., CA 92648, Tel: 714-960-7720, TWX: 510-101-1759 TWINC UD; Empl.: 85; *Sls. Mgr.:* Glenn Johnson; *Dist. Mgr.:* Glenn Johnson

VERSALOGIC, 3888 Stewart Rd., Eugene, OR 97402, Tel: 503-485-8575, FAX: 503-485-5712

VERTEX COMPUTER CABLE & PRODUCTS, 61 Executive Blvd., Farmingdale, NY 11735, Tel: 516-293-1610, TELEX: 14-3155, TWX: VERTEX FDLE; FSC No.: 6T500; Empl.: 250; *Sls. Mgr.:* M. Scanzano; *Dist. Mgr.:* Penny Shaw

VERTEX INDUSTRIES, INC., P. O. Box 996, 23 Carol St., Clifton, NJ 07014, Tel: 201-472-1331, TWX: 710-989-7021, FAX: 201-472-0814; Empl.: 85; *Sls. Mgr.:* Ron Byer

VERTOX CO., 10022 Imperial Ave. E., Garden Grove, CA 92643, Tel: 714-530-4541, TELEX: 678401 TAB IRIN; FSC No.: 53688; Empl.: 12; *Sls. Mgr.:* Steve Hacker; *Dist. Mgr.:* Steve Hacker

VESTA TECHNOLOGY, INC., 7100 W. 44th Ave. Ste. 101, Wheat Ridge, CO 80033, Tel: 303-422-8088, FAX: 303-422-9800; Empl.: 6

VIABLE SYSTEMS INC., Box 116, Sherborn, MA 01770, Tel: 617-653-7665, TELEX: 922 495 VIABLEUS, FAX: 617-653-7665; Empl.: 30

VIA WEST INC., 534 N. Stone Ave., Tucson, AZ 85705, Tel: 602-623-5716, TELEX: 333089 VIA WEST UD; Empl.: 25; *Sls. Mgr.:* David C. Troupe

VIBRAC, 1 Columbia Dr., Amherst, NH 03031, Tel: 603-882-6777, TELEX: 312698 VIBRAC; Empl.: 50; *Sls. Mgr.:* R. Searle

VIBRA-METRICS, INC., 1014 Sherman Ave., Hamden, CT 06514, Tel: 203-288-6158, 1-800-352-2001, TWX: 710-465-0169, FAX: 203-288-4937; Empl.: 25; *Sls. Mgr.:* Tom Golden ..... **B•1930**

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CA Canoga Pk., FLW 818-719-0037
CA Carlsbad, FLW 619-434-5251
CA Costa Mesa, FLW 714-751-7521
CA Hayward, FLW 415-786-9070
CO Parker, Heritage Chem. Co. 303-690-0589
CT North Haven, International Div. 203-288-1638
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Ft. Lauderdale, EDC 305-974-2500
IL Carpentersville, Precision Meas. Prods. 312-426-4446
MA Danvers, Pat Jenks Assocs. 617-777-5600
MI Southfield, Comtel Instrs. 313-358-2505
NJ Martinsville, Blejwas Assocs. 201-221-1440
NJ Martinsville, Blejwas Assocs. 201-221-1772
NY Baldwinsville, Oshex Assocs., Inc. 315-635-6027
NC Raleigh, Lee-Carolinas 919-848-8818
OH Cleveland, Comtel Instrs. 216-442-8080
OH Cleveland, Comtel Instrs. 216-442-0444
OH Dayton, Comtel Instrs. 513-426-5310
OH Hilliard, Comtel Instrs. 614-876-8305
PA Philadelphia, MetraSystems 215-247-7347
PA Pittsburgh, Comtel Instrs. 412-922-5720
TN Chattanooga, Pump & Vibration Consits. 404-935-5851
TX Argyle, MilesTek 817-455-7444
TX Houston, Techsas, Inc. 713-589-2323
UT W. American Fork, Highland Tech. Mktg. 801-756-2634
UT West American Fork, Highland Tech. Mktg. 801-756-3744
WI New Berlin, Comtel -Midwest 414-544-6042
EXP New Haven, CT, Masten Wright 203-288-1638
Can Ile Perrot, Que., Dalimar 514-453-0033
Can N. Vancouver, B.C., Interworld Elctrns. 604-984-4171
Can Rexdale, Ont., SRP Control Sys. Ltd. 416-746-0117

VIBRATION INSTRUMENTS CO., 1614 Orangethorpe Way, Anaheim, CA 92801, Tel: 714-879-6085, TELEX: 692433; FSC No.: 32102; Empl.: 35; *Sls. Mgr.:* Fritz Egger

VIBRO-METER CORP., 1 Progress Rd., Billerica, MA 01822-5058, Tel: 617-663-7322, TELEX: 948145, TWX: 710-320-1872; FSC No.: 617-667-1944; Empl.: 50; *Sls. Mgr.:* John Snow

VICKERS INSTRUMENTS, INC., Vickers America (Holdings), Inc., 800 W. Cummings Pk., Ste. 1900, Woburn, MA 01801, Tel: 617-932-3800, TELEX: 949913; Empl.: 20; *Sls. Mgr.:* Phill Truckle

VICOM SYSTEMS, INC., 2520 Junction Avenue, San Jose, CA 95134, Tel: 408-946-5660, TELEX: 171-603; Empl.: 65; *Sls. Mgr.:* N. Carlson

VICON INDUSTRIES, INC., 525 Broad Hollow Rd., Melville, NY 11747, Tel: 516-293-2200, TELEX: 144581, FAX: 516-293-2627; Empl.: 284; *Sls. Mgr.:* Carol Ryan; *Dist. Mgr.:* Carol Ryan

VICTOREEN, INC., A Sheller-Globe Corp. Subsidiary, 6000 Cochran Rd., Solon, OH 44139, Tel: 216-248-9300, TWX: 810-421-8287, FAX: 216-248-9301 ..... **A•2040-2045**

Local Sales Offices & Reps

AZ Tempe, Ele-Comm Assocs. 602-844-0566
MA Newton, Victoreen, Inc. 617-964-2226
WA Edmond, EDCO Sls. 206-776-8922

VICTOR ELEC. WIRE & CABLE, 618 Main St., W. Warwick, RI 02893, Tel: 401-821-1700, SALES 401-821-7800, TELEX: 952122, TWX: 710-382-1534, FAX: 401-828-0441; Empl.: 900; *Sls. Mgr.:* E. M. Colasanto

VICTOR WIRE & CABLE CORP., 3601 Holdrege Ave., Los Angeles, CA 90016, Tel: 213-870-9933; Empl.: 30

VICTORY ENGINEERING CORP., Victory Rd., Springfield, NJ 07081, Tel: 201-379-5900, TWX: 710-983-4430; Empl.: 150; *Sls. Mgr.:* J. Bacek

VIDAIRE ELECTRONICS MFG. CORP., 54 Nancy St., W. Babylon, NY 11704, Tel: 516-491-1826; Empl.: 20

VIDCO, 8029 S.W. Cirrus Dr., Beaverton, OR 97005, Tel: 503-641-1804, FAX: 503-641-1806; Empl.: 10; *Sls. Mgr.:* Bradley Cohen

VIDEO AUTOMATION SYSTEMS, Upper Shad Rd., Pound Ridge, NY 10576, Tel: 914-764-4613; Empl.: 5

VIDEO LOGIC CORP., 1294 Lawrence Station Rd., Sunnyvale, CA 94086, Tel: 408-745-0933, TELEX: 35-7400

VIDEO MONITORS, INC., Dotronix, Inc., 3833 N. White Ave., Eau Claire, WI 54703, Tel: 715-834-7785, TELEX: 510-100-1880, FAX: 715-834-5672; Empl.: 190; *Sls. Mgr.:* L. Stewart

VIKING CASES, 10480 Oak St. N.E., St. Petersburg, FL 33702, Tel: 813-577-1216; *Sls. Mgr.:* Jeff Shacter

VIKING CONNETORS CO., Criton Technologies, 21001 Nordhoff St., P.O. Box 2379, Chatsworth, CA 91311, Tel: 818-341-4330, TWX: 910-494-2094; FSC No.: 05574; Empl.: 375; *Sls. Mgr.:* Dale Horton

VIKING ELECTRONICS, Industrial St., Hudson, WI 54016, Tel: 715-386-8861; Empl.: 24; *Sls. Mgr.:* Roy Crist

VIKING INDUSTRIAL PRODUCTS, 729 Farm Rd., Marlboro, MA 01752, Tel: 617-481-4600; Empl.: 20; *Sls. Mgr.:* Aubrey Elms

VIRGINIA PANEL, 1400 New Hope Rd., Waynesboro, VA 22980, Tel: 703-949-8376, FAX: 703-942-2856; Empl.: 225; *Sls. Mgr.:* Jeff Stowers

FAX: 703-985-3848

VIRGINIA PLASTICS CO., P.O. Box 4577, Roanoke, VA 24015-0577, Tel: 703-985-3811, TWX: 710-870-0440; FSC No.: 59608; Empl.: 130; *Sls. Mgr.:* Dee Goode; *Dist. Mgr.:* Sharon Hancock ..... **C•1584-1587, 1908-1909**

Local Sales Offices & Reps

CA	Santa Clara, Penmark Sls. Co.	408-980-1303
CO	Denver, Lindberg Co.	303-758-9033
CT	Middletown, Gerber Sls.	203-347-3000
FL	Lighthouse Pt, Mr. Charles J. Kerns	305-785-6362
IL	Wheaton, Chadra-Schilke	312-653-8126
MD	Gaithersburg, Carwithen Assocs.	301-921-9545
MA	Waltham, Gerber Sls.	617-890-3334
MI	Livonia, Engrg. & Mktg. Svcs. Co.	313-522-9465
MN	Minneapolis, Northstar Comps., Inc.	612-553-1888
NJ	Cranbury, Kay Sls. Assocs.	609-655-3778
NY	Buffalo, NRM Mktg. Grp.	716-634-4300
NY	Skaneateles, NRM Mktg. Grp.	315-685-8991
NY	Spencerport, NRM Mktg. Grp.	716-352-9166
NC	Carrboro, Triangle Comp. Sls.	919-929-3758
NC	Conover, Sonrise Technlgs.	704-464-6633
OK	Bixby, MGR Elctrns.	918-369-5186
OH	Cincinnati, Makin & Assocs.	513-871-2524
OH	Cleveland, Makin & Assocs.	216-248-7370
OH	Columbus, Makin & Assocs.	614-848-5424
OR	Portland, SPS Elctrns.	503-297-6919
PA	Harrison City, NRM Mktg. Grp.	412-327-0858
TX	Austin, MGR Elctrns.	512-250-0926
TX	Dallas, MGR Elctrns., Inc.	214-238-5246
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Redmond, SPS Elctrns.	206-323-4140
Can	Toronto, Ont., Tiemkay, Inc.	416-736-1221

Local Distributors

CA	Granada Hills, Acort Inds.	818-368-4474
MN	Minneapolis, K & H Elctrn. Distrbg.	800-328-8515
NH	Manchester, Yankee Elctrn. Supp. Co.	800-221-1738

VIRTIS CO., Rte. 208, Gardiner, NY 12525, Tel: 914-255-5000, TELEX: 926474; Empl.: 92; *Sls. Mgr.:* J. D. Schmidt

VISHAY-MANN SYSTEM, See Vishay Resistive Systems Group

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VISHAY RESISTIVE SYSTEMS GROUP, 63 Lincoln Hwy., Malvern, PA 19355, Tel: 215-644-1300, TWX: 510-668-8944; Empl.: 500; *Dist. Mgr.:* Iris Demeritt ..... **A•2046-2051, 2105**

Local Sales Offices & Reps

AL	Huntsville, JWL Assocs.	205-883-1712
AZ	Phoenix, Howe & Howe	602-264-7971
CA	Los Alamitos, Reed Elctrns.	213-598-6676
CA	Redwood City, James S. Heaton Co.	415-367-9000
CA	San Diego, Vishay Res. Sys. Grp.	619-690-5112
CO	Englewood, Comps. Sls. Inc.	303-779-8060
CT	Wallingford, Comp Rep Assocs.	203-269-1145
FL	Altamonte Springs, Semtronic Assocs.	305-831-8233
FL	Clearwater, Semtronic Assocs.	813-461-4675
FL	Ft. Lauderdale, Semtronic Assocs.	305-731-2484
GA	Atlanta, JWL Assocs.	404-320-7643
ID	Boise, N. R. Schultz Co.	208-377-8686
IL	Rolling Meadows, Eagle Tech. Sls.	312-991-0700
IN	Carmel, Shamrock Elctrn. Sls.	317-848-5265
KS	Olathe, Technical Sls. Assocs.	913-829-2800
MD	Lutherville, J. A. Dougherty Sls. Co.	301-321-7890
MA	Westwood, Comp Rep Assocs.	617-329-3454
MI	Plymouth, Jay Mktg. Assocs.	313-459-1200
MO	St. Louis, Technical Sls. Assocs.	314-521-2044
NJ	Flanders, K & R Engrg. Sls. Co.	201-584-5235
NM	Albuquerque, Nelco Electronix	505-293-1399
NY	Rochester, L-Mar Assocs.	716-381-9100
NC	Charlotte, JWL Assocs.	704-541-5750
NC	Raleigh, JWL Assocs.	919-787-4826
OH	Aurora, EMA, Inc.	216-562-6104
OH	Centerville, EMA, Inc.	513-433-2800
OR	Beaverton, N. R. Schultz Co.	503-643-1644
PA	Horsham, TMI	215-441-4300
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Dallas, Edward F. Aymond Co.	214-826-7620
TX	Houston, Vishay Resistive Sys. Grp.	713-550-0568
UT	Salt Lake City, Harris/CSI	801-974-5155
WA	Bellevue, N. R. Schultz Co.	206-454-0300
PR	Caguas, Comp Rep Assocs.	809-746-6550

Local Distributors

AZ	Tempe, Shelley-Ragon, Inc.	602-894-2058
AZ	Tempe, TTI, Inc.	602-431-1191
CA	Chatsworth, Petell/Passive Comps. Inc.	818-341-1745,805-583-3210
CA	Chatsworth, Petell/Passive Comps. Inc.	818-700-8838
CA	Chatsworth, Shelley-Ragon, Inc.	818-998-3333
CA	Chatsworth, TTI, Inc.	818-709-1010
CA	Milipitas, TTI, Inc.	408-946-5577
CA	San Diego, Shelley-Ragon, Inc.	619-453-7133
CA	San Diego, TTI, Inc.	619-587-4888
CA	San Jose, Shelley-Ragon, Inc.	408-432-0600
CO	Denver, TTI, Inc.	303-429-6806
CO	Englewood, Shelley-Ragon, Inc.	303-762-0670
FL	Orlando, TTI, Inc.	305-859-1000
CT	Stratford, TTI, Inc.	203-375-1400
FL	Tampa, Impala Elctrns., Inc.	813-885-4747, 800-237-7777
FL	Tampa, Shelley-Ragon, Inc.	813-623-6560
GA	Norcross, TTI, Inc.	404-662-0911
ID	Coer d'Alene, A-I Elctrns.	208-765-3280
IL	Lombard, Shelley-Ragon, Inc.	312-629-8833
IL	Palatine, Ohm Elctrns.	312-359-5500
IA	Cedar Rapids, Shelley-Ragon, Inc.	319-373-0525
MD	Baltimore, RESCO/Baltimore	301-529-0500, 800-638-1242
MD	Beltsville, RESCO/Washington	301-937-9100
MA	Wilmington, TTI, Inc.	617-658-4700
MN	Eden Prairie, TTI, Inc.	612-944-5080
MN	St. Paul, Shelley-Ragon, Inc.	612-642-2823
MO	Hazlewood, Shelley-Ragon, Inc.	314-454-0480
MO	Independence, Shelley-Ragon, Inc.	816-254-3410
NJ	Flanders, VKR Svcs., Inc.	201-584-5393, 800-454-9767
NJ	Mt. Laurel, TTI Inc.	609-234-6400
NY	Bohemia, Shelley-Ragon, Inc.	516-567-7751
NY	Farmingdale, Command Elctrns. Corp.	516-293-1212
NY	Hauppauge, Mast Distrs., Inc.	516-273-4422
NY	Ronkonkoma, TTI, Inc.	516-737-2000
NY	Valley Stream, L & S Elctrns.	516-561-2474
OH	Cleveland, Specialized Comps. Sls.	216-464-0405
OH	Dayton, Micro Mil Div.	513-434-8231
OH	Worthington, TTI, Inc.	614-848-5770
PA	Malvern, Vishay Resistive Sys. Grp.	215-644-1300
TX	Fort Worth, TTI, Inc.	817-595-3100
TX	Houston, Texas Comp. Corp.	713-468-3882
TX	Redmond, Shelley-Ragon, Inc.	214-349-2424
WA	Redmond, Shelley-Ragon	206-883-2220
WA	Redmond, TTI, Inc.	206-882-0291
Can	Que., Kaytronics, Inc.	514-745-5800

VISIONARY ELECTRONICS, 141 Parker Avenue, San Francisco, CA 94118, Tel: 415-751-8811

VISION ENGINEERING, INC., 570 Danbury Rd., New Milford, CT 06776, Tel: 203-355-3776, TELEX: 643769; Empl.: 15; *Sls. Mgr.:* John Clery

VISIONICS CORPORATION, 343 Gibraltar Dr., Sunnyvale, CA 94089, Tel: 408-745-1551, TELEX: 346352, FAX: 408-734-9012; *Sls. Mgr.:* Alex Wellins .... **D•1118**

VISTAR CORP., 13740 McCormick Dr., Tampa, FL 33626, Tel: 813-855-6611, TELEX: 522434; Empl.: 25; *Sls. Mgr.:* Ron Rooks; *Dist. Mgr.:* Ron Rooks

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AL	Huntsville, Remco	205-553-3763
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CA	Mountain View, Westech Sls.	415-961-1422
CA	San Diego, Harvey King, Inc.	619-587-9300
CA	Torrance, Assoc Reps.	213-328-6708
FL	Boca Raton, Beacon Elctrns.	305-392-3500
GA	Atlanta, Remco	404-447-6937
IL	Elmhurst, Utronix Sls.	312-834-1100
MA	Sharon, Adcour	617-784-8123
MI	Brighton, Michigan Mktg. & Sls.	313-229-6218
MN	Eden Prairie, Bohlig & Assocs.	612-944-8404
NJ	Whippany, Robert Smith Assocs.	201-540-0204
NY	Plainview, Robert Smith Assocs.	516-681-3155
NC	Raleigh, Remco	919-787-2112
OH	Worthington, Dynel Co.	614-436-9452
OR	Portland, Electronic Mktg. Grp.	503-684-5935
PA	Penndel, Rayco Sls.	215-757-1899
VA	Forest, Beacon North	804-239-8486
VA	Sterling, Beacon No.	703-591-1300
WA	Redmond, Elctrn. Mktg. Grp.	206-882-0962
EXP	CT, Litchfield, Intrade	203-567-5901

Local Distributors

AL	Huntsville, Component Distr.	205-883-7501
AZ	Tempe, Anjon Entprs.	602-894-1332
AR	Little Rock, Component Distr.	501-227-6278
CA	Costa Mesa, Orange County Comps.	714-979-3597
CA	Los Angeles, Electric Switch	213-660-1310
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CA	Torrance, WBC Electro Supp.	213-328-6871
CO	Englewood, Industrial Elctrns. Inc.	303-694-9444
FL	Ft. Lauderdale, Component Distr.	305-971-4950
GA	Norcross, Component Distrs.	404-441-3320
MA	Lynn, Land Elctrn. Supp.	617-592-2220
MI	Grand Rapids, S. F. Elctrns. Supp.	616-459-0216
MN	New Brighton, Chris Elctrn. Distr.	612-631-2647
NJ	Bellmawr, Midatlantic Elctrns.	609-931-5303
NY	Elmsford, Ancar Elctrn. Supp.	914-592-7100
NC	Raleigh, Component Distr.	919-834-9465
OH	Aurora, IPD	216-562-8113
OH	Centerville, IPD	513-435-2086
TX	Farmers Bch., Force Elctrns.	214-247-9955
TX	Houston, Force Elctrns.	713-772-8483
VA	Falls Church, Component Distr.	703-241-8227
WA	Redmond, Paccom	206-883-9200
WA	Redmond, Priebe Elctrns.	206-881-2363
EXP	CT, Litchfield, Intrade	203-567-5901

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VITEC ELECTRONIC CORPORATION, 1525A East Acequia, Visalia, CA 93291, Tel: 209-739-1077, TELEX: 4972623 VITEC ..... **A•2435-2439**

Local Sales Offices & Reps

AL	Huntsville, EPi Inc.	205-534-3747
AZ	Tempe, Techni Source Inc.	602-730-8093
CA	San Diego, Miners & Assocs.	619-566-9891
CA	Visalia, Vitec Elctrns. Corp.	209-739-1077
DC	McLean, Jin Sung Hsia	703-734-1739
FL	Longwood, SAM Reps. Inc.	305-869-0097
GA	Atlanta, Elctrns. Mktg. Assocs.	404-448-1215
IL	Addison, Baldwin Sls. Assocs., Inc.	312-279-0352
KS	Overland Pk., EPi Inc.	913-642-9118
MN	Minneapolis, HMR Inc.	612-888-2122
MS	Jackson, EPi Inc.	601-856-6251
MO	St. Louis, EPi Inc.	314-962-1411
NM	Albuquerque, Techni Source Inc.	505-268-4232
NC	Raleigh, Elctrn. Mktg. Assocs.	919-847-8800
OH	Beachwood, Elctrn. Sls. Master Inc.	216-831-9555
SC	Greenville, Elctrn. Mktg. Assocs.	803-233-4637
WA	Seattle, Evergreen Mktg. Inc.	206-633-3160

Local Distributors

CA	Costa Mesa, E.E.P. Corp.	714-549-2275
CA	Irvine, Schweber Elctrns.	714-863-0261
CA	Santa Clara, Wyle Labs.	408-727-2500
CT	Danbury, Hamilton Avnet	203-797-2842
FL	Oakland Pk., Zelcon, Inc.	305-565-2555
GA	Norcross, Hamilton Avnet	404-447-7500
IL	Northbrook, Classic Comps. Supp., Inc.	312-272-9650
IL	Palatine, OHM Elctrns.	312-359-5500
IL	Rosemont, Advent Elctrns.	312-297-6200
IN	Indianapolis, Bell Inds.	317-875-8200
IA	Cedar Rapids, Dee Elctrns., Inc.	319-365-7551
KY	Louisville, Peerless Elctrn. Equip.	502-637-7674
ME	N. Adams, ICO-Rally Corp.	413-664-4951

MI Farmington Hills, Advent Elctrns. 313-477-1650
MI Livonia, RS Elctrns. 313-525-1155
MN N. Adams, Elctrn. Supp. Ctr. 413-664-1086
NJ Kenilworth, Federated Purchaser, Inc. 201-272-0505
NY Binghamton, Pioneer-Standard Elctrns., Inc. 607-722-9300
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NY Elmsford, Ancar Elctrns. 914-592-7100
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NY Rome, Rome Elctrns. 315-337-5400
NY Ronkonkoma, M-Tron Comps., Inc. 516-467-5100
NY Westbury, Schweber Elctrns. 516-334-7474
NC Charlotte, Dixie Elctrns. 704-377-5413
NC Winston-Salem, Dixie Elctrns. 919-724-5961
OH Cleveland, Pioneer-Standard Elctrns., Inc. 216-587-3600
OH Dayton, Hamilton Avnet 513-439-6700
OH Dayton, Stotts-Friedman 513-298-5555
OK Tulsa, Radio, Inc. 918-587-9123
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PA Philadelphia, Almo Elctrns. Corp. 215-698-4000
SC Columbia, Dixie Elctrns. 803-779-5332
WI Milwaukee, Marsh Elctrns. 414-475-6000
WI New Berlin, Classic Comps. Supp. Inc. 414-786-5300
Can Burnaby, BC, RAE Indl. Elctrns. 604-291-8866

VITRAMON N.A., P. O. Box 544, Bridgeport, CT 06601, Tel: 203-268-6261, TWX: 710-450-3640; Empl.: 606; *Sls. Mgr.:* Paul Davis; *Dist. Mgr.:* S. Judt

VIZ METEOROLOGICAL INSTRUMENTS, 335 E. Price St., Philadelphia, PA 19144-5782, Tel: 215-844-2626, TWX: 710-670-2626; FSC No.: 41226; Empl.: 450; *Sls. Mgr.:* V. Scott Zelov; *Dist. Mgr.:* V. Scott Zelov

VIZ TEST EQUIPMENT, Kappa Networks Inc., 175 Commerce Drive, Ft. Washington, PA 19034, Tel: 215-643-6950, 1-800-523-3696, FAX: 215-643-5237; Empl.: 10; *Sls. Mgr.:* F. H. Tribolet; *Dist. Mgr.:* F. Menichello ..... **D•1342-1345**

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AR Little Rock, Leo Barker Co. 501-834-2537
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CA San Francisco, Tech. Sls. Assocs. 415-467-1434
CO Denver, Mountain Reps. 303-623-0972
FL Ft. Lauderdale, UniRep, Inc. 305-587-7481
GA Roswell, Henry W. Phillips Co., Inc. 404-992-3070
IL Park Ridge, Bob Burns & Assocs., Inc. 312-775-1233
IN Bloomington, Reptronics 812-334-0383
MD Woodbine, DJC Elctrn. Sls. 301-795-7020
MA Milford, Jonel Sls. Assocs. 617-478-4650
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MO Raytown, Marty Tarkski Sls. Co. 816-358-1442
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OR Portland, Joseph V. Belusko Co. 503-222-4279
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TX Dallas, Crockett Sls. Co. 214-350-3377
Can Ontario, H. W. Cowan Canada Ltd. 416-773-4331

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IL Chicago, Newark Elctrns. 312-784-5100
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IN Indianapolis, Meunier Elctrn. Supp. 317-635-3511
MA Needham, You-Do-It Elctrns. 617-449-1005
MI Livonia, RS Elctrns. 313-525-1155
MN St. Louis Pk., Edtronics Co. 612-938-7541
MO St. Louis, Van Sickle Inc. 314-621-5000
NJ Clarksburg, Accutest 609-259-0460
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NY Lindenhurst, RNJ Elctrns. Inc. 516-226-2700
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PA Philadelphia, Sunshine Sci. 215-673-5600
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VA Richmond, Avec Elctrns. 804-359-6071
WI Milwaukee, E-M Instrs. 414-272-7799

VL

FAX: 213-663-3711

VL ELECTRONICS, INC, 3171 Los Feliz Blvd. Suite 303, Los Angeles, CA 90039, Tel: 213-661-8883, TELEX: 62597050; FSC No.: 95-3896380; Empl.: 6; *Sls. Mgr.:* Christopher Sieh; *Dist. Mgr.:* Christopher Sieh ... **B•1103**

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CA Pasadena, Luscombe Engrg. 213-684-2000
CA San Diego, Luscombe Engrg. Co. 619-549-9699
CO Littleton, MRC 303-794-4684
CO Littleton, T.M.C. 303-723-0643
IN Indianapolis, S.T.B. & Assocs. 317-844-9227
IA Marion, A.E.M. Assocs. 319-377-1129
KS Olathe, A.E.M. Assocs. 913-764-1079
MD Baltimore, Eastern Elctrns. 301-256-4221
MA Canton, New England Elctrn. Sls. 617-828-4835
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WA Bothell, A/D Elctrns. 206-481-8555
WI Colgate, Rep One 414-628-4016
Can Dorval, Que., Dosh-Dart Import Ltd. ... 514-636-1913
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663

Local Distributors
CA Los Angeles, VL Elctrns Inc. 213-661-8883
NC Raleigh, Eastern Elctrns. 919-876-7591

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VME MICROSYSTEMS INTL. CORP., 12090 South Memorial Pkwy., Huntsville, AL 35803-3308, Tel: 205-880-0444, FAX: 205-882-0859; *Sls. Mgr.:* Carl J. Leary

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VOLTARC TUBES, 176 Linwood Ave., Fairfield, CT 06430, Tel: 203-255-2633, TELEX: 96-4337, FAX: 203-259-1194; Empl.: 180; *Sls. Mgr.:* Albert H. Katz

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VOLTEX, 3460 Great Neck Rd., Amityville, NY 11701, Tel: 516-842-2772; Empl.: 55; *Sls. Mgr.:* S. Vogel ..... **D•2039-2041**

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MD Burtonsville, Bekr Inds., Inc. 301-421-1200
MA Burlington, Tri-Com Assocs. 617-272-8163

VOLTRONICS CORPORATION, West St., P.O. Box 476, E. Hanover, NJ 07936, Tel: 201-887-1517, TWX: 710-986-8253, FAX: 201-887-1517; FSC No.: 18736;Multiple; Empl.: 70; *Sls. Mgr.:* Richard J. Newman ..... **A•1185**

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CA San Diego, Fetty/Schoenduve, Inc. ... 619-292-5136
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MN St. Paul, Countryman Assocs. 612-645-9151
MO Lee's Summit, S. W. Wollard 816-578-4221
NY Melville, RF Elctrn. Sls. Grp. 516-420-8890
OH West Chester, J & B Sls. 513-874-0236
PA Camphill, Quick Response Tech. Sls. 717-936-9696
TX Dallas, Talo Prods., Inc. 214-644-6010
UT Bountiful, Herb Bass Assocs. 801-292-8991
VA Sterling, Beacon North Inc. 703-478-2480
WA Seattle, Datacom 206-285-2525
Can St. Laurent, Que., RF Microwave 514-335-2335

VONCO, INC., 22829 Heslip Drive, Novi, MI 48050, Tel: 313-977-0400, TELEX: 181450; FSC No.: 7J499; *Sls. Mgr.:* Larry Ragsdale

VOTAN, 4487 Technology Dr., Fremont, CA 94538, Tel: 415-490-7600; Empl.: 60; *Sls. Mgr.:* Robert Russo; *Dist. Mgr.:* Ron Williams

VOYAGER TECHNOLOGIES, INC., 2250 Cabot Blvd. W. Bldg. 40M, Langhorne, PA 19047, Tel: 215-750-0270; Empl.: 15; *Sls. Mgr.:* Roger J. Peirce

VRN INTERNATIONAL

FAX: 813-347-7520

VRN INTERNATIONAL, Div. Vernitron, 2801 72nd St. N., Box 44000, St. Petersburg, FL 33743, Tel: 813-347-2181, TELEX: 6815306, TWX: 310-681-5306; FSC No.: 84048; Empl.: 400; *Sls. Mgr.:* R. Fielder; *Dist. Mgr.:* R. Fielder ..... **A•2107-2109; B•1031; D•1061**

Local Sales Offices & Reps
AL Huntsville, R. O. Whitesell & Assoc. ... 205-883-5110
AZ Phoenix, Shefler-Kahn 602-257-9015
CA Burlingame, Wm. J. Purdy Co. 415-347-7701
CA Campbell, Kottmeier Assocs. 408-371-8700
CO Englewood, Omega, Ltd. 303-762-1921
CT Farmington, R. Perron Co. 203-673-4825
FL Orlando, Cartwright & Bean 305-422-4531
IL Downers Grove, Circuit Sls. 312-833-2242
IN Fort Wayne, Ro Whitesell & Assocs. .. 219-432-5591
IN Indianpolis, Ro Whitesell & Assocs. ... 317-359-9283
IN Kokomo, Ro Whitesell & Assocs. 317-457-9127
KS Merriam, MTS 913-236-8557
KY Louisville, Ro Whitesell & Assocs. 502-426-7696
MI Grand Rapids, Ro Whitesell & Assocs. 616-942-5420
MI Southfield, Ro Whitesell & Assocs. 313-559-5454
MI St. Joseph, Ro Whitesell & Assocs. ... 616-983-7337
MN Minneapolis, PSI 612-944-8545
NM Albuquerque, Shefler-Kahn 505-345-3591
NY Great Neck, Mos Assocs. 516-487-3966
NY Syracuse, Pi'tronics 315-435-7346
OH Cincinnati, Ro Whitesell & Assocs. 513-521-2290
OH Cleveland, Ro Whitesell & Assocs. 216-447-9020

OH Columbus, Ro Whitesell & Assocs. ... 614-888-9396
OH Dayton, Ro Whitesell & Assocs. ... 513-298-9546
OK Tulsa, Comptech ... 918-622-7744
PA Lawrenceville, DVS ... 609-896-1112
PA Pittsburg, Ro Whitesell & Assocs. ... 412-963-6161
TX Arlington, Comptech ... 817-265-6007
UT Salt Lake City, Omega, Ltd. ... 801-277-8061
VA Charlottesville, LD Lowery ... 804-973-6672
Can Rexdale, Ont., Source Elec., Ltd. ... 613-592-5392

Local Distributors

AR Little Rock, Carlton-Bates ... 501-562-9100
CA Chatsworth, TTI ... 818-709-1010
CA San Diego, Shelley-Ragon ... 619-453-7133
CA San Fernando, Petell Elec. ... 213-365-9841
CA San Jose, Future ... 408-945-9100
CA San Jose, Shelley-Ragon ... 408-942-9111
CA Thousand Oaks, Bell Inds. ... 818-340-1940
CO Denver, Denver-Wintronics ... 303-431-7161
CO Lakewood, Acacia ... 303-232-2882
CT Bethel, Future ... 203-847-6442
CT Norwalk, Cobra Comps. ... 203-847-6442
CT Wallingford, Sager Elctrl. Supp. ... 203-265-4600
FL Clearwater, Future ... 813-441-4771
FL Ft. Lauderdale, NRC Elctrns. ... 305-772-4500
FL Orlando, TTI Inc. ... 305-849-1000
FL Tampa, Impala Elctrns. ... 813-885-4747
GA Norcross, TTI ... 404-662-0911
IL Lisle, Components Inc. ... 312-852-7707
IA Cedar Rapids, Dee Elctrns. ... 319-365-7551
MA Woburn, TTI Inc. ... 617-938-8800
MD Columbia, TTI ... 301-995-1331
MD Rockville, M S Elctrns. ... 301-340-6400
MA Framingham, NOW ... 617-872-5876
MA Hingham, Sager Elctrl. Supp. ... 617-749-6700
MA Westboro, Future ... 617-366-2400
MI Farmington Hills, Advent Elctrns. ... 313-477-1650
MN Eden Prarie, TTI ... 612-944-5080
MN Minneapolis, Aero-Space ... 612-884-4725
MO St. Louis, Olive ... 314-426-4500
NJ Berlin, GCI ... 609-768-6767
NJ East Hanover, State Elctrns. ... 201-887-2550
NJ Mt. Laurel, Future ... 609-778-7600
NJ New Brunswick, Brothers Elctrns. ... 201-238-2200
NJ Whippany, Tonar Ind. ... 201-884-1400
NM Albuquerque, Sterling ... 505-884-1900
NY Bohemia, TTI Inc ... 516-567-1500
NY Buffalo, Summit ... 716-887-2800
NY E. Syracuse, Add Elctrns. Corp. ... 315-437-0300
NY Farmingdale, Command Elctrns. Corp. ... 516-293-1212
NY Hauppauge, Fairmont Elec. Sls. ... 516-231-3313
NY Hauppauge, Jaco Elctrns. ... 516-273-5500
NY Huntington Station, Sherburn Elctrns. ... 516-231-4300
NY Liverpool, Future ... 315-451-2371
NY Valley Stream, L & S Elctrns. ... 516-561-2474
NC Charlotte, Elctrns. Mktg. ... 704-394-6195
NC Raleigh, Southeastern ... 919-828-2311
OH Columbus, Elctrns. Mktg. ... 614-299-4161
OH Dayton, Bell Micro-Mil ... 513-434-8231
OK Tulsa, Radio ... 918-587-9123
PA Braddock, Leff ... 412-351-5000
PA Montgomeryville, Pyttronic ... 215-643-2850
PA Philadelphia, PEI Genesis ... 215-568-7400
TX Ft. Worth, TTI Inc. ... 817-831-0441
TX Houston, Sterling ... 713-627-9800
TX Richardson, Altair ... 214-231-5166
UT Salt Lake City, Future ... 801-972-8489
VA Charlottesville, Virginia Radio ... 804-296-4184
WA Bellevue, Future ... 206-881-8199
WA Redmond, Priebe Elec. Inc. ... 206-881-2363
WI Milwaukee, Marsh Elctrns. ... 414-475-6000

VTM MICROWAVES, INC., 4975 W. 80 Ave., Westminster, CO 80030, Tel: 303-426-6866; FSC No.: 52474; Empl.: 15

V-TRON ELECTRONICS CORP., 10 Venus Way, P.O. Box 3297, S. Attleboro, MA 02703, Tel: 617-761-9100, FAX: 617-761-4727; Empl.: 250; *Sls. Mgr.:* Richard E. French

Local Sales Offices & Reps

CT Wallingford, Com-Sale ... 203-269-7964
MA Waltham, Com-Sale ... 617-890-0011
NH Manchester, Com-Sale ... 603-668-1440
NJ Haworth, Kay Sls. Assocs. ... 201-384-3261
TX Fort Worth, Diversified Comps. ... 817-249-5818
VA Portsmouth, FDB Sls. Corp. ... 804-484-3162

VU-DATA, 9180 Brown Deer Rd., San Diego, CA 92121, Tel: 619-452-7670, TWX: 910-335-1586, FAX: 619-452-2543; FSC No.: 34160; Empl.: 15; *Sls. Mgr.:* M. Knapp

WABASH ELECTRICAL COMPONENT GRP., See Kearney/Wabash Electrical Components

WABASH RELAY & ELECTRONICS, Kearney-National Company, First & Webster Streets, P.O. Box 708, Wabash, IN 46992, Tel: 219-563-2191, TWX: 810-290-2722, FAX: 219-563-1652; Empl.: 250; *Sls. Mgr.:* Bob Lunn ... **B•1610-1611**

Local Sales Offices & Reps

AL Huntsville, Hughes Assocs., Inc. ... 205-533-9108
AZ Fountain Hills, Halbar Assocs., INc. ... 602-837-2464
CA Glendale, Halbar ... 818-246-8263
CA San Mateo, Halbar ... 415-349-4700
CO Englewood, Computech ... 303-773-3981
FL Tampa, APM Assocs. ... 813-886-2457
GA Norcross, Hughes Assocs., Inc. ... 404-662-1587
IL Arlington Hgts., M. J. Petersen Assocs. ... 312-577-8200
IN Fort Wayne, M/S Sls. ... 219-436-3023
KS Lenexa, Midtec Assocs. ... 913-541-0505
MD Glen Burnie, Macrotech Assocs., Ltd. ... 301-766-1111
MA Andover, Crawford Assocs. ... 617-470-2122
MN Edina, PWC, Inc. ... 612-831-5999
MS Corinth, Hughes Assocs., Inc. ... 601-287-2915
MO St. Louis, Midtec Assocs. ... 314-275-8666
NJ Watchung, Dolan Assocs. ... 201-753-2671
NC Raleigh, Tingen Tech. Sls. ... 919-878-4440
TN Nashville, Hughes Assocs., Inc. ... 615-871-0908
TX Denton, Stevens Sls. Co. ... 817-382-4735
WA Redmond, Halbar Assocs., Inc. ... 206-882-0990

Local Distributors

CA Fullerton, Pyramid Elctrn. Supp. ... 714-773-0781
CA Santa Clara, Pyramid Elctrn. Supp. ... 408-727-9810
IL Elk Grove Village, Nu-Way Elctrn. Distrs. ... 312-437-7120
PA Philadelphia, Shap Elctrns. Co. ... 215-969-3300
TX Dallas, Aeromerica, Inc. ... 214-484-7508
WA Kent, Pyramid Elctrn. Supp., Inc. ... 206-872-5800

THE WADSWORTH ELECTRIC MANUFACTURING CO., INC., 20 W. 11th St., Covington, KY 41012, Tel: 606-431-0900; *Sls. Mgr.:* J. C. White

WAGO CORP., 9085 N. Deerbrook Trail, Brown Deer, WI 53223, Tel: 414-354-5511, FAX: 414-357-7450; FSC No.: 65996; *Sls. Mgr.:* Michael A. Lane

WAHL INSTRUMENTS, INC., 5750 Hannum Ave., Culver City, CA 90231, Tel: 800-421-2853, TELEX: 66-4406; Empl.: 60

WALDES TRUARC, INC., Member of the Seeger Fastening Sys. Grp., 29-01 Borden Ave., Long Island City, NY 11101-4478, Tel: 718-392-3100, TELEX: 126-829; Empl.: 450

WALKER POWER, INC., Walker Magnetics Group, 10 B Mill St., Warner, NH 03278, Tel: 603-456-3111; Empl.: 70; *Sls. Mgr.:* Paul D. Iverson

FAX: 617-853-3344

WALKER SCIENTIFIC, Rockdale St., Worcester, MA 01606, Tel: 617-852-3674, 617-853-3232, TELEX: 92-0489; Empl.: 83; *Sls. Mgr.:* B. Langley ... **D•1346**

WALL, A. T., CO., 55 Service Ave., Warwick, RI 02886, Tel: 401-739-0740, TWX: 710-382-1535, FAX: 401-732-5784; Empl.: 75; *Sls. Mgr.:* J. G. Matzen; *Dist. Mgr.:* R. Huntsman

WALL-ABLE MFG. CORP., 2201 Landmeier Rd., Elk Grove Vl, IL 60007, Tel: 312-956-8000, TELEX: 312288 WLLABLE, FAX: 312-956-8082; Empl.: 150; *Sls. Mgr.:* Dennis O'Brien ... **C•1588-1589**

Local Sales Offices & Reps

FL Miami, J.R. Assocs. ... 305-593-0621
GA Conyers, J.R. Assocs. ... 404-922-1231
IL Prospect Hgts., AL&W Sls. Co. ... 312-541-9080
IN Indianapolis, D.M. Assocs. ... 317-842-4424
NM Albuquerque, Nelco Electronix ... 505-293-1399
NY Dobbs Ferry, L. J. Valle, Inc. ... 914-693-5072
NC Lewisville, J.R. Assocs. ... 919-945-9574
TN Releigh, J.R. Assocs. ... 615-892-7630
TX Del Rio, C. Sweigart ... 512-774-7748

FAX: 617-685-7691

WALL INDUSTRIES, 5 Watson Brook Rd., Exeter, NH 03833, Tel: 800-321-WALL; Empl.: 50; *Sls. Mgr.:* Dorothy Amato ... **D•2043**

Local Sales Offices & Reps

AZ Scottsdale, Memco Sls. ... 602-952-2254
CA Hayward, Pacific Mktg. ... 415-887-1620
CA Pasadena, A-F Sls. Engrg. ... 213-681-5631
CO Aurora, Butler Tech. Sls. ... 303-343-3787
FL Maitland, Beacon Elctrns. ... 305-647-3496
GA Atlanta, Beacon Elctrns. ... 404-256-9640
IL Chicago, ESA Tech. Mktg. ... 312-554-0120
IN Indianapolis, Elctrn. Mktg. Consits. ... 317-253-1668
MA Chelmsford, Encotronics ... 617-256-4207
MI East Detroit, Elect. Mktg. Consits. ... 317-253-1668
MN Eden Prairie, High Technlg. Sls. ... 612-944-7274
MO St. Louis, Reptronics ... 314-576-9816
NJ E. Brunswick, Winch Sls. ... 201-828-4615
NY N. Syracuse, Labtronics ... 315-455-7314
OH Cleveland, E.M.C.I. ... 216-458-8486
PA Huntingdon Valley, Inacker Sls. ... 215-947-5660
TX Austin, Milco Mktg. Inc. ... 512-453-3023
TX Dallas, Milco Mktg. ... 214-783-2716
TX Houston, Milco Mktg. Inc. ... 713-723-5003
WA Kirkland, N.W. Comp. Sls. ... 206-828-4838
WI Madison, ESA Tech. Mktg. ... 312-544-0120
Can Oakville, Ont., Haltronics ... 416-844-2121

WALL LENK CORPORATION, Box 3349, Kinston, NC 28502-3349, Tel: 919-527-4186, FAX: 919-527-4189; Empl.: 60; *Sls. Mgr.:* Richard W. Cooper

WAMCO, INC., 11555-A Coley River Cir., Fountain Valley, CA 92708, Tel: 714-545-5560, TELEX: 678-459, FAX: 714-545-6093; FSC No.: 58774; Empl.: 15; *Sls. Mgr.:* Gordon R. Calvert; *Dist. Mgr.:* Sheila A. Sherman .... **B•1146-1147**

Local Sales Offices & Reps

CA Cupertino, E & F Assocs. ... 408-446-2349
CA Laguna Hills, Cronin & Assocs. ... 714-951-5630
IL Elmhurst, Utronix Sls., Inc. ... 312-834-1100
IN Kokomo, Schillinger Assocs., Inc. ... 219-282-4570
KS Parker, S. W. Wollard Co. ... 913-898-6552
NY Jericho, Metro Tech. Sls., Inc. ... 516-935-3330
NY Massapequa, Richard McGrath, Inc. ... 516-789-0400
OR Beaverton, Rep West ... 503-626-4279

WARD LEONARD ELECTRIC CO., INC., 31 South St., Mt. Vernon, NY 10550, Tel: 914-664-1000, TWX: 710-562-0144; FSC No.: 63743;15109; Empl.: 450; *Dist. Mgr.:* Richard I. Limato

WARREN G-V, UNIT OF SIGNAL CO., 1 Apollo Dr., Whippany, NJ 07981, Tel: 201-386-1200, FAX: 201-386-9331; FSC No.: 93929; Empl.: 200; *Sls. Mgr.:* William Vandertulip

WARREN-KNIGHT INSTRUMENT CO., Warren Industries, Inc., 2045 Bennett Rd., Philadelphia, PA 19116, Tel: 215-464-9300; Empl.: 50; *Sls. Mgr.:* Richard M. Marron

WASATCH HIGH VOLTAGE, P.O. Box 15457, Salt Lake City, UT 84115, Tel: 801-265-9561; Empl.: 32; *Sls. Mgr.:* Jack Reynolds

WATCO, INC., 315 Racetrack Rd., N.E., Ft. Walton, FL 32548, Tel: 904-863-2247, FAX: 904-863-1883; FSC No.: 49232; Empl.: 10; *Sls. Mgr.:* Douglas G. Moreland

WATERS MANUFACTURING, INC. Talley Industries

FAX: 617-358-5649

WATERS MANUFACTURING, INC., Talley Industries, Longfellow Ctr., Wayland, MA 01778, Tel: 617-358-2777, TELEX: 948441; FSC No.: ;Multiple; Empl.: 125; *Sls. Mgr.:* James Dyne ... **A•2110-2111**

Local Sales Offices & Reps

AZ Sun City, Hannah Hill ... 602-933-4623
CA Hayward, Liaisen, Inc. ... 415-783-1131
CA Lomita, Techrep ... 213-539-9070
CO Broomfield, Hannah Hill ... 303-460-0602
CT Bloomfield, Sir Assocs. ... 203-243-9343
FL Melbourne, R-Rep ... 305-725-6993
FL Pompano Beach, R-Rep Co. ... 305-725-6993
IL La Grange Park, Bierhaus Sls ... 312-354-5100
MA Westford, Sir Assocs. ... 617-692-2500
MI Southfield, Fred H. Gehrke & Assoc. .. 313-559-5363
MO Hazelwood, Acorn Elctrns. ... 314-731-2002
NJ Union, S. Simberkoff Assocs. ... 201-687-6363
NY Le Roy, SSAI ... 716-768-7213
OH Dayton, INH Comp. Sls. ... 513-434-8808
TX Dallas, Allied Comps. ... 214-238-0408

WI Milwaukee, Bierhaus Sls. 414-963-0318
Can Rexdale, Ont., Myelco, Inc. 416-674-1636

Local Distributors

CA Lomita, TecRep Comps. 213-539-9070
TX Dallas, Allied Comps. 214-238-0408

WATKINS-JOHNSON CO., 3333 Hillview Ave., Palo Alto, CA 94304, Tel: 415-493-4141, TELEX: 34-8415, TWX: 910-373-1253; FSC No.: 14482; Empl.: 3000

WAVECOM, Sub. of Loral Corp., 9036 Winnetka Ave., Northridge, CA 91324, Tel: 818-882-3010, TELEX: 6502408147; FSC No.: 28979; Empl.: 99

WAVELINE, Box 718, W. Caldwell, NJ 07006, Tel: 201-226-9100, TWX: 710-734-4324; FSC No.: 00443; Empl.: 95; *Sls. Mgr.:* D. Morsillo

WAVETEK, (Western Area Sales Office), 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-565-9234

WAVETEK, (Central Area Sales Office), 5808 Churchman Bypass, Indianapolis, IN 46203, Tel: 317-782-4619

WAVETEK, Northeast Area Sales Office, One Executive Blvd., Ste. 206, Suffern, NY 10901, Tel: 914-357-5544

WAVETEK, Southeast Area Sales Office, 2085 U.S. 19 North, Ste. 102, Clearwater, FL 34623, Tel: 813-797-1792

WAVETEK DATRON, See Datron Instruments (or call area sales offices)

WAVETEK MICROWAVE, INC., (Formerly Pacific Measurement, Inc.), 488 Tasman Dr., Sunnyvale, CA 94089, Tel: 408-734-5780, FAX: 408-747-1265

For sales offices and representatives, see Wavetek San Diego, Inc.

WAVETEK RF PRODUCTS, INC., (Formerly Wavetek Indiana, Inc.), 5808 Churchman By-Pass, Indianapolis, IN 46203, Tel: 317-787-3332, FAX: 317-788-5999

For sales offices and representatives, see Wavetek San Diego, Inc.

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FAX: 619-565-9558

WAVETEK SAN DIEGO, INC., 9045 Balboa Avenue, San Diego, CA 92123, Tel: 619-279-2200 ..... **D•1347**

Local Sales Offices & Reps

AL Huntsville, Southern Mktg. Assocs. 205-534-6020
AZ Phoenix, Tech. Mktg. Specialists 602-582-4800
CA Costa Mesa, Ward/Davis Assocs. 714-556-0955
CA Redondo Bch., Ward/Davis Assocs. .. 213-643-6977
CA San Diego, Ward/Davis Assocs. 619-292-1000
CA Santa Clara, Ward/Davis Assocs. 408-245-3700
CO Denver, Tech. Mktg. Specialists 303-691-5620
CT Wallingford, Pat Jenks Assocs. 203-265-9939
FL Longwood, Southern Mktg. Assocs. ... 305-682-7317
GA Marietta, Southern Mktg. Assocs. 404-565-0603
IL Arlington Hgts., Dytec/Cen., Inc. 312-394-3380
IN Indianapolis, Dytec/Cen., Inc. 317-297-5988
KS Lenexa, Dytec/South, Inc. 913-888-0215
MD Rockville, Creative Mktg. Assocs. 301-251-4100
MA Danvers, Pat Jenks Assocs. 617-777-5600
MI Madison Hgts., WKM Assocs. 313-588-2300
MN Edina, Dytec Instrs., Inc. 612-831-7169
MO Maryland Hgts., Dytec/South, Inc. 314-739-0665
NM Albuquerque, Tech. Mktg. Specialists 505-889-4595
NY Great Neck, RTI 516-829-3770
NY Liverpool, NTS Assocs., Inc. 315-451-1091
NC Greensboro, Southern Mktg. Assocs. 919-854-5588
OH Independence, WKM Assocs., Inc. 216-524-5930
OR Beaverton, Northwest Test & Meas. ... 503-645-9000
PA Southampton, Eastern Instrmn. of PA 215-355-7700
TX Dallas, Data Mktg. Assocs. 214-661-0300
TX Houston, Data Mktg. Assocs. 713-780-2511
WA Redmond, Northwest Test & Meas. ... 206-881-8857
WI Brookfield, Dytec/Central, Inc. 414-792-0320
Can Montreal, Que., Interfax Sys., Inc. 514-336-0392

WAYNE KERR, INC., Wayne Kerr plc, 600 W. Cummings Pk., Woburn, MA 01801, Tel: 617-938-8390, TELEX: 6817257 WKERR WOBN; *Sls. Mgr.:* Pat Prather; *Dist. Mgr.:* Robert Fesmire

WAYNE TRANSFORMER CO., INC., 666 Pacific St., Brooklyn, NY 11217, Tel: 718-783-9007, TELEX: 125327; *Sls. Mgr.:* G. V. Mandell ..... **A•2440**

Local Sales Offices & Reps

NJ Basking Ridge, NuTronix 201-953-0950
NY Long Island, NuTronix 201-953-0950
NY New York, NuTronix 201-953-0950
NY Westchester County, NuTronix 201-953-0950

WEBER, Inmark Corporation-Importer, 147 W. Cedar St., Norwalk, CT 06854, Tel: 203-866-8474, FAX: 1-203-866-0918

WECO®

FAX: 514-694-0956

WECO ELECTRICAL CONNECTORS, INC., 16805 Hymus Blvd., Kirkland, Quebec, Canada H9H 3L4, Tel: 514-694-9136; FSC No.: 5935, 5963, 5940; Empl.: 52; *Sls. Mgr.:* David Asseraf; *Dist. Mgr.:* David Asseraf ..... **C•1590-1600**

Local Sales Offices & Reps

AL Huntsville, B.C.I. Inc. 205-539-4411
CA Newport Bch., SPA Inc. 714-863-1193
CA San Jose, Landia Sls. Grp. 408-280-5695
CO Littleton, Chinook Tech. Sls. 303-933-9007
FL Deerfield Bch., Florida Comp. Sls. 305-429-1758
FL Tampa, Florida Comp. Sls. Inc. 813-960-7044
GA Chamblee, B.C.I. Inc. 404-455-0405
IL Palatine, Key Entprs. Inc. 312-991-2144
IN Indianapolis, MEI (Mktg. Engrs. Inc.) ... 317-872-5665
IA Coralville, Engrg. Prods. 319-354-5344
KS Shawnee Mission, Microtronics Inc. ... 913-262-1444
ME Kittery, Olsen Tech. Sls., Inc. 207-439-0280
MD Belair, LHR Assocs., Inc. 301-877-3405
MA Scituate, Olsen Tech. Sls. Inc. 617-878-9386
MN Edina, Engrg. Prods. Assocs. Inc. 612-835-9022
MO St. Charles, Microtronics Inc. 314-946-8500
NJ Roebling, LHR Assocs., Inc. 609-829-6861
NJ Woodbridge, John Chirico Assocs. Inc. 201-855-9600
NY Buffalo, Sweetco Assocs. Inc. 716-632-0011
NY Johnson City, Sweetco Assocs. Inc. ... 607-729-0827
NY Rochester, Sweetco Assocs. Inc. 716-225-2383
NY Utica, Sweetco Assocs. Inc. 315-797-6721
NC Raleigh, C-Tech 919-782-8100
OH Cleveland, Marlow Assocs. 216-991-6500
OR Portland, SPS Elctrns. 503-297-6919
PA Harrisburg, Beil & Whitaker 717-564-6900
TX Lufkin, Narjen Intl. Sls. 409-634-6101
UT Taylorsville, Chinook Tech. Sls. 801-969-3684
WA Redmond, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-453-9462

Local Distributors

AL Mobile, Specialty Distbg. Co. 205-344-0450
AZ Scottsdale, Cypress Elctrns. 602-949-0802
AZ Tempe, Control Design Supp. Inc. 602-829-7981
CA Anaheim, Control Design Supp. Inc. ... 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
CA Buena Pk., Cypress Elctrns. 213-744-0355, 714-521-5230
CA Fountain Valley, Comp. Ctr. 714-979-0433
CA Fullerton, I.S.I. Mktg. Co. 714-773-0411
CA San Carlos, Control Design Supp. Inc. 415-592-4806
CA San Diego, Cypress Elctrns. 619-535-0011
CA San Diego, Sigma Elctrns. 619-565-2000
CA Santa Clara, Cypress Elctrns. 408-980-2500
CO Wheat Ridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. Inc. 305-788-3220, 1-800-432-5895
FL Bradenton, Specialty Distbg. Co., Inc. 813-756-9571, 1-800-282-5861
FL Davie, ARCO Dists. Inc. 305-473-2550, 1-800-432-0299
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GA Savannah, Specialty Distbg. Co. 912-234-1684, 1-800-874-6997
GA Smyrna, ERC Parts Inc. 404-352-1626
GA Stone Mtn., Control Design Supp. Inc. 404-979-3500
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NJ S. River, Kon-Tac Inc. 201-254-5100

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OH Cleveland, Aesco Elctrns. Inc. 216-621-5835
OH Columbus, Aesco Elctrns. Inc. 614-882-6762
OH WATS, Aesco Elctrns. Inc. 1-800-362-0022
OR Beaverton, Cypress Elctrns. 503-641-2233
OR Portland, Dunn Elctrns. Inc. 503-285-0214
PA Malvern, Control Design Supp. Inc. 215-296-0150
PA Pittsburgh, Aesco Elctrns. Inc. 412-344-1550
PA York, Elctrn. Comps. for Industry 717-846-5334
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TX Dallas, Cypress Elctrns. 214-869-1435
WA Bothell, Cypress Elctrns. 206-483-1144
WA Kirkland, Dunn Elctrns. 206-821-3678
WI New Berlin, Control Design Supp. Inc. 414-784-1015,1-800-242-4395
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Can Winnipeg, Manitoba, WES Elctrns. Ltd. 204-632-1260

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CA Newport Bch., SPA Inc. 714-863-1193
CA San Jose, Landia Sls. Grp. 408-280-5695
CO Littleton, Chinook Tech Sls. 303-933-9007
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FL Tampa, Florida Comp. Sls. Inc. 813-960-7044
GA Chamblee, B.C.I. Inc. 404-455-0405
IL Palatine, Key Entprs. Inc. 312-991-2144
IN Indianapolis, MEI (Mktg. Engrs.) 317-872-5665
IA Coralville, Engrg. Prods. Assocs. 319-354-5344
KS Shawnee Mission, Microtronics Inc. 913-262-1444
ME Kittery, Olsen Tech Sls. Inc. 207-439-0280
MD Belair, LHR Assocs. Inc. 301-877-3405
MA Scituate, Olsen Tech Sls. Inc. 617-878-9386
MN Edina, Engrg. Prods. Assocs. 612-835-9022
MO St. Charles, Microtronics Inc. 314-946-8500
NJ Woodbridge, John Chirico Assocs. Inc. 201-855-9600
NY Buffalo, Sweetco Assocs. Inc. 716-632-0011
NY Johnson City, Sweetco Assocs. Inc. 607-729-0827
NY Rochester, Sweetco Assocs. Inc. 716-225-2383
NY Utica, Sweetco Assocs. Inc. 315-797-6721
NC Raleigh, C-Tech 919-847-0202
OH Cleveland, Marlow Assocs. 216-991-6500
OR Portland, SPS Elctrns. 503-297-6919
PA Harrisburg, Beil & Whitaker 717-564-6900
TX Lufkin, Narjen Inter Sls. 409-634-6101
UT Taylorsville, Chinook Tech Sls. 801-969-3684
VA Belair, LHR Assocs. Inc. 301-877-3405
WA Redmond, SPS Elctrns. 206-323-4140
WI Milwaukee, Key Entprs. Inc. 414-453-9462

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AZ Scottsdale, Cypress Elctrns. 602-949-0802
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CA Anaheim, Control Design Supp. Inc. 213-802-1371, 714-821-1516
CA Anaheim, DECO Elctrns. Inc. 714-630-8252
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CA Fountain Valley, Comp. Ctr. 714-979-0433
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CA San Carlos, Control Design Supp. Inc. 415-592-4806
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CA San Diego, Cypress Elctrns. Inc. 619-535-0011
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CO Wheat Ridge, Cypress Elctrns. 303-431-2622
CT Yalesville, Glynn Elctrns. 203-265-2498
FL Altamonte Springs, Control Design Supp. 305-788-3220,1-800-432-58
FL Bradenton, Specialty Dist. Co. Inc. 813-756-9571, 1-800-282-58
FL Davie, ARCO Dists. Inc. 305-473-2550, 305-940-3295
FL Ft. Lauderdale, Specialty Dist. Co. inc. 305-561-2544
FL Jacksonville, Specialty Dist. Co. Inc. ... 904-356-8426
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GA Atlanta, Specialty Dist. Co. Inc. 404-458-6341, 1-800-392-98
GA Augusta, Specialty Dist. Co. Inc. 404-722-1526, 1-800-874-87
GA Brunswick, Specialty Dist. Co. Inc. 912-265-1927, 1-800-241-38
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GA Fayetteville, Frankland Inc. 404-461-4026
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GA Marietta, Specialty Dist. Co. Inc. 404-422-4333
GA Norcross, Specialty Dist. Co. Inc. 404-448-4004
GA Savannah, Specialty Dist. Co. Inc. 912-234-1684
GA Smyrna, ERC Parts Inc. 404-352-1626
GA Stone Mtn., Control Design Supp. Inc. 404-979-3500
GA Valdosta, Specialty Dist. Co. Inc. 912-242-4910, 1-800-233-85
IL Carol Stream, Lectro Comps. Inc. 312-690-0520, 1-800-323-22
IL Genoa, Control Design Supp. Inc. 815-784-6519
IN Indianapolis, Control Design Supp. Inc. 317-788-4614
IA Marion, Control Design Supp. Inc. 319-373-2923
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MD Gaithersburg, Axis Elctrns. Inc. 301-840-9640
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MA Middleboro, Glynn Elctrns. Inc. 617-947-4262
MA Woburn, Control Design Supp. Inc. 617-932-9404
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MO St. louis, Control Design 314-426-3160
NH Manchester, Glynn Elctrns. 603-622-8131
NJ S. River, Kon-Tac Inc. 201-254-5100
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OH Akron, Aesco Elctrns. Inc. 216-762-8818
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OR Portland, Dunn Elctrns. Inc. 503-285-0214
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MN Minneapolis, Furber Sls. Co. 612-881-3620
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OR Tigard, LD Elctrns. 503-649-6177
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Can St. Laurent, Que., Techrep 514-337-6046

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NJ	Wharton, WestCon-N.E. Sls. Off. ..	201-361-361-7527

FAX: 408-395-1518

WESTCOR CORPORATION, 485-100 Alberto Way, Los Gatos, CA 95032, Tel: 408-395-7050, TWX: 910-240-2108, ESYLNK: 62334410; *Sls. Mgr.:* Nancy Pepper ..... **D•2044-2049**

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IN	Cicero, Engrg. Prods. Assocs.	317-984-5226
IA	Coralville, Engrg. Prods. Assocs.	319-354-5344
MN	Minneapolis, Engrg. Prods. Assocs.	612-835-9022
OR	Beaverton, Core II Mktg.	503-641-0877
TX	Austin, Allied Comps., Inc.	512-331-4494
TX	Dallas, Allied Comps., Inc.	214-238-0408
TX	Hurst, Allied Comps., Inc.	817-589-0456
WA	Redmond, Core II Mktg.	206-885-4344
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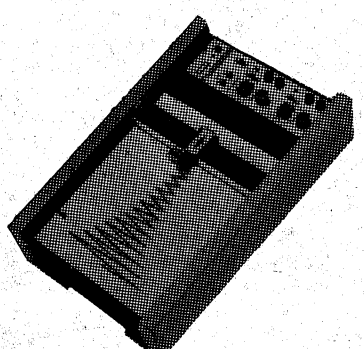

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PA	Huntington Valley, Henry Mann	215-355-7200
PA	Plymouth Meeting, Techni-Tool Inc. ...	215-825-4990
TX	Houston, Electro Tex	713-529-3456

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Can	Vancouver, Comtrade Entprs., Ltd.	604-222-0156

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WESTINGHOUSE ELECTRIC CORP., Control Division, P.O. Box 819, Oldsmar, FL 34667, Tel: 813-855-4621, TELEX: 358713; Empl.: 200; *Sls. Mgr.:* M. C. Yuhas

WESTINGHOUSE ELECTRIC CORP., Indl. Govt. Tube Div., Westinghouse Circle, Horseheads, NY 14845, Tel: 607-796-3271, TWX: 510-252-1588; Empl.: 700; *Sls. Mgr.:* P. C. Ponzi

WEST INSTRUMENT, A Mark IV Company, 3860 N. River Rd., Schiller Park, IL 60176, Tel: 312-678-6400, TWX: 910-227-0723; Empl.: 400; *Sls. Mgr.:* W. J. Bell, Jr.; *Dist. Mgr.:* W. J. Bell, Jr.

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AZ	Phoenix, Metermaster/Phoenix	602-437-1425
AR	Little Rock, Brownell Electro, Inc.	501-562-2061
CA	Los Angeles, EIL Instrs., Inc.	213-685-7020
CA	Los Angeles, Metermaster/Los Angeles	213-685-4340
CA	Palo Alto, Metermaster/Palo Alto	415-960-8500
CA	Ridgecrest, EIL Instrs., Inc.	619-375-5550
CA	S. Pasadena, D.A.E. Instr. & Svc., Inc. ..	213-258-0578
CA	San Diego, Metermaster	619-560-4841
CA	Sunnyvale, EIL Instrs., Inc.	408-245-4320
CO	Aurora, R & R Instrmn.	303-340-8728
CO	Denver, EIL Instrs., Inc.	303-534-4160
CT	Middletown, EIL Instrs., Inc.	203-346-6646
FL	Miami, Brownell Instrs. & Controls Co.	305-884-3072
FL	Orlando, Brownell Instrs. & Controls Co.	305-843-6770
FL	Palm Bay, EIL Instrs., Inc.	305-725-8300
GA	Atlanta, Brownell Instrs. & Controls Co.	404-762-5181
GA	Norcross, Metermaster	404-446-0166
IL	Bridgeview, EIL Instrs.	312-430-2292
IL	Countryside, Pacific Indicator	312-352-3500
IL	Itasca, Metermaster	312-250-0606
IN	Indianapolis, EIL Instrs., Inc.	317-545-1373
IN	Indianapolis, Rockwell Engrg. Co.	317-251-9453
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LA	Harahan, Butler Land Inc.	504-734-8888
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MD	Sparks, EIL Instrs., Inc.	301-771-4800
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MN	Minneapolis, Instrmn. Svc., Inc.	612-544-8916
MO	St. Louis, Indl. Svc. Labs.	314-535-5760
MO	St. Louis, Scherrer Instrs., Inc.	314-644-5362
NJ	Belleville, Marshall, Div. of Miscorp	201-751-1190
NJ	Edison, Brownell Instrs. & Controls Co.	201-287-2030
NJ	Pennsauken, EIL Instrs., Inc.	609-488-0474
NY	Clarence, EIL Instrs., Inc.	716-634-8500
NY	Farmingdale, Brownell Instrs. & Controls Co.	516-420-4142
NY	Hauppauge, EIL Instrs., Inc.	516-231-6333
NY	New York, Brownell Instrs. & Controls Co.	212-691-1171
NY	New York, Herman H. Sticht Co., Inc.	212-732-8163
NY	New York, Nilsson Labs.	212-675-7944
NY	Pittsford, EIL Instrs., Inc.	716-586-8251
NC	Charlotte, Brownell Instrs. & Controls Co.	704-597-1270
NC	Charlotte, Mill Power Supp. Co.	704-373-3336
NC	Charlotte, Trott Elctrns.	704-376-2237
NC	Raleigh, Brownell Instrs. & Controls Co.	919—876-6524
OH	Cleveland, Metermaster	216-651-4100
OH	Dayton, EIL Instrs., Inc.	513-435-2134
OK	Tulsa, Tri-State Instr. Lab	918-836-0286
PA	Camp Hill, Process Engrg. Co.	717-761-5083
PA	Malvern, Rumsey Elec. Co.	215-296-3900
PA	Pittsburgh, EIL Instrs., Inc.	412-731-5230
PA	Pittsburgh, Process Engrg. Co.	412-561-5050
PA	Trevose, Brownell Electro, Inc.	215-364-2830
SC	Columbia, Brownell Electro, Inc.	803-772-6111
TN	Knoxville, Brownell Instrs. & Controls Co.	615-966-3441
TN	Memphis, Brownell Instrs. & Controls Co.	901-795-8487
TN	Nashville, Brownell Instrs. & Controls Co.	615-889-8230
TX	Beaumont, Straughn Elctrn.	409-838-4563
TX	Dallas, Butler & Land, Inc.	214-343-8800
TX	Dallas, EIL Instrs., Inc.	214-931-1236
TX	Garland, Metermaster	214-271-5671
TX	Harlingen, Bush Supply Co.	512-428-1613
TX	Houston, Brownell Instrs. & Controls Co.	713-694-2771
TX	Houston, Butler & Land, Inc.	713-896-0808
TX	Houston, CMI Meters & Instr.	713-644-1631
TX	Houston, EIL Instrs., Inc.	713-271-3100
UT	Salt Lake City, EIL Instrs., Inc.	801-261-8877
VA	Richmond, Metermetrics	804-275-1431
VA	Springfield, EIL Instrs., Inc.	703-569-2611
VA	Virginia Bch., EIL Instrs., Inc.	804-499-3746
WA	Redmond, EIL Instrs., Inc.	206-882-3222
WA	Seattle, Eicher-Richards Co.	206-523-7888
WI	Milwaukee, E-M Instrs.	414-272-7799
Can	Mississauga, Ont., EIL Instrs., Inc.	416-624-6660

WESTRONICS INC. OF TEXAS, 2441 Northeast Pkwy, Box 961003, Ft. Worth, TX 76161, Tel: 817-625-2311, FAX: 817-625-1068; Empl.: 180; *Sls. Mgr.:* Paul Shultz

WEST-TRONICS, INC., 215 Park St., Bensenville, IL 60106, Tel: 312-860-3560, FAX: 312-860-5350; Empl.: 175; *Sls. Mgr.:* Will Allen

WHEELOCK, INC., 273 Branchport Ave., Long Branch, NJ 07740, Tel: 201-222-6880, TWX: 710-722-6510, FAX: 201-222-8707; Empl.: 200; *Sls. Mgr.:* William L. Goldstein, Sls./Mktg. VP

WHITMOR WIRE & CABLE, 27737 Ave. Hopkins, Valencia, CA 91355, Tel: 805-257-2400, TELEX: 194479, FAX: 805-257-2495; FSC No.: 15851; Empl.: 29; *Sls. Mgr.:* Mark Lee; *Dist. Mgr.:* Mark Lee

WHITSO, 9326 Byron St., Schiller Pk., IL 60176, Tel: 312-678-5200; Empl.: 200

WHITTAKER CORP., 10880 Wilshire Blvd., Los Angeles, CA 90024, Tel: 213-475-9411, TELEX: 674891; Empl.: 9,600

WHITTAKER CORP., Electronic Resources Div., 1955 N. Surveyor Ave., Simi Valley, CA 93063, Tel: 805-584-4100, TWX: 910-498-2751; FSC No.: 72152

WHITTAKER CORP., Providence Chemicals Div., King Philip Rd., P.O. Box 16069, E. Providence, RI 02916, Tel: 401-434-1770, TELEX: 92-7652; Empl.: 25

WHITTAKER-YARDNEY POWER SYSTEMS, Whittaker-Tech. Prods., Inc., 82 Mechanic St., Pawcatuck, CT 02891, Tel: 203-599-1100, TELEX: 6813114, TWX: 710-470-0260; FSC No.: 87362; Empl.: 250; *Sls. Mgr.:* Rene DuBois

WIDE BAND ENGINEERING CO., INC., Box 21652, Phoenix, AZ 85036, Tel: 602-254-1570; Empl.: 10

WIDE RANGE ELCTRNS. CORP., 140 Sun Valley Cir., St. Louis, MO 63026, Tel: 314-343-9191, TELEX: 44-2560; Empl.: 8; *Sls. Mgr.:* Donald Toone

WILBRECHT ELECTRONICS, 346 Chester St., St. Paul, MN 55107, Tel: 612-222-2791, FAX: 612-222-7639; Empl.: 200; *Sls. Mgr.:* Laurie Wilbrecht

Local Sales Offices & Reps

AZ	Tempe, B.F. Designs, Inc.	602-345-7799
CA	Belmont, Ken Stroube Assocs.	415-593-4137
CA	Santa Ana, Local Sls., Inc.	714-993-1800
CO	Broomfield, Connors Co.	303-466-9628
FL	Plantation, Gallagher & Assocs.	305-473-2101
IL	Mt. Prospect, Dombrow Co.	312-253-3326
IN	Ft. Wayne, Naunas Sls. Co.	219-432-4792
MA	Sudbury, KSA of New England	617-443-5881
MN	Minneapolis, Allied Comp. Reps., Inc.	612-435-7876
NY	Fairport, Net Sls.	716-223-1030
NC	Kernersville, Wallace Elec. Sls.	919-996-2742
OH	Sharon Cen., Merit Elctrns.	216-239-2186
PA	Paoli, Stitzer Assocs.	215-644-5500
TX	Austin, Swearingen Sls., Inc.	512-339-8663
Can	Nepean, Ont., Intrade Canada, Inc.	613-727-1272

WILCO

FAX: 317-293-9462

WILCO CORP., 6451 Saguaro Court, Indianapolis, IN 46268, Tel: 317-293-9300 ..... **A•1316-1318**

Local Sales Offices & Reps

AL	Huntsville, K & E Assocs.	205-883-9720
CA	San Jose, Texel North	408-272-6836
CA	Seal Bch., Texel	213-596-9411
FL	Hollywood, Askland Elctrn. Comps.	305-987-1074
IL	Arlington Hgts., Dinneen & Assocs.	312-870-0970
MA	Billerica, Bennetron	617-663-7017
MI	Grand Rapids, DEM Elctrn. Sls.	616-361-5414
MI	Warren, DEM Elctrn. Sls.	313-575-9444
NM	Albuquerque, Waide Assocs.	505-294-7600
NY	Hicksville, L. Tronix	516-935-0220
NC	Matthews, R G Sls. Co.	704-847-0049
OH	Cincinnati, JMK Elctrns.	513-271-3860
OH	Cleveland, JMK Elctrns.	216-886-7100
TX	Austin, Swearingen Sls., Inc.	512-339-8663
TX	Dallas, Swearingen Sls. Inc.	214-241-8767
Can	Thornhill, Ont., R.F.Q. Ltd.	416-881-1976

Local Distributors

CA	Garden Grove, Inductive Prods.	714-891-2572
CA	Huntington Bch., Inductor Supp. Co.	800-854-1881
NJ	E. Brunswick, Brothers Elctrns., Inc.	201-238-2200
NY	Bohemia, L.I., Key Comps.	516-567-7500

WILCO WIRE & CABLE CO., INC., 1921 Las Plumas Ave., San Jose, CA 95133, Tel: 408-926-8880; Empl.: 52; *Sls. Mgr.:* Joe Shepherd; *Dist. Mgr.:* Ken Schmidt

WILCOXON RESEARCH, 2096 Gaither Rd., Rockville, MD 20850, Tel: 301-330-8811, TELEX: 898-342; Empl.: 40; *Sls. Mgr.:* Fred Wilcoxon

WILKINSON, P.O. Box 4558, Westlake Village, CA 91359, Tel: 818-889-0050, 800-822-4653, TELEX: 698213, FAX: 818-889-3810; Empl.: 44; *Sls. Mgr.:* R. Cook; *Dist. Mgr.:* R. Cook

WILMANCO, 19529 Business Center Drive, Northridge, CA 91324, Tel: 818-993-1662/1663, TWX: 9103807912 WILMANCOUWAV, FAX: 818-993-5438; FSC No.: 1Y521; Empl.: 12; *Sls. Mgr.:* Christian Noiroux

WILMAR ELECTRONICS, INC., 2430 Amsler St., Torrance, CA 90505, Tel: 213-326-6668, TELEX: 182417, FAX: 213-326-9147; FSC No.: 25248; Empl.: 25; *Sls. Mgr.:* Zev Heifetz

Local Sales Offices & Reps

CA	Emeryville, Davis Gregory & Doll	415-428-9103
PA	Philadelphia, Tech. Instr. Sls.	215-345-4110

WILMORE ELECTRONICS CO., Box 1329, Hillsborough, NC 27278, Tel: 919-732-9351, TELEX: 292617; Empl.: 48; *Sls. Mgr.:* J. L. Harris ..... **D•2050-2054, 2162-2163**

WILSON, H. F., ENGINEERING CO., 475 Taft Ave., Glen Ellyn, IL 60137, Tel: 312-469-8473, TELEX: 72-1438; Empl.: 21; *Sls. Mgr.:* H. Wilson; *Dist. Mgr.:* William Henry

WILSON, H. M., CO., 11501 Chimney Rock Rd., Houston, TX 77035, Tel: 713-729-1183; Empl.: 3; *Sls. Mgr.:* H. M. Wilson

WILSON ELECTRONICS, See Regency Land Mobile, Inc.

WILTRON, 490 Jarvis Dr., Morgan Hill, CA 95037-2809, Tel: 408-778-2000, TELEX: 285227 WILTRON MH, FAX: 408-778-0239; FSC No.: 20944; Empl.: 650; *Sls. Mgr.:* W. Baxter

WINSYSTEMS, INC., P.O. Box 121361, Arlington, TX 76012, Tel: 817-274-7553, FAX: 817-548-1358; FSC No.: 67098

WINTEK CORP., 1801 South St., Lafayette, IN 47904-2993, Tel: 317-742-8428, 800-742-6809, TELEX: 70-9079, FAX: 317-448-4823; Empl.: 16 ..... **D•1116-1117**

WIREBENDERS, INC., 2440 W. Mission Ln., Ste. 9,10, Phoenix, AZ 85021, Tel: 602-861-1856, FAX: 602-870-9242; FSC No.: 5950;FSCS/CAGE 1DA26; Empl.: 18; *Sls. Mgr.:* Leo Middleton

THE WIREMOLD COMPANY, 60 Woodlawn Street, W. Hartford, CT 06110, Tel: 203-233-6251, TWX: 710-425-6281; Empl.: 900; *Sls. Mgr.:* F. D. Casteel

WIRE-PRO, INC., 23 Front Street, Salem, NJ 08079, Tel: 609-935-7601, 609-935-7651, TWX: 510-680-4750, FAX: 609-935-0102; Empl.: 225; *Sls. Mgr.:* Philip Negrin, Mktg. Mgr.; *Dist. Mgr.:* Philip Negrin

WON TRONICS, Apollo Magnetics Corp., 2720 W. Beverly Blvd., Los Angeles, CA 90057, Tel: 213-381-2500, TWX: 910-321-4348; *Sls. Mgr.:* Michael Ronzon

WORKMAN ELCTRN. PRODS., Box 3828, Sarasota, FL 33578, Tel: 813-371-4242, TWX: 810-864-0401; Empl.: 150; *Sls. Mgr.:* Frank Pounds

WORLDNET MARKETING INC., 3187 F Airway Ave., Costa Mesa, CA 92626, Tel: 714-545-7118, TELEX: 3781824, FAX: 714-540-9138; Empl.: 7; *Sls. Mgr.:* Frank Buday; *Dist. Mgr.:* Frank Buday

'WORLD' TEST SYSTEMS, INC., P. O. Drawer 1428, Waynesboro, VA 22980, Tel: 703-949-6753; *Sls. Mgr.:* Buford H. Baber

WOVEN ELECTRONICS, Woven Electronics Corporation, Old Stage Road, Simpsonville, SC 29681, Tel: 803-963-5131, TWX: 810-963-5131, FAX: 803-963-1761; Empl.: 400; *Sls. Mgr.:* Peggy Burnett ..... **C•1910**

Local Sales Offices & Reps

CA	Diamond Bar, Solomon Tech. Sls	714-595-8212
CO	Denver, Spectrum Mktg. Sls. Assocs.	303-480-9991
IL	St. Charles, A. T. Sinker Co.	312-377-6169
MD	Bethesda, Warren Mount Co.	301-657-9312
MN	Bloomington, PWC Inc.	612-831-5999
NH	Merrimack, A. T. Sinker Co.	603-424-8061
NJ	Clinton, A.T. Sinker Co.	201-730-8975

WYLE LABS, See Electronic Enclosures

XCEL CORPORATION, See Digitran and Computron Display Sys. Divs.

XCP, INC., 8 W. Main St., Dryden, NY 13053, Tel: 607-844-9143; *Sls. Mgr.:* Diane Rademacher

XEBEX DATA SYSTEMS, 6610 Buckley Dr., Cambria, CA 93428, Tel: 805-927-5008; Empl.: 4; *Sls. Mgr.:* W. E. Walker

XEDAR CORP., 2500 Central Ave., Boulder, CO 80301, Tel: 303-443-6441; *Sls. Mgr.:* Kathleen Heil

XENON CORP., 20 Commerce Way, Woburn, MA 01801, Tel: 617-938-3594, TELEX: 928204; Empl.: 45; *Sls. Mgr.:* Louis R. Panico

XENOTRONIX INC., 26074 Ave., Hall No. 10, Valencia, CA 91355, Tel: 805-257-4793, FAX: 805-257-1093; *Sls. Mgr.:* Coleen Miller

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Local Sales Offices & Reps

AL	Huntsville, The Novus Grp.	205-534-0044
CA	San Jose, Richards Assocs.	408-297-3010
FL	Orlando, Currie Peak & Frazier	305-855-0843
GA	Lilburn, The Novus Grp.	404-381-1015
IL	Itasca, LTD Technlgs., Inc.	312-773-2900
IN	Carmel, Berndt Assocs.	317-844-0114
MD	Hunt Valley, Phoenix Sls.	301-628-2066
MI	Southfield, Fred Gehrke	313-559-5363
MN	Minneapolis, Berndt Assocs.	612-546-2021
MO	Ellisville, Gateway Tech. Sls.	314-391-6543
NH	Nashua, Bell Controls	603-882-6984
NY	Hartsdale, Spectrum Sls.	914-472-8600
NY	Syracuse, M. M. Hare	315-457-6859
NC	Raleigh, The Novus Grp.	919-883-7771
OH	Cincinnati, Tri-State Mktg.	513-761-7993
PA	Jenkintown, Monument Tech. Assocs.	215-884-3737
TX	Dallas, Allied Comps.	214-238-0408
WI	Milwaukee, LTD Technlgs.	414-774-1000

XERCON, INC., P.O. Box 554, Portland, OR 97207, Tel: 503-292-8682; Empl.: 6; *Sls. Mgr.:* G. Osgood

XEROX CORPORATION, Xerox Square, 0-5, Rochester, NY 14644, Tel: 800-832-6979; Empl.: 100,367

XERTEX CORP., See Rosemont Corp., Sensall National Sonics

XICO

FAX: 818-341-3824

XICO, INC., 9737 Eton Ave., Chatsworth, CA 91311, Tel: 818-709-4403, TELEX: 709577, ESYLNK: 62253150; Empl.: 21; *Sls. Mgr.:* Ralph Reccia ..... **D•1109**

XICOR, INC., 851 Buckeye Court, Milpitas, CA 95035, Tel: 408-432-8888, TWX: 910-379-0033, FAX: 408-432-0640; FSC No.: 60395; Empl.: 670; *Sls. Mgr.:* Bruce Mattern; *Dist. Mgr.:* Bruce Mattern

XKD CORPORATION, 101 Cooper Court, Los Gatos, CA 95030, Tel: 408-395-3700, TELEX: 171946, FAX: 408-354-2606; *Sls. Mgr.:* Robert S. Anderson

XSIS ELECTRONICS, INC., 12620 W. 63rd St., Shawnee, KS 66216, Tel: 913-631-0448, TELEX: 437227, FAX: 913-631-1170; FSC No.: 57051; *Sls. Mgr.:* Jerry Dehnert ..... **A•1488-1489**

Local Sales Offices & Reps

AL	Huntsville, Murcota Corp.	205-539-8476
AZ	Phoenix, Western High Tech. Mktg.	602-266-2070
CA	Mission Viejo, Chaparrah Elctrn. Sls.	714-582-2950
CA	Mtn. View, Loeswick's	415-967-5880
CT	Cheshire, Ashworth Assocs.	203-968-0656
IL	Schaumberg, Sieger Assocs.	312-310-8844
KY	Ft. Mitchell, G. W. Thelen Co.	606-341-8181
MD	Ellicott City, VPI, Inc.	301-461-2525
MA	Shrewsbury, Ashworth Assocs.	617-845-9688
MN	Eden Prairie, Aldridge Assocs., Inc.	612-944-8433
NJ	Fairfield, Addem Sls.	201-882-0993
NM	Albuquerque, Western High Tech Mktg.	505-884-2256
NY	E. Syracuse, R. D. Sherman	315-433-1165
NC	Winston-Salem, Murcota Corp.	919-722-9445
PA	Montgomeryville, Rufo Sys. Comps.	215-368-8495
TX	Sherman, Repmaster	214-247-6236
EXP	NY, Great Neck, Ad Auriema	516-487-0700

X-TRON ELECTRONICS, INC., 1869 National Avenue, Hayward, CA 94545, Tel: 415-783-2145; FSC No.: 54166; Empl.: 12; *Sls. Mgr.:* Jackie Medina; *Dist. Mgr.:* Jackie Medina

XYCOM, 750 N. Maple Rd., Saline, MI 48176, Tel: 313-429-4971, TWX: 810-223-8153; Empl.: 225; *Sls. Mgr.:* Dan Lewis; *Dist. Mgr.:* Bill Nemeth

XYLOG CORP., 83 Hobart St., Hackensack, NJ 07601, Tel: 201-489-4040, FAX: 201-489-6745; Empl.: 30; *Sls. Mgr.:* Milton Frank ..... **D•2056**

YAMAICHI ELECTRONICS, 2471 E. Bayshore Rd. 6530, Palo Alto, CA 94303, Tel: 415-493-3756, TWX: 910-373-2060, ESYLNK;; *Sls. Mgr.:* Kathy Fioretti

YELLOW SPRINGS INSTRUMENT CO., Box 279, Yellow Springs, OH 45387, Tel: 513-767-7241, TELEX: 205437; Empl.: 380; *Sls. Mgr.:* M. Mason

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Local Sales Offices & Reps

AZ	Mesa, Elec-Com Assocs.	602-844-0566
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IN	Indianapolis, RDP Corp.	317-243-8788
KS	Overland Park, Advanced Indl. Sys.	913-432-8065
MA	Norwell, Bordewieck Engrg.	617-659-4915
MI	Grand Rapids, Smith Instr. Equip.	616-245-1195
MI	Midland, Smith Instr. Equip.	517-496-9250
MI	Warren, Smith Instr. Equip.	313-755-3110
MN	Minneapolis, Trask Engrg.	612-537-2434
MO	Ellisville, Advanced Indl. Sys.	314-391-0366
NJ	Scotch Plains, RJM Sls.	201-322-7880
NY	Syracuse, Labtronics	315-455-7314
OH	Dayton, RDP Assocs.	513-253-6175
TX	Pasadena, Tech-Quip, Inc.	713-473-2891
TX	Plano, Acudata, Inc.	214-424-3567

Local Distributors

CA	Foster City, Therm-X	415-573-3323
CA	San Dimas, RDX Corp.	714-599-0985
GA	Atlanta, Craft Assocs.	404-256-0420
IL	Chicago, Newark Elctrnsa	312-784-5100
MA	Norwell, Bordewieck Eng. Sls.	617-659-4915
MN	Minneapolis, Trask Engrg.	612-537-2434
NJ	Scotch Plains, RJM Sls.	201-322-7880
NY	Amherst, Terryberry Sls.	716-688-3071
OH	Dayton, RDP Corp.	513-253-6175
TX	Argyle, Milestek Inc.	817-455-7444

YEW CORP., See Yokogawa Corp. of America

YOKOGAWA CORP. OF AMERICA, 200 West Park Drive, Peachtree City, GA 30269, Tel: 404-487-1471, FAX: 404-487-1822; Empl.: 300; *Sls. Mgr.:* Chuck Micallef; *Dist. Mgr.:* Jack Martz

YORK METAL PRODUCTS, INC., 34-20 12th St., Long Island City, NY 11106, Tel: 718-932-3660; Empl.: 45; *Sls. Mgr.:* Harold Miller

YORK TECHNOLOGY, INC., 210 N. Glenoaks Blvd., Ste. C, Burbank, CA 91502, Tel: 818-955-8927, TELEX: 3762780, TWX: 910-968-YORK CA, FAX: 818-955-9728

BATTERY YUASA

FAX: 213-949-5527

YUASA BATTERY (AMERICA), INC., 9728 Alburtis Ave., Santa Fe Springs, CA 90670, Tel: 213-949-4266, TELEX: 696272; Empl.: 5,000; *Sls. Mgr.:* Les Biggins ..... **D•1495**

Local Sales Offices & Reps

AZ	Phoenix, Westrep	602-997-8899
CA	Huntington Bch., West Elctrn Sls.	213-493-5569
CA	San Jose, Novatronix	408-727-9530
CO	Denver, Lindberg Co.	303-758-9033
CT	Horth Haven, Kitchen & Kutchin	203-239-0212
FL	Tampa, Over and Over	813-626-9100
GA	Atlanta, Over and Over	404-449-6205
IL	Arlington Hgts., Brainard-Wilson Mktg.	312-437-2700
IA	Cedar Rapids, R.W. Kunz & Assocs.	319-396-5386
KS	Prairie Vlg., R.W. Kunz & Assocs.	913-648-3535
MA	Burlington, Kitchen & Kutchin	617-229-2660
MN	Minneapolis, Johnson Co.	612-941-8526
MO	St. Louis, R.W. Kunz & Assocs.	314-966-4977
NJ	Berkeley Hgts., Cambridge Allen & Assocs.	201-464-0203
NJ	Carlstadt, Yuasa Battery (Amer.) E. Reg. Off.	201-896-8800
NY	Rochester, Ossman Comps. Sls.	716-359-1200
NY	Syracuse, Ossman Comps. Sls.	315-455-6611
NC	Charlotte, Over and Over	704-542-9111
OH	Columbus, McFadden Sls.	614-459-1280
OK	Tulsa, Barry Sls.	918-749-7775
OR	Portland, Earl & Brown	503-245-2283
TX	Houston, Barry Sls.	713-784-5860
TX	Richardson, Barry Sls.	214-234-0255
UT	Salt Lake City, Lindberg Co.	801-277-2643
WA	Lynwood, Earl & Brown	206-885-5064
WI	Waukesha, Brainard-Wilson Mktg.	414-797-7940
Can	Pointe-Claire, Que., Tech Trek, Ltd.	514-697-3385
Can	Rexdale, Ont., Tech Trek, Ltd.	416-674-1717

Local Distributors

AL	Huntsville, Newark Elctrns.	205-837-9011
AL	Janeau, Janeau Elctrl. Equip.	907-586-2260
AZ	Glendale, Lynntronics	602-931-5981
CA	Buena Pk., Cypress Elctrns.	714-521-5230
CA	Costa Mesa, House of Batteries	714-642-8222
CA	San Diego, Tauber Elctrns.	619-274-7242
CA	Santa Clara, Cypress Elctrns.	408-980-2500
CO	Wheatridge, Cypress Elctrns.	303-431-2622
FL	Miami, Elctrn. Equip.	305-871-3500
GA	Norcross, Applied Power	404-263-0421
HI	Honolulu, Elctrl. Equip.	808-533-3881
IL	Addison, L Comp	312-628-1400
IL	Downers Grove, Jarbo Battery	312-964-9358
IN	Indianapolis, Newark Elctrns.	317-872-7070
KS	Wichita, L Comp	316-265-5100
MD	Beltsville, Mark Elctrns.	301-595-5040
MA	Middleboro, Glynn Elctrns.	617-947-4262
MI	Brighton, Applied Power	313-229-6550
MI	Grand Rapids, Newark Elctrns.	616-214-6681
MN	Minneapolis, Bergquist Co.	612-835-2322
MS	Jackson, Newark Elctrns.	314-291-6200
MO	Kansas City, L Comp	816-221-2400
NH	Salem, Cronin Elctrns.	603-898-4440
NJ	Clifton, Engrd. Assemblies	201-340-0600
NJ	Edison, Newark Elctrns.	201-572-2103
NY	Farmingdale, Battery Expeditors	516-752-0111
NY	FLushing, W & W Assocs.	718-961-2103
NY	Rochester, Masline Elctrns.	716-546-5373
NY	Rochester, Newark Elctrns.	716-473-6600
NC	Raleigh, Engrd. Assemblies	919-790-9700
OH	Columbus, Whitehead Elctrns.	614-224-1186
OH	Solon, Repco Elctrns.	216-248-8900
OR	Portland, Standard Batteries of Portland	503-234-7251
PA	Willow Grove, Resco Elctrns.	215-659-4440
SC	Greenville, Newark Elctrns.	803-228-9610
TX	Allen, Prime Distrbg.	214-231-0170
TX	Dallas, Cypress Elctrns.	214-869-1435
UT	Salt Lake City, Newark Elctrns.	801-484-8611
WA	Redmond, Priebe Elctrns.	206-881-2363
WI	Milwaukee, Newark Elctrns.	414-463-1100
Can	Brampton, Ont., Zentronics	416-451-8445

ZAMBRE CO., INC., 2134 Old Middlefield Way, Mountain View, CA 94043, Tel: 415-968-9176

Z-Communications Inc.

FAX: 305-735-1094

Z COMMUNICATIONS, INC., 5450 N.W. 33rd Ave., Ste. 100, Ft. Lauderdale, FL 33309, Tel: 305-735-1000; FSC No.: 1564A; Empl.: 20; *Sls. Mgr.:* Jonell Stevenson ..... **A•1491-1493**

ZEBRA TECHNOLOGIES CORPORATION, 3455 Commercial Ave., Northbrook, IL 60062, Tel: 312-564-1800, TELEX: 206230; FSC No.: ;;;312-564-4714; Empl.: 110; *Sls. Mgr.:* Kevin O'Donnell

ZEHNTEL, INC., 2625 Shadelands Dr., Walnut Creek, CA 94598, Tel: 415-932-6900, TELEX: 371-6185, TWX: 910-385-6300; Empl.: 500; *Sls. Mgr.:* Dick Noren; *Dist. Mgr.:* Jim Mohr

CARL ZEISS, INC., One Zeiss Drive, Thornwood, NY 10594, Tel: 914-747-1800, TELEX: RCA 221834, TWX: WV64-6928

ZENDEX CORP., 6700 Sierra La., Dublin, CA 94568, Tel: 415-828-3000, TWX: 910-389-4009, FAX: 415-828-1574; Empl.: 42; *Sls. Mgr.:* Woody Bowers

ZENITH CRT & COMPONENTS OPERATIONS, 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733; *Sls. Mgr.:* Norm Berkowitz

ZENITH

FAX: 312-391-7532

ZENITH COMPONENTS GROUP, Zenith Electronics Corp., 1000 Milwaukee Ave., Glenview, IL 60025, Tel: 312-391-7733, TELEX: 254396; *Sls. Mgr.:* George Zimmerer ..... **D•2057-2059**

Local Sales Offices & Reps

AZ	Phoenix, Pinnacle Comp. Sls.	602-994-0441
CA	Calabasas, Centaur Corp.	818-704-1655

CA Irvine, Centaur Corp. 714-261-2123
CA Mtn. View, Taarcom, Inc. 415-960-1550
CA San Diego, Centaur Corp. 619-278-4950
CT Clinton, Selmark Assocs., Inc. 203-573-9088
MA Millis, Selmark Assocs., Inc. 617-376-2914
NH Hopkinton, Selmark Assocs., Inc. 603-746-3299
OK Tulsa, CompTech 918-622-7744
TX Austin, CompTech 512-331-8922
TX Dallas, CompTech 214-751-1181

ZERO CORP., 777 Front St., Burbank, CA 90503, Tel: 818-846-4191, FAX: 818-841-5618; Empl.: 1400; *Sls. Mgr.:* Doug Griffith ..... **C•1100, 1120**

Local Sales Offices & Reps
AZ Phoenix, Howe & Howe Sls., Inc. 602-264-7971
CA Burbank, Zero-West Div. 818-846-4191
CA San Diego, San Diego Sls. Off. 619-271-7221
CO Boulder, Component Prod. Sls. Co. Inc. 303-530-2800
FL Clearwater, Zero-East Div. 813-531-8991
IL Elk Grove Village, Carlson Elctrns. Sls. 312-956-8240
IN Indianapolis, L.M. DeVoe Co. 317-842-3245
IA Cedar Rapids, Carlson Elctrn. Sls. 319-377-6341
MS Jackson, S. L. Welch 601-932-5534
MD Baltimore, Marktron 301-628-1111
MA Monson, Zero-East Div. 413-267-5561
MI Grosse Pointe Park, Greiner Assoc. Inc. 313-499-0188
MN Bloomington, Elctrn. Sls. Agcy. 612-884-8291
MO St. Louis, Cadon Techn. Sls. 314-645-8670
NY Commack, MTR, Inc. 516-462-9580
NM Albuquerque, Fry-Gates 505-262-1525
NY East Syracuse, Fountain Young & Co. 315-437-7733
NC Apex, Wolff Elect. 919-362-5022
OH Columbus, Tom Mulligan & Assocs. 614-457-2242
OR Lake Oswego, RTS, Inc. 503-244-4123
PA Boswell, B.E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Greenville, Sunbelt Sls. 803-877-9088
TX Dallas, Tesco Inc. 214-553-1200
TX Fort Worth, Milco Mktg. 214-783-2716
TX Houston, Milco Mktg. 713-723-5003
UT Salt Lake City, Effective Sls. 801-266-9617
MD Rockville, Marxtron 301-251-8990
WA Vashon, RTS, Inc. 206-285-1363

ZERO CORP., Zero East Div., 288 Main St., Monson, MA 01057, Tel: 413-267-5561, TWX: 710-354-1450; *Sls. Mgr.:* Roger St. Martin ..... **C•1120**

Local Sales Offices & Reps
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CT Monson, Zero-East Div. 413-267-5561
IN Indianapolis, C.C. Electro Sls. 317-355-1508
IN Indianapolis, Leslie M. Devoe Co. 317-842-3245
MD Rockville, Marktron, Inc. 301-251-8990
MA Monson, Zero-East Div. 413-267-5561
MA Palmer, Benoit-Senecal Co. 413-283-8384
MI Grosse Pointe Pk., Greiner Assocs., Inc. 313-499-0188
MS Jackson, S. L. Welch & Assocs. 601-932-5534
NY Commack, MTR, Inc. 516-462-9580
NY Syracuse, Fountain Young Co. 315-437-7733
NC Apex, Wolff Elctrn. Sls., Inc. 919-362-5022
OH Columbus, Tom Mulligan & Assoc. 614-457-2242
PA Boswell, B. E. Gibson 814-629-6772
PA Huntingdon Valley, Inacker Sls. 215-947-5660
SC Greenville, Sunbelt Sls. 803-877-9088
Can Islington, Ont., Pipe-Thompson Ltd. 416-236-2355

ZETA LABS., Sub. of CCT Corp., 2811 Orchard Parkway, San Jose, CA 95134, Tel: 408-434-3600, TWX: 910-433-0855; FSC No.: 31260; Empl.: 280; *Sls. Mgr.:* C. W. Frank

ZEUS INDL. PRODS. INC., P.O. Box 298, Raritan, NJ 08869, Tel: 201-526-0800, 800-526-3842, TWX: 710-480-9346, FAX: 201-526-5699; FSC No.: 32039; Empl.: 150; *Sls. Mgr.:* Jeffrey J. Tourville; *Dist. Mgr.:* Michael C. Tourville ..... **C•1718, 1837, 1911**

ZEVATECH, INC., 1580 Old Oakland Rd., Suite C-108, San Jose, CA 95131, Tel: 408-289-1001; Empl.: 70; *Sls. Mgr.:* Bob Black; *Dist. Mgr.:* Bob Black

ZEXCO, 7661 Densmore, 68, Van Nuys, CA 91406, Tel: 818-997-7895

ZIATECH, 3433 Roberto Ct., San Luis Obispo, CA 93401, Tel: 805-541-0488, TELEX: 4992316, FAX: 805-541-5088; Empl.: 55; *Sls. Mgr.:* Jim Eckford

ZIERICK MANUFACTURING CORP., 56 Radio Circle, Mt. Kisco, NY 10549, Tel: 914-666-2911, 800-882-8020, TWX: 710-571-2143; Empl.: 120; *Sls. Mgr.:* L. T. Noyes; *Dist. Mgr.:* Jack Becker ..... **C•1601**

Local Sales Offices & Reps
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CA Hayward, Arow Fasteners 415-487-2100
CA Laguna Hills, Yarbrough Timco 714-859-7021
CA Mission Hills, Coast Air 818-898-2288
CA N. Hollywood, Alatec Prods. 818-764-5600
CA San Jose, Bisco Inds. 408-435-8980
CO Denver, Hardware Specialty 303-371-8553
FL Winter Pk., Hardware Specialty 305-677-8500
MA Marlborough, Hardware Specialty 617-481-8622
MA Winchester, Rush Inds. 617-729-5800
MO Bridgeton, Alatec Prods. 314-298-0100
NJ Pine Brook, Alatec Prods. 201-227-8140
NY Long Island City, Hardware Specialty 718-361-9393
NY Peekskill, Lawrence Tufts 914-739-2107
OR Beaverton, Comps. Resources 503-641-8488
WA Redmond, Comps. Resources 206-454-8666
Can Concord, Ont., Zierick Canada Ltd. 416-669-1429

ZIPPERTUBING CO., Box 61129, Los Angeles, CA 90061, Tel: 213-321-3901, TWX: 910-346-6713, FAX: 213-321-3086; Empl.: 120; *Sls. Mgr.:* Terry Plummer

Local Sales Offices & Reps
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FL Deerfield Bch., Sls. Engrg. Concepts 305-426-4601
MD Columbia, Pro-Rep 301-381-7460
MA Norwood, Tom Maguire Assocs. 617-551-0500
NJ Wayne 201-256-4980
OH Cleveland, Comps. & Specialty Co. 216-734-0655
TX Carrollton 214-931-7060
WA Mukilteo, Krippner & Assocs. 206-743-3579
Can Toronto, Ont., Norgay Entprs., Ltd. 416-259-9663

ZIRMEX, See Degussa Electronics, Hybrid Div.

ZI-TECH INSTRUMENT CORP., P.O. Box 391567, Mountain View, CA 94039, Tel: 415-966-8484, TELEX: 334-447, FAX: 415-966-8201; Empl.: 15; *Sls. Mgr.:* J. Ziman

ZITEL CORPORATION, 630 Alder Dr., Milpitas, CA 95035, Tel: 408-946-9600, TELEX: 171607, TWX: 910-338-0567

Z-LINE POWER CONTROLLERS, See Pulizzi Engineering, Inc.

ZYLAB CORP., 3105-T N. Frontage Rd., Arlington Hgts., IL 60004, Tel: 312-632-1100, TELEX: 38 3422 ZYLAB CGO, TWX: 910-380-4603 ZYLAB CGO, ESYLNK: 62753465, FAX: 312-632-1129; Empl.: 15; *Sls. Mgr.:* Tom Priestley

ZYMOS CORP., 477 N. Mathilda Ave., Sunnyvale, CA 94086, Tel: 408-730-8800, 408-730-5400, TWX: 910-339-9530; *Sls. Mgr.:* Jeff Jacobsen

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

MINIGLOSSARY CAPACITORS

Anode: One of two plates or conductors. In polarized capacitors, the anode should be connected to the positive conductor in the circuit.

Capacitive Reactance: The measure of the opposition of a capacitor to accepting a charge and expressed in ohms. When direct current is applied under stated conditions capacitive reactance becomes a constant but, when alternating current is applied the capacitive reactance varies until an equilibrium is achieved and the capacitor appears to have only direct current present. This condition is commonly used in filter applications or in coupling circuits.

Cathode: One of two plates or conductors. In electrostatic capacitors the cathode is metallic. In electrolytic capacitors the cathode is a liquid, gel or other conductive material which is in intimate contact with a metallic cathodic connection.

Dielectric Constant: The measure of quality of the insulating materials in a capacitor. Dry air has a dielectric constant of one (1). Aluminum oxide used in aluminum electrolytic capacitors has a nominal dielectric constant of ten (10).

Electrolytic: A capacitor with one metallic conductor (generally the anode) and with a liquid or semiconductor cathode. Nonpolarized electrolytic capacitors generally have two equal anodes as well as the liquid cathode. These anodes operate alternately as anode and cathodic connection as alternating current is applied.

Electrostatic: One of two general classes of capacitors in which two or more discrete metallic conductors are present and separated by an insulating dielectric material. Examples include: mica, ceramic, film, and paper types.

Farad: The basic unit of measure in capacitors. A capacitor charged to one volt with a charge of one coulomb (one ampere flowing for one second) has a capacitance of one farad. Capacitors are generally rated at portions of a farad (microfarads or picofarads).

1 farad (F) = 1,000,000 microfarads (μF) 1 microfarad (μF) = 1,000,000 picofarads (pF)

Impedance: All capacitors exhibit impedance. It is a function of capacitor type and internal construction. This can be particularly important in certain applications such as filters for switching power supplies. Capacitors used in these applications often have special multiple tab construction to shorten current paths and to reduce internal resistance.

Leakage Current: Expressed as dcl for electrolytic capacitors, a measure of the intrinsic losses in a charged capacitor. Generally speaking, the lower the dcl, the higher quality the capacitor.

Power Factor: A measure of the overall efficiency of a capacitor. Power factor ratings take all internal losses into consideration in a complex formula. This parameter of certain capacitors is often very important in AC applications such as motor-start and/or motor-run capacitors.

Rated Voltage: The rated working voltage of a capacitor. Generally expressed in DC Volts (Vdcw). This is the voltage at which a capacitor may be safely operated at 25°C continuously within its overall parameters.

Ripple Current: The total amount of alternating and direct current that may be applied to an electrolytic capacitor under stated conditions. In general, the higher the ripple current applied, the shorter the operating life of the capacitor will be. Application of significantly higher than rated ripple currents can shorten the capacitor life dramatically and may even cause catastrophic failure (explosion).

Surge Voltage: The momentary surge voltage which may be applied for a stated length of time without doing permanent damage to the unit.

Temperature: Capacitors are generally rated at 25°C at sea level under specific humidity conditions. Operating temperature ranges are also given, along with derating (reliability) curves for operation at temperatures other than 25°C.

Temperature Coefficient: Expressed as TC in ppm (parts per million) or in percent (%) from the norm of 25°C. This is seldom a straight line and may vary widely for certain types. Most capacitors have positive TC in that the capacitance increases as temperature increases. Some types, however, have negative TC in that the capacitance decreases as temperature increases.

Ceramic Capacitor Codes
(Capacitance Given In pF)

Color	Digit	Multiplier	Tolerance			Temperature Coefficient ppm°C	Significant Figure	Multiplier
			Class 1		Class 2			
			10pF or less	Over 10pF				
Black	0	1	±2.0pF	±20%	±20%	0	0.0	−1
Brown	1	10	±0.1pF	±1%		−33		−10
Red	2	100		±2%		−75	1.0	−100
Orange	3	1000		±3%		−150	1.5	−1000
Yellow	4	10000			+100% −0%	−220	2.0	−10000
Green	5		±0.5pF	±5%	±5%	−330	3.3	+1
Blue	6					−470	4.7	+10
Violet	7					−750	7.5	+100
Gray	8	0.01	±0.25pF		+80% −20%	+150 to −1500		+1000
White	9	0.1	±1.0pF	±10%	±10%	+100 to −750		+10000
Silver								
Gold								

MINIGLOSSARY
BASIC CAPACITOR FORMULAS

I. Capacitance (farads)

English: $C = \frac{.224\ K\ A}{t_D}$

Metric: $C = \frac{.0884\ K\ A}{t_D}$

II. Energy stored in capacitors (Joules, watt-sec)

$$E = \tfrac{1}{2}\ CV^2$$

III. Linear charge of a capacitor (Amperes)

$$I = C\frac{dV}{dt}$$

IV. Total Impedance of a capacitor (ohms)

$$Z = \sqrt{R_s^2 + (X_C - X_L)^2}$$

Where Rs = ESR

V. Capacitive Reactance (ohms)

$$X_C = \frac{1}{2\pi fC}$$

VI. Inductive Reactance (ohms)

$$X_L = 2\pi fL$$

VII. Phase Angles:

Ideal Capacitors: Current leads voltage 90°
Ideal Inductors: Current lags voltage 90°
Ideal Resistors: Current in phase with voltage

VIII. Dissipation Factor

$$DF = \tan\delta\ (\text{loss angle}) = \frac{ESR}{X_c} = (2\pi fC)\ (ESR)$$

IX. Power Factor

PF = Sine δ (loss angle) = Cos ϕ (phase angle)
PF = DF (when less than 10%)

X. Quality Factor (dimensionless)

$$Q = \text{Cotan}\ \delta\ (\text{loss angle}) = \frac{1}{DF}$$

XI. Equivalent Series Resistance (ohms)

$$ESR = (DF)\ (Xc) = (DF)\ (\tfrac{1}{2}\pi fC)$$

XII. Power Loss (watts)

Power loss = $(2\pi fCV^2)$ (DF)

XIII. KVA (Kilowatts)

$$KVA = 2\pi fCV^2 \times 10^{-3}$$

XIV. Temperature Characteristic (ppm/°C)

$$TC = \frac{Ct - C_{25}}{C_{25}\ (T_t - 25)} \times 10^6$$

XV. Cap Drift (%)

$$C.D. = \frac{C_1 - C_2}{C_1} \times 100$$

XVI. Reliability of Ceramic Capacitors

$$\frac{L_O}{L_t} = \left(\frac{V_t}{V_O}\right)^x \quad \left(\frac{T_t}{T_O}\right)^\tau$$

XVII. Capacitors in Series (current the same)

Any number: $\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} \text{---} + \frac{1}{C_N}$

Two: $C_T = \frac{C_1 C_2}{C_1 + C_2}$

XVIII. Capacitors in Parallel (voltage the same)

$$C_T = C_1 + C_2 \text{---} + C_N$$

XIX. Aging Rate

A.R. = % Δ C/decade of time

XX. Decibels

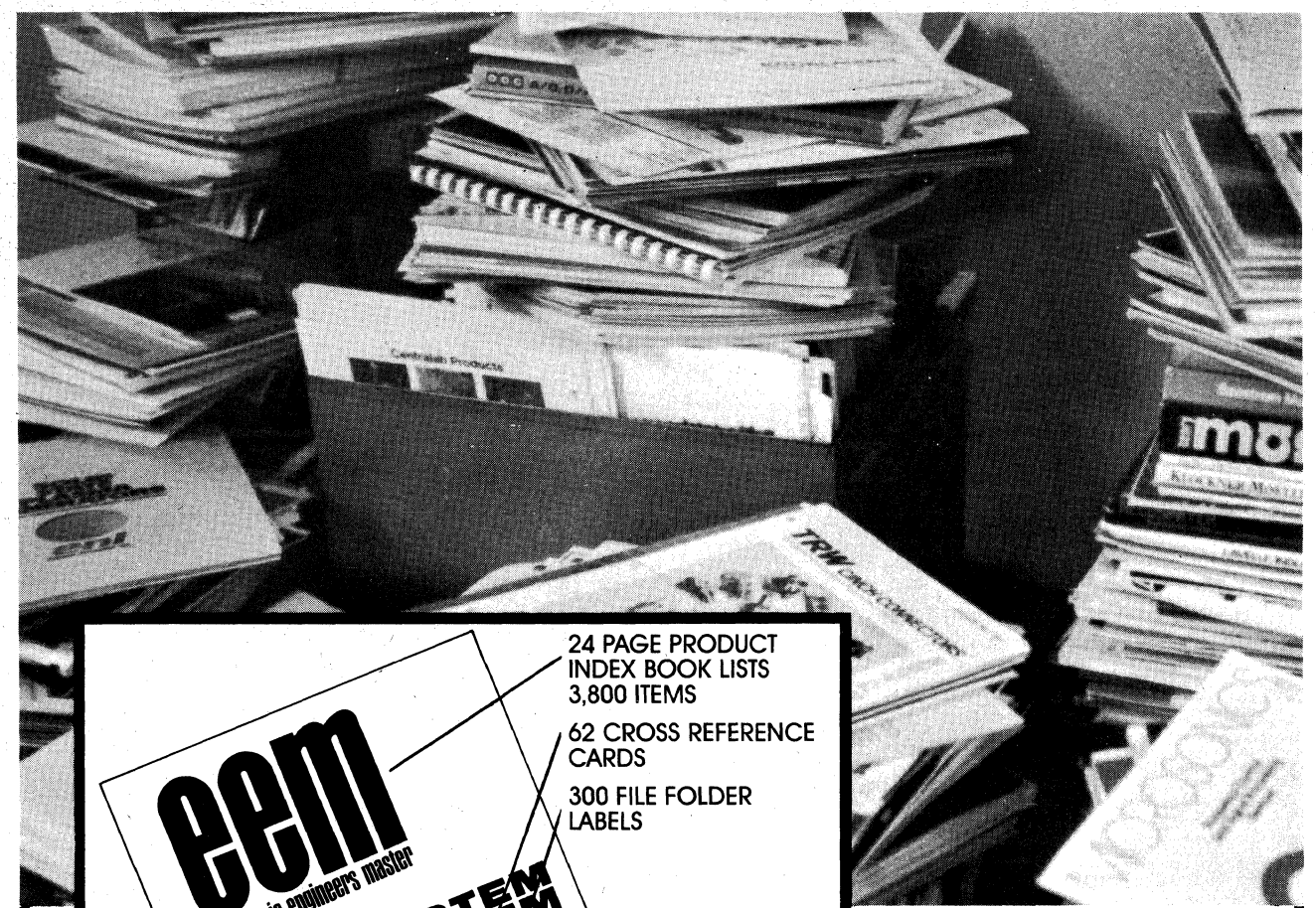
$$db = 20 \log \frac{V_1}{V_2}$$

Metric prefixes:

Pico	X 10^{-12}
Nano	X 10^{-9}
Micro	X 10^{-6}
Milli	X 10^{-3}
Deci	X 10^{-1}
Deca	X 10
Kilo	X 10^3
Mega	X 10^6
Giga	X 10^9
Tera	X 10^{12}

Symbols:

K = Dielectric Constant
A = Area
t_D = Dielectric thickness
V = Voltage
t = time
R_s = Series Resistance
f = frequency
L = Inductance
δ = Loss angle
ϕ = Phase angle
x + y = Exponent effect of voltage and temp
L_O = Operating life
L_t = Test life
V_t = Test voltage
V_O = Operating voltage
T_t = Test temperature
T_O = Operating temperature



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MINIGLOSSARY CONNECTORS

Connector terminology is often quite confusing. This confusion starts with the very names of connectors. The name of a connector may derive from its shape, application, type of conductor or even method of termination.

Shape—Circular, cylindrical, and rectangular.

Electrical application—High voltage, RF, microwave, input/output, etc.

Mechanical application—Printed circuit, rack & panel, cable, etc.

Conductor type—Coaxial, flat cable, ribbon cable, flex circuit, etc.

Termination method—Wirewrap, soldercup, solderless, etc.

Hardware such as clamps, hoods, and adapters are frequently used to convert cable connectors to rack and panel types. This adds to the name confusion. A very common telephone connector, for example (the "C" type) got its name from the model number of the original maker.

Contact: The part(s) of the connector that actually provides circuit continuity between its two sections—the parts which are normally mated. The back end of the connector should properly be called the *termination*. This is the point where the wires or PC board is attached to the connector.

Contact alignments: Often called *contact float*. Describes the amount of allowable contact movement within the connector body. Permits self-alignment.

Male vs. female: In the U.S. this describes the contact construction. In Europe this term is more often used to describe the outer shell mating action which may be the reverse of the contacts.

Closed entry: A female contact which prevents entry of a male contact larger than a specific size.

Open entry: A female contact designed for a specific size of male contact but which will allow entry of larger male contacts by spring action.

Hermaphrodite: Contacts or connector bodies which are the same configuration. Male/female designations do not apply. Bodies usually have some mechanical means for maintaining polarity.

Hermetic seal: Glass-to-metal seals at terminations. Often used improperly to describe vacuum-tight seals.

Waterproof seal: May or may not be truly *waterproof*. May prevent easy entrance of casual water by means of a rubber or other boot.

Printed circuit connector: Connectors which are used in conjunction with printed circuit boards. There are two distinctly different styles.

Edgeboard. May be called *edge* or *card*. The printed circuit (PC) board edge enters the connector.

Two-piece: One part of the connecting pair is physically attached to the PC board itself. The other part is attached to something else such as a cable or a motherboard.

Readout: Describes the arrangement at the terminating edge of a PC board. May be single or double. A double readout PC board has termination strips on each side not usually interconnected.

Ribbon connectors: A type of connector which allows flat "ribbon" cable to be attached to a round or rectangular connector but also used interchangeably for flat connectors to flat cable.

Ribbon contact connector: Describes the contacts in a rectangular connector which have a self-wiping mating action. Not the same as ribbon connector.

Solderless terminal: Any style of termination which does not require solder for a permanent connection. See *crimp* and *insulation displacement*.

Crimp termination: A stripped wire is inserted into a barrel or trough which is then crimped to the conductor with a suitable tool.

Insulation displacement: Unstripped insulated wire is fitted into a channel containing metal teeth which are forced through the insulation to make contact with the conductor.

Service rating: The maximum rated voltage and/or current which may be applied continuously. May be called *working voltage*. Can be confused with the term used to describe how many times a connector may be mated and separated.

Withstanding voltage: Also called *test voltage*. The voltage a connector must withstand for one minute without breakdown. Applied between connectors and between connectors and shell and any grounding devices of the connector.

MINIGLOSSARY POWER SUPPLIES

Ambient reference: Refers to the temperature of the still air surrounding the power supply

Case reference: One of the specs that make up the nominal rating. The temperature of the case with the temperature of the surrounding still air at a stated temperature (usually 25°C).

Crowbar circuit: Protects the load. A protective circuit that applies a short circuit across the output immediately upon overload. (See overvoltage).

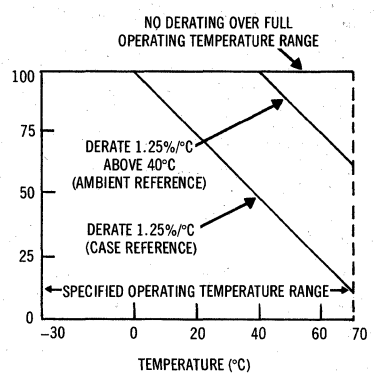


Fig. 1. Power output derating can be referred to ambient or case.

Derating: The degree output is reduced as temperature increases. Usually referenced to ambient case temperature and shown on a graph.

Efficiency: Ratio of the output power to the required input power. Usually expressed as a percentage given nominal environmental temperature.

EMI/RFI: Interference electronic circuitry caused by energy from electromechanical or radio frequency power supplies.

Foldback: Built-in protective circuits that automatically reduce the output voltage and/or current to very low levels in the event of an overload.

Holdover (Holdup): The interval that rated output will continue after input ceases. Usually milliseconds.

Input reflected current: The peak-to-peak alternating current generated by switching transients in DC/DC converters. Should not exceed 1%.

Inrush current limiting: Built-in circuits that monitor high currents through the rectifiers to the capacitors at turn ON. Circuit is usually inhibited as capacitors attain full charge.

Nominal rating: The spec value of the supply at stated conditions of input, output, and temperature.

Overshoot: A transient voltage change occurring during turn ON or OFF or during an abrupt load change.

Overvoltage (Overload) protection: Built-in circuits that protect the load or the supply by shutting it down or providing foldback.

Recovery: The time interval between the termination of an overload and restoration to normal operations.

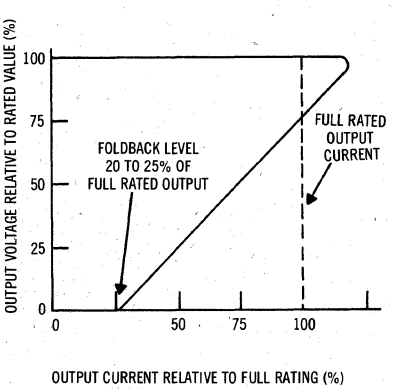


Fig. 2. Current foldback limiting self-resets with removal of fault.

Response: The time interval between a stated step change in input voltage or load current and return of output to normal operating conditions.

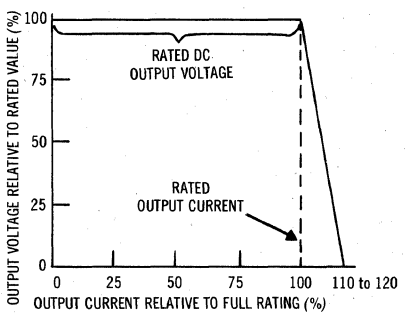


Fig. 3. Current limiting restrictions output current to a valve somewhat greater than full rated output; it resets when fault is removed.

Sensing: Regulation techniques that monitor output voltage and/or current. *Local sensing* refers to the output terminals. *Remote sensing* allows a feedback from the load circuit to the power supply.

Soft start: Allows the supply to start from zero current and/or voltage over a stated period of time during start up to prevent voltage overshoots and current imbalances.

Switchers: Power supplies using switching techniques to achieve high efficiency regulation. These techniques can have attendant EMI/RFI problems.

Tracking: The maintaining of fixed ratios between multiple outlets despite variations in line, load or temperature. Particularly important in supplies with symetrical (+)(−) outputs.

Transient protection: Circuitry designed to protect the supply from high amplitude line transients. Generally expressed in terms of peak voltage and maximum transient time duration.

CHARACTERISTICS OF BATTERIES AND FUEL CELLS

System	Anode	Cathode	Theoretical battery		Practical battery		
			Voltage, V	Capacity, Ah/kg	Typical voltage, V	Capacity[a]	
						Wh/kg	Wh/dm³
Primary:							
Leclanche	Zn	MnO_2	1.6	230	1.2	65	175
Magnesium	Mg	MnO_2	2.0	270	1.5	100	195
Organic cathode	Mg	*m*-DNB	1.8	1,400	1.15	130	180
Alkaline MnO_2	Zn	MnO_2	1.5	230	1.15	65	200
Mercury	Zn	HgO	1.34	185	1.2	80	370
Mercad	Cd	HgO	0.9	165	0.85	45	175
Silver oxide	Zn	AgO	1.85	285	1.5	130	310
Zinc-air	Zn	Air (O_2)	1.6	815	1.1	200	190
Li-organic electrolyte	Li	[b]	2.1-5.4	130-660	1.8-3.2	250	400
Secondary:							
Lead-acid	Pb	PbO_2	2.1	55	2.0	37	70
Edison	Fe	Ni oxides	1.5	195	1.2	29	65
Nickel-cadmium	Cd	Ni oxides	1.35	165	1.2	33	60
Silver-zinc	Zn	AgO	1.85	285	1.5	100	170
Silver-cadmium	Cd	AgO	1.4	230	1.05	55	120
Zinc-nickel oxide	Zn	Ni oxides	1.75	185	1.6	55	110
Zinc-air[c]	Zn	Air (O_2)	1.6	815	1.1	150	155
Cadmium-air[c]	Cd	Air (O_2)	1.2	475	0.8	90	90
Zinc-O_2	Zn	O_2	1.6	610	1.1	130	120
H_2-O_2	H_2	O_2	1.23	3,000	0.8	45	65
Reserve:							
Cuprous chloride	Mg	CuCl	1.5	240	1.4	45	65[d]
Silver-chloride	Mg	AgCl	1.6	170	1.5	60	95[d]
Zinc-silver oxide	Zn	AgO	1.85	285	1.5	30	75[e]
Thermal	Ca	[b]	2.8	240	2.6	10	20[f]
Ammonia-activated	Mg	*m*-DNB	2.2	1,400	1.7	22	60[g]
High-	NA	S	2.1	685	1.8	200	[h]
temperature	Li	S	2.2	1,150	1.8	200	[i]
Solid electrolyte	Ag	Polyiodide	0.66	. . .	0.6	180	75[j]
Fuel cell:							
Hydrogen[c]	H_2	Air	1.23	26,000	0.7		[k]
Hydrazine[c]	N_2H_4	Air	1.5	2,100	0.7	800[b]	[l]
Methanol[c]	CH_2OH	Air	1.3	1,400	0.9	175[b]	185[m]

a Delivered capacity when discharged at normal temperatures (20°C) at normal discharge rates.
b Based on fuel consumption only.
c Weight of air not considered in computation of watt hours.
d Water-activated
e Automatically activated; high rate discharge; 2- to 10-min rate.
f Fused salt; heat-activated; high rate discharge; 2- to 10-min rate.
g Four-minute discharge rate.
h β-alumina electrolyte, 300°C operation.
i Fused salt; 350°C operation.
j Solid $RbAg_4I_5$ electrolyte.
k Several different cathode materials used.
l Fuel consumption is based on source of H_2.
m Based on methanol battery-fuel supply in situ.

WIRE GAUGES— DIAMETER, AREA AND COPPER WEIGHT

	Diameter at 20°C (68°F)		Area at 20°C (68°F)			Weight at 20°C (68°F), bare copper wire		
Size, AWG	mils	mm	mils	c mils	mm	lb/1,000 ft.	lb/mile	kg/km
4/0	460.0	11.68	166,200	211,600	107.2	640.5	3,382	953.2
3/0	409.6	10.40	131,800	167,800	85.01	507.8	2,681	755.7
2/0	364.8	9.266	104,500	133,100	67.43	402.8	2,127	599.5
1/0	324.9	8.252	82,891	105,600	53.49	319.5	1,687	477.6
1	289.3	7.348	85,730	83,690	42.41	253.3	1,338	337.0
2	257.6	6.543	52,120	66,360	33.62	200.9	1,061	298.9
3	229.4	5.827	41,330	52,620	26.67	159.3	841.1	237.1
4	204.3	5.189	32,780	41,740	21.15	126.3	667.1	188.0
5	181.9	4.620	25,990	33,090	16.77	100.2	528.8	149.0
6	162.0	4.115	20,610	26,240	13.30	79.44	419.4	118.2
7	144.3	3.665	16,350	20,820	10.55	63.03	332.8	93.80
8	128.5	3.264	12,970	16,510	8.367	49.98	263.9	74.38
9	114.4	2.906	10,280	13,090	6.631	39.61	209.2	58.95
10	101.9	2.588	8,155	10,380	5.261	31.43	166.0	46.77
11	90.7	2.304	6,460	8,230	4.17	24.90	131	37.1
12	80	2.05	5,130	6,530	3.310	19.8	104	29.4
13	72.0	1.83	4,070	5,180	2.63	15.7	82.9	23.4
14	64.1	1.63	3,230	4,110	2.08	12.4	65.7	18.5
15	57.1	1.45	2,560	3,260	1.650	9.87	52.1	14.7
16	50.8	1.29	2,030	2,580	1.31	7.81	41.2	11.6
17	45.3	1.150	1,610	2,050	1.040	6.21	32.8	9.24
18	40.3	1.02	1,280	1,620	0.823	4.92	26.0	7.32
19	35.9	0.912	1,010	1,290	0.653	3.90	20.6	5.81
20	32.0	0.813	804.0	1,020	0.519	3.10	16.4	4.61
21	28.5	0.724	638.0	812.0	0.412	2.46	13.0	3.66
22	25.3	0.643	503.0	640.0	0.324	1.94	10.2	2.88
23	22.6	0.574	401.0	511.0	0.259	1.55	8.16	2.30
24	20.1	0.511	317.0	404.0	0.205	1.22	6.46	1.82
25	17.9	0.455	252.0	320.0	0.162	0.970	5.12	1.44
26	15.9	0.404	199.0	253.0	0.128	0.765	4.04	1.14
27	14.2	0.361	158.0	202.0	0.102	0.610	3.22	0.908
28	12.6	0.320	125	159.0	0.0804	0.481	2.54	0.715
29	11.3	0.287	100.0	128.0	0.0647	0.387	2.04	0.575
30	10.0	0.254	78.50	100.0	0.0507	0.303	1.60	0.450
31	8.9	0.226	62.20	79.2	0.0401	0.240	1.27	0.357
32	8.0	0.203	50.30	64.0	0.0324	0.194	1.02	0.288
33	7.1	0.180	39.60	50.40	0.0255	0.153	0.806	0.227
34	6.3	0.160	31.20	39.7	0.0201	0.120	0.634	0.179
35	5.6	0.142	24.60	31.4	0.0159	0.0940	0.501	0.141
36	5.0	0.127	19.60	25.00	0.0127	0.0757	0.400	0.113
37	4.50	0.114	15.90	20.20	0.0103	0.0613	0.324	0.0912
38	4.0	0.102	12.60	16.0	0.00811	0.0484	0.256	0.0721
39	3.5	0.0889	9.62	12.2	0.00621	0.0371	0.196	0.0552
40	3.1	0.0787	7.55	9.61	0.00487	0.0291	0.154	0.0433
41	2.8	0.0711	6.16	7.84	0.00397	0.0237	0.125	0.0353
42	2.5	0.0635	4.91	6.25	0.00317	0.0189	0.0999	0.0282
43	2.2	0.0559	3.80	4.84	0.00245	0.0147	0.0774	0.0218
44	2.0	0.0508	3.14	4.00	0.00203	0.0121	0.0639	0.0180
45	1.8	0.0457	2.54	3.24	0.00164	0.00981	0.0519	0.0146
46	1.6	0.0406	2.01	2.56	0.00130	0.00775	0.0409	0.0115
47	1.4	0.0356	1.54	1.96	0.000993	0.00593	0.0313	0.00883
48	1.2	0.0305	1.13	1.44	0.000730	0.00436	0.0230	0.00649
49	1.1	0.0279	0.950	1.21	0.000613	0.00366	0.0193	0.00545
50	1.0	0.0254	0.785	1.00	0.000507	0.00303	0.0160	0.00450

NOMOGRAPH VOLTAGE DROP

NOMOGRAPH OF VOLTAGE DROP ACROSS LOAD SUPPLY LEADS (as a function of wire size and load current)

THIS NOMOGRAPH CAN BE USED TO FIND:

Maximum current carrying capacity recommended for any standard wire size.*

1) With a straight edge, connect from the wire size on Scale 2 to the point "A" on Scale 3.
2) Read I_{max} on Scale 1.

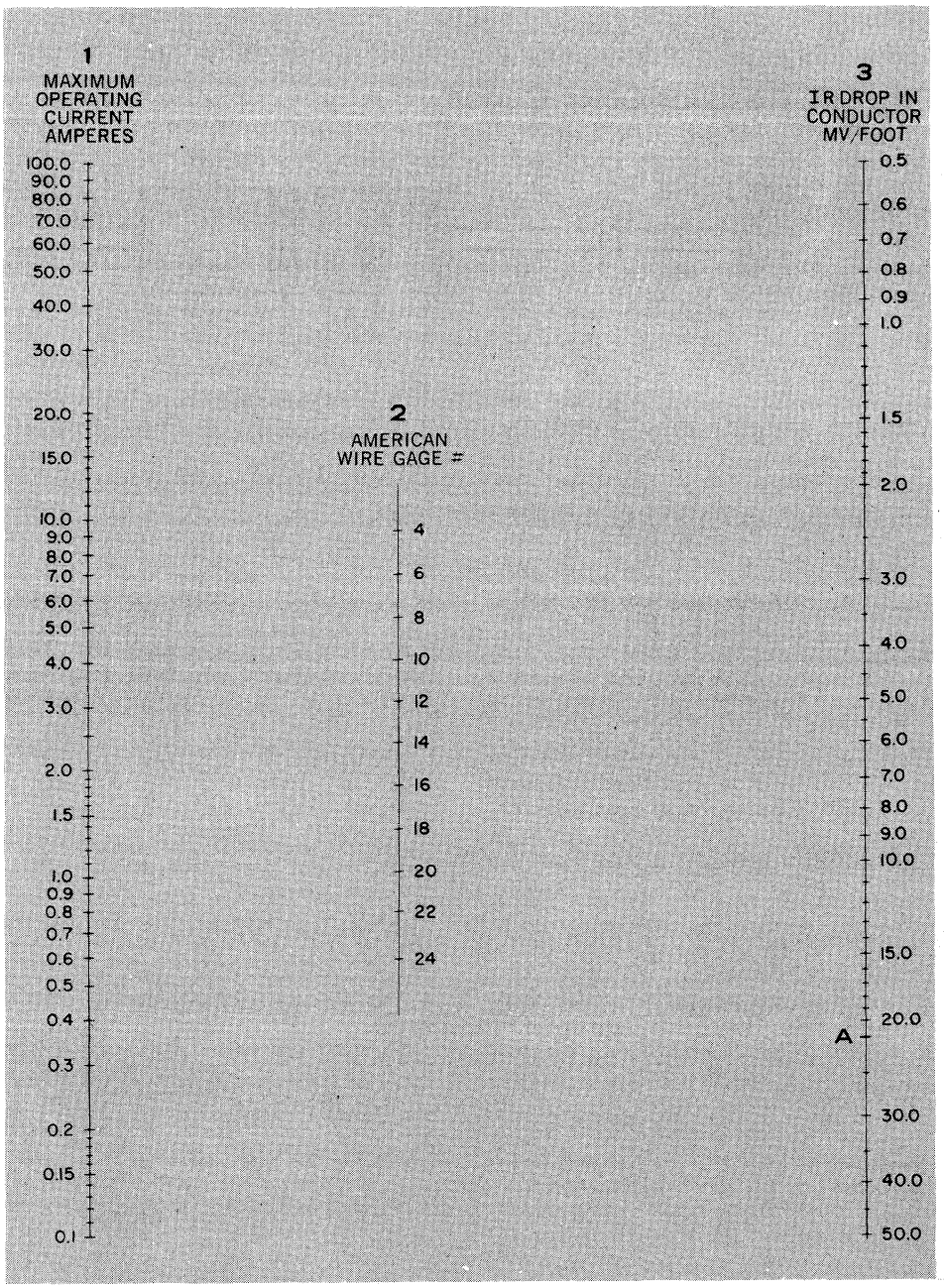
Voltage drop in millivolts per foot for known wire size and operating current.

1) With a straight edge, connect the known current on Scale 1 and the wire size on Scale 2.
2) Read voltage drop on Scale 3.

Wire size required for known operating current and known maximum tolerable voltage drop across supply leads.

1) Determine maximum tolerable drop in millivolts **per foot** of lead (sum of positive and negative leads).
2) Connect the value on Scale 3 (as determined in step 1) to the known current on Scale 1.
3) Read wire size on Scale 2.

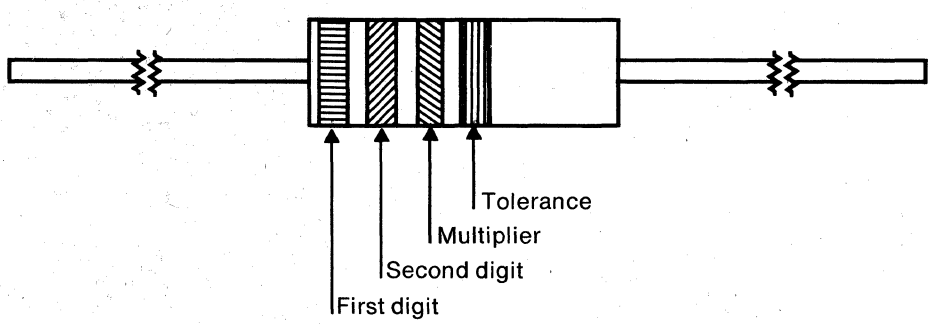
** Based on an arbitrary minimum 500 circular mils per ampere. High-temperature class insulation will safely allow higher currents.*



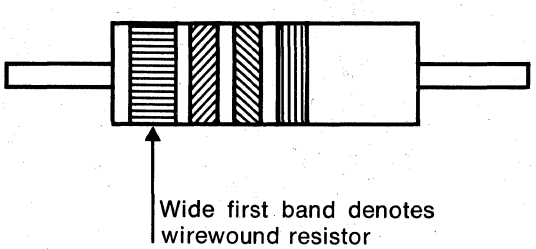
NOTE: A voltage stabilized Power Supply controls the voltage across its output terminals. Hence, the wire conductors used to connect the load must be considered as part of the load. At high load currents, the voltage drop across the supply leads may appreciably degrade stablization at the load. Kepco models equipped with the *remote error sensing* feature can automatically compensate for voltage drops of up to 500 mV across each load supply lead.

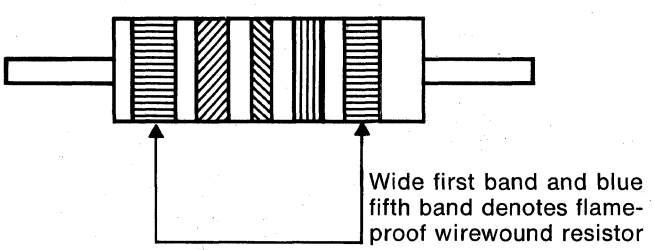
MINIGLOSSARY
RESISTOR COLOR CODES

EIA/MIL Resistor Color Codes



Color code for general-purpose industrial resistors

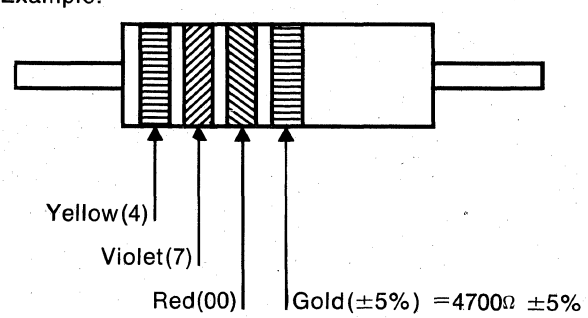




Color code for general-purpose wirewound resistors

Color	Significant digit	Multiplier	Tolerance
Black	0	1	—
Brown	1	10	± 1%
Red	2	100	± 2%
Orange	3	1000	± 3%
Yellow	4	10,000	± 4%
Green	5	100,000	—
Blue	6	1,000,000	—
Violet	7	10,000,000	—
Gray	8	—	—
White	9	—	—
Gold	—	0.1	± 5%
Silver	—	0.01	±10%
No color	—	—	±20%

Example:



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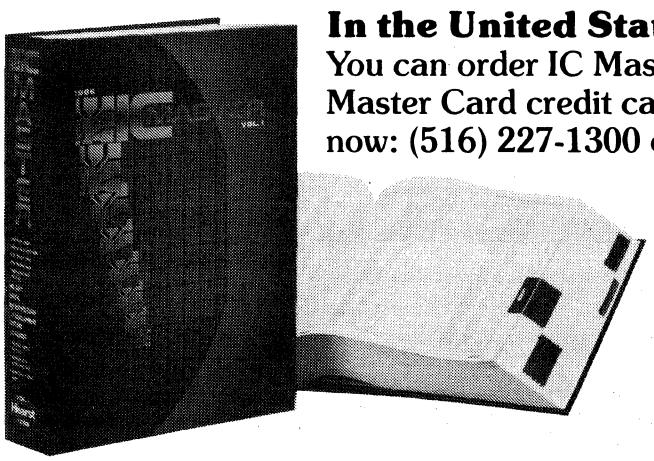

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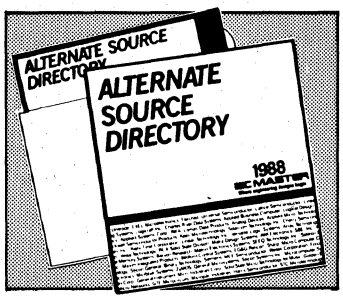

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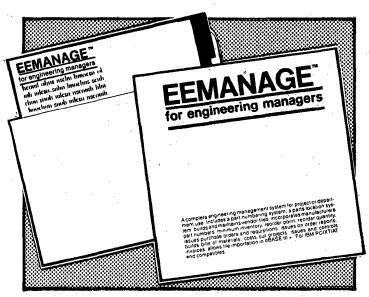

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TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
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Capacitors, Basic Formulas ..... **A**•1030
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Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
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Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
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Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
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Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
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Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
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Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
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Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
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Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
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SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
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Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

qualified products lists-2440

"Qualified Products Lists" are issued periodically by the U.S. Government as a guide for the procurement of electronic components by government contractors. Each list contains every separately designated part that has qualified under the latest Military Specification for its class and the name(s) of the manufacturer(s) of each.

EEM is publishing the names of those North American companies that are qualified producers of one or more products in each of the lists that apply to a selected group of electronic products normally cataloged in these pages. Addresses for these companies will be found in the EEM Yellow Pages.

For the complete QPLs and update information write or call:

Naval Publications and
Forms Center
5801 Tabor Ave.
Philadelphia, PA 19120
(215) 697-3321.

MIL-A-6752 FSC 6625
Ammeters, Voltmeters, and Loadmeters; DC

Bach-Simpson Ltd.
General Electric Co., Cincinnati, OH
Hickok Electrical Inst. Co.
Ideal Precision Meter Co.
International Instruments Div., Sigma Instruments

MIL-B-81757 FSC 6140
Batteries and Cells, Storage Nickel-Cadmium

General Electric Co., Gainesville, FL
Marathon Battery Co.
Rebling Plastics Co.
SAFT America, Inc.

MIL-B-23071 FSC 4140
Blowers, Miniature, for cooling electronic equipment (10 to 500 CFM)

Eastern Air Devices, Inc.
EG&G Rotron, Inc.
IMC Magnetics Corp., Westbury, NY
TRW Motor Div.

MIL-B-5423 FSC 5930
Boots, Dust and Water Seal (for toggle and pushbutton switches and rotary-actuated parts)

APM Hexseal Division
Multi-Flex Seals, Inc.

MIL-C-19978 FSC 5910
Capacitors, Fixed, Plastic (or Paper-Plastic), Dielectric (Hermetically sealed in metal, ceramic, or glass cases)

Chicago Condenser Corp.
Sprague Electric Co.
Stone City Products Co.
TRW Capacitor Div.
West-Cap Arizona

MIL-C-915 FSC 6145
Cable and Cord, Electrical

Anaconda-Ericsson, Inc., Continental Wire & Cable
BIW Cable Systems, Inc.
Brand-Rex Company
Carol Cable Co. West
Cerro Wire & Cable Co.
Chester Cable Corp.
Collyer Insulated Wire Co.
Consolidated Products Corp.
General Cable Corp.
ITT Surprenant Div.
Marine Industrial Cable Corp.
Mohawk Wire & Cable Corp.
Monroe Wire & Cable Corp.
The Okonite Co.
Phalo Corp.
Pirelli Cable Corp.
Plastoid Corporation
Rome Cable Corporation
Times Wire & Cable Co.
Vector Cable Co.

MIL-C-7974 FSC 5935
Cable Assemblies and Attachable Plugs, external electrical power, aircraft

Anderson Power Products
Burton Electrical Engineering
FKC Engineering Co.
General Cable Co., Cornish Products Div.

MIL-C-17 FSC 6145
Cables, Radio Frequency: Flexible & Semirigid

Belden Electronic Wire & Cable
Cablewave Systems, Inc.
Champlain Cable Corp.
ITT Surprenant
Phalo Corp.
Plastoid Corp.
Precision Tube Co., Inc.
Saxton Products, Inc.
Storm Products Co.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.
Times Fiber Communications, Inc.
Uniform Tubes, Inc.

MIL-C-22442 FSC 5965
Cable Assembly, Aircraft Audio

Astrocom Electronics, Inc.
Hiltronics Corp.
Telephonics

MIL-C-13777 FSC 6145
Cable, Special Purpose

BIW Cable Systems, Inc.
Brand-Rex Company
Rome Cable Corp.
ITT Surprenant

MIL-C-27500 FSC 6145
Cable, Electrical, Shielded and Unshielded, Aerospace

Judd Wire

MIL-C-55681 FSC 5910
Capacitors, Chip, Multiple Layer, Unencapsulated, Ceramic Dielectric

American Technical Ceramics
AVX Ceramics Corp.
Monolithic Components Corp.
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC
Unitrode Corp.
U.S. Microtek Components
Vitramon Inc.

MIL-C-83439 FSC 5910
Capacitors, Fixed, Feedthrough, EMI Suppression, (AC, DC, and AC-DC, Hermetically Sealed in Metal Cases)

Murata Erie, Canada
Sprague Electric Co.

MIL-C-27287 FSC 5910
Capacitors, Fixed, Plastic Dielectric, DC (Nonmetallic Cases)

Mepco/Electra Inc., Columbia, SC
Midwec Corp.
San Fernando Electric Mfg. Co.
TRW Capacitor Div.

MIL-C-55514 FSC 5910
Capacitors, Fixed, Plastic (or Metallized Plastic) Dielectric, in Nonmetal Cases

Electronic Concepts, Inc.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC

MIL-C-39022 FSC 5910
Capacitors, Fixed, Metallized, Paper-Plastic Film, or Plastic Film Dielectric, DC and AC (Hermetically Sealed in Metal

Acushnet Capacitor Co., Inc.
Alissa Manufacturing Co.
Components Research Co., Inc.
Sprague Electric Co.
TRW Capacitors
Union Carbide Corp., Greenville, SC
West-Cap Arizona

MIL-C-39018 FSC 5910
Capacitors, Fixed, Electrolytic (Aluminum Oxide)

Cornell-Dubilier Electronics, Sanford, NC
Mepco/Electra, Inc., Columbia, SC
Sangamo Capacitor Div.
Sprague Electric Co.

MIL-C-39003 FSC 5910
Capacitors, Fixed, Electrolytic, Tantalum, Solid-Electrolyted

Acushnet Electronics Co.
Mallory Capacitor Co.
Mepco/Electra, Inc., West Palm Beach, FL.
Sprague Electric Co.
Union Carbide Corp., Greenville, SC

MIL-C-3965 FSC 5910
Capacitors, Fixed, Electrolytic, (Nonsolid Electrolyte), Tantalum

Cornell-Dubilier Electronics, Sanford, NC
Hunter-Stanley Electronics, Inc.
Mallory Capacitor Co.
Mepco/Electra, Inc., West Palm Beach, Fl.
Mepco/Electra, Inc., Columbia, SC
Sprague Electric Co.
Tansitor Electronics, Inc.

MIL-C-19978 FSC 5910
Capacitors, Fixed, Plastic (or Paper-Plastic), Dielectric (Hermetically sealed in Metal, Ceramic, or Glass Cases)

Chicago Condenser Corp.
Sprague Electric Co.
Stone City Products Co.
TRW Capacitor Div.
West-Cap Arizona

MIL-C-11272 FSC 5910
Capacitors, Fixed, Glass-Dielectric

American Technical Ceramics Div.
Corning Glass Works, Raleigh, NC
Republic Electronics Corp.
Vitramon Inc.

MIL-C-11015 FSC 5910
Capacitors, Fixed, Ceramic-Dielectric (General Purpose)

Automation Components, Inc.
AVX Ceramics Corp.
Centralab, Los Angeles, CA
Cera-Mite Corp.
Corning Glass Works, Raleigh, NC
Republic Electronics Corp.
San Fernando Electric Mfg. Co.
Sprague Electric Co.
Tusonix, Inc.
Union Carbide Corp., Greenville, SC
Vitramon, Inc.

MIL-C-123 FSC 5910
Capacitors, Fixed, Ceramic Dielectric, (Temperature Stable & General Purpose)

San Fernando Electric Mfg. Co.

MIL-C-62 FSC 5910
Capacitors, Fixed, Electrolytic (DC, Aluminum, Dry Electrolyte, Polarized)

Sprague Electric Co.

MIL-C-5 FSC 5910
Capacitors, Fixed, Mica-Dielectric

Acushnet Capacitor Co., Inc.
ADI Electronics, Inc.

Cornell-Dubilier Electronics, New Bedford, MA
Sangamo Capacitor Co.
Silvered Electronic Mica Co., Inc.(SEMCO)
Soshin Electric Ltd. (Distr. by Multi Products Intl.)

MIL-C-23269 FSC 5910
Capacitors, Fixed, Glass Dielectric

Corning Glass Works, Raleigh, NC
Vitramon, Inc.

MIL-C-14409 FSC 5910
Capacitors, Variable, (Piston-Type, Tubular Trimmer)

Johanson Mfg. Corp.
Muratie Erie, Erie, PA
Sprague-Goodman Electronics, Inc.
Voltronics Corp.

MIL-C-81 FSC 5910
Capacitors, Variable, Ceramic Dielectric

Tusonix, Inc.

MIL-C-7079 FSC 5925
Circuit Breakers, Non Trip Free

Potter & Brumfield Div., AMF Inc., Gainesville, GA

MIL-C-55629 FSC 5925
Circuit Breakers, Magnetic, Unsealed or Panel Seal, Trip Free

Airpax Corp., Cambridge, MD
Heinemann Electric Co., Lawrenceville, NJ

MIL-C-15306 FSC 5950
Coils, Fixed and Variable, Radio Frequency

Cambridge Thermionic Corp.
Dale Electronics, Inc., Columbus Div.
Delevan, Div. of American Precision Industries, Inc.
Jeffers Electronics, Inc.
Nytronics Components Group, Inc.
Piconics, Inc.
Torotel Products, Inc.
TRW Inductive Products Div.
Vanguard Electronic Co., Inglewood, CA
West-Cap Arizona

MIL-C-22992 FSC 5935
Connectors, Electrical Waterproof, Quick Disconnect, Heavy Duty Type, & Accessories

Amphenol, Broadview, IL
Bendix Corp., Electrical Components Div.
Burndy/Berco
ITT Cannon Electric

MIL-C-21097 FSC 5935
Connectors, Electrical, Printed Wiring Board

AMP Incorporated
Amphenol, Broadview, IL
EDAC, Incorporated
Elco Corp., Connector Div.
TRW Connector Div., Elm Grove Village, IL
Winchester Electronic Div., Litton Industries

MIL-C-24308 FSC 5935
Connectors, Electric Rectangular, Miniature Polarized Shell, Rack Panel

ADI Electronics, Inc.
AMP, Inc.
General Connector Corp.
ITT Cannon Electric, Fountain Valley, CA
Matrix Science Corp.
Positronic Industries, Inc.
Souriau, Inc., Valencia, CA
TRW Connectors Div., Elk Grove Village, IL

MIL-C-81703 FSC 5935
Connectors, Electric, Circular, Miniature, Rack & Panel or Push-Pull Coupling

Deutsch Elec., Component Div.
Sealtron, Inc.

MIL-C-25516 FSC 5935
Connector, Electrical, Miniature

TRW Electronic Components, Minneapolis, MN

MIL-C-26500 FSC 5935
Connectors, General Purpose, Electrical, Miniature, Circular

Amphenol, Broadview, IL
Glenair, Inc.
Hermetic Seal Corp.
Pyle-National Co.
TRW Connectors, Minneapolis, MN

MIL-C-28748 FSC 5935
Connectors, Electrical, Rectangular, Rack & Panel, Solder Type, & Crimp Type Contacts

Continental Connector Corp.
Dale Electronics Inc., Columbus, NE
Hughes Aircraft Co., Connecting Devices Div., Irvine, CA
Positronic Industries, Inc.
U.S. Components, Inc.
Winchester Electronics, Div. Litton Industries, Inc.

MIL-C-28804 FSC 5935
Connectors, Electric, Rectangular, High Density, Polarized Center Jackscrew

Hughes Aircraft Co., Connecting Device Div., Irvine, CA

MIL-C-3912 FSC 5935
Connectors, Coaxial, Radio Frequency

AMP, Inc.

Amphenol RF Operations, Danbury, CT
Automatic Connector, Inc.
Bendix Corp., Electrical Components Div.
Cablewave Miniature Products
Delta Electronics Mfg. Corp.
ITT Cannon Electric, Phoenix, AZ
Kings Electronics Co., Inc.
OMNI Spectra, Inc., Microwave Connector Div.
Sealectro Corp.
Solitron/Microwave
Speciality Connector Co.

MIL-D-3954 FSC 5985
Dummy Load, Electrical, Waveguide

Struthers Electronics Corp.

MIL-E-1 FSC 5960
Electron Tubes

Amperex Electronic Corp., Hicksville Div.
Beam Tube Corp.
Cetron Electronics
EG & G, Inc., Electro-Optic Div.
GEC Technology Corp.
General Atronics Corp.
General Electric Co., Microwave Tube Operation
General Electric Co., MIDPS
ITT Electron Tube Div.
Litton Industries, Electron Tube Div., Williamsport, PA
LND, Inc.
Machlett Labs., Inc.
Microwave Assoc., Inc., Burlington, MA
M.U. Incorporated
National Electronics, Inc.
OMNI-Wave Electronics Corp.
Philips ECG, Inc., Altoona, PA
Raytheon Co., Quincy, MA
Raytheon, Waltham, MA
RCA Corp., Lancaster, PA
TGM Detectors, Inc.
Thomas Electronics, Inc.
Thomson-CSF Comps. Corp., Dover, NJ
Varian Assoc., Palo Alto, CA
Varian Canada, Inc., Georgetown, Ont.
Varo Electron Devices, Inc.
Watkins-Johnson Co., Stewart Div.
Western Electric Co., Inc.
Westinghouse Electric Corp., Electronic Tube Div.

MIL-F-15733 FSC 5915
Filters, Radio Interference

Captor Corp.
Centre Engineering, Inc.
Fil-Coil Co., Inc.
Murata Erie, Canada
RFI Corporation
San Fernando Electric Mfg. Co.
Spectrum Control, Inc.
Sprague Electric Co. Filter Div., North Adams, MA

MIL-F-18327 FSC 5915
Filters: High Pass, Low Pass, Band Suppression & Dual Functioning

ADC Products
Conolog Corp.
OPT Industries, Inc.
TRW Inductive Products Div.

MIL-F-23419 FSC 5920
Fuses, Instrument Type

Bussmann Mfg. Div., McGraw-Edison Co.
Littelfuse, Inc.

MIL-I-1361 FSC 6625
Instrument Auxiliaries, Electrical Measuring: Shunts, Resistors, & Transformers

Brown Boveri Electric, Inc., West Columbia, SC.
Electromagnetic Industries, Inc.

MIL-I-27273 FSC 6130
Inverter, Power, Static

Hamilton Standard Div., United Technologies Corp.
Magnetika, Inc.

MIL-J-641 FSC 5935
Jacks, Telephone

ADC Products
Kings Electronics Co., Inc.
Switchcraft, Inc.

MIL-L-3661 FSC 6210, 6250
Lampholders, Indicator Lights, Indicator Light Housings, & Indicator Light Lenses

Cutler Hammer Grp., Eaton Corp., Aerospace Controls/Systems Div.
Dialight
General Instrument Corp., Lamp Div.
Littelfuse, Inc.
Oak Switch Systems

MIL-M-10304 FSC 6625
Meters, Electrical Indicating, Panel Type, Ruggedized

A&M Instrument, Inc.
Bach-Simpson, Ltd.
Ideal Precision Meter Co., Inc.
International Instruments
Phaoston Instruments & Electronic Co.
Simpson Electric Co.
Triplett Corp.

MIL-O-55310 FSC 5955
Oscillators, Crystal

McCoy Electronics Co.
Oscillatek Corp.
Q-TECH Corp.
Spectrum Tehnology, Inc.
Vectron Labs., Inc.
Xsis Electronics, Inc.

MIL-P-26517 FSC 6130
Power Supply, Transformer-Rectifier, Aircraft

Wagner Electric Corp., Tung-Sol Div.

Westinghouse Electric Corp., Aerospace Electrical Division

MIL-R-28803 FSC 6240
Readouts, Segmented

Master Specialties

MIL-R-19648 FSC 5945
Relays, Time Delay, Thermal

Warren Communications

MIL-R-83726 FSC 5945
Relays, Time Delay, Electric & Electronic

Deutsch Relays, Inc.
Hi-G Co. , Inc., Windsor Locks, CT
Leach Corp., Control Products Div.
Struthers-Dunn, Inc.
Tempo Instrument, Plainview, NY

MIL-R-83407 FSC 5945
Relays, Reed (Mercury Wetted)

Struthers-Dunn, Inc.

MIL-R-39016 FSC 5945
Relays, Electromagnetic

Branson Corp.
Communications Instruments, Inc.
Deutsch Relays, Inc.
Electronics Specialty Div.
GENICOM Corp. (General Electric Co.), Waynesboro, VA
Gould Inc., Allied Control Division, Plantsville, CT
Hi-G Co., Inc., Windsor Locks, CT
Teledyne Relays

MIL-R-28750 FSC 5945
Relays, Solid State

Hi-G Co., Inc., Windsor Locks, CT
Teledyne Relays

MIL-R-94 FSC 5905
Resistors, Variable, Composition

Allen-Bradley Co.
Clarostat Mfg. Co., Inc.
Precision Electronic Components, Ltd.

MIL-R-26 FSC 5905
Resistors, Fixed, Wire-Wound (Power Type)

CAL-R, Inc.
Dale Electronics, Inc., Columbus, NE
E-Systems, Inc., Memcor, Div.
Ohmite Mfg. Co.
Pacific Resistor Co.
RCL Electronics, Inc.
Shallcross, Inc.
TEL-Labs, Inc.
Tepro of Florida, Inc.
Ultronix, Inc.
Ward Leonard Electric Co.

MIL-R-22 FSC 5905
Resistors, Variable (Wirewound, Power Type)

E-Systems, Inc., Memcor Div..
Ohmite Mfg. Co.

MIL-R-55342 FSC 5905
Resistors, Fixed, Film, Chip

Dale Electronics, Inc., Columbus, NE
Mepco/Electra, Inc., Morristown, NJ
Mini-Systems, Inc.
State of the Art, Inc.

MIL-R-83401 FSC 5905
Resistor Networks, Fixed Film

Allen-Bradley Co.
Dale Electronics, Inc., Columbus, NE
California Micro Devices, Inc.
KDI Pyrofilm Corp.
Mepco/Electra, Inc., Morristown, NJ
Sprague Electric Co.
Techno-Comps. Corp.
TRW Resistors
Vishay Resistive Systems

MIL-R-39008 FSC 5909
Resistors, Fixed, Composition (Insulated)

Allen-Bradley Co.

MIL-S-22432/9 FSC 6105
Servomotor, Type 18SM4c

Tachtronic Instruments, Inc.

MIL-S-12883 FSC 5935
Sockets & Accessories for Plug-In Electronic Components

Augat, Inc.
Deutsch Relays, Inc.
Eby Company

MIL-S-3786 FSC 5930
Switches, Rotary, Selector

Cole Instruments Corp.
Janco Corp., Burbank, Ca
Grayhill, Inc.

MIL-S-3928 FSC 5985
Switches (Coaxial), RF Transmission Line

Amphenol, RF Operations
Transco Products, Inc.

MIL-S-6807 FSC 5930
Switches, Rotary, Selector

Electro Switch Corp.

MIL-S-8805 FSC 5930
Switches & Switch Assemblies, Sensitive & Push (Snap Action)

Eaton Corp. Aerospace Controls/Systems Div.
Haydon Switch & Instrument, Inc.
Licon Div.
Master Specialties Co.
Micro Switch
Nexus
Otto Engineering
Saint Switch, Inc.
Stacoswitch
Texas Instruments, Inc., Materials & Controls Grp.

Unimax Switch Corp.
VIZ Mfg. Co., Inc.

MIL-S-9395 FSC 5930
Switches, Pressure (Absolute, Gauge & Differential)

Consolidated Controls Corp.
Electro-National Corp.
Hydra-Electric Co.
Scott Aviation
Sigma-Netics, Inc.

MIL-S-22885 FSC 5930
Switches, Pushbutton, Illuminated

Aerospace Optics, Inc.
APM Hexseal Div.
Eaton Corp., Aerospace/Commercial Controls Division
Jay-El Products, Inc.
Korry Mfg. Co.
Licon Div.
Master Dynamics Corp.
Master Specialties Co.
Micro Switch
Precision Molded Products
Stacoswitch
Unimax Switch Corp.

MIL-S-22710 FSC 5930
Switches, Rotary (Printed Circuit), (Thumbwheel, Inline & Pushbutton)

Digitran Co.
EECO, Inc.
Janco Corp.

MIL-T-23648 FSC 5905
Thermistor, (Thermally Sensitive, Resistor) Insulated

Ametick, Inc., Rodan Div.
Quality Thermister, Inc.
Unitrode Corp.
Victory Engineering Corp.

MIL-T-27 FSC 5950
Transformers & Inductors (Audio, Power, & High-Power Pulse)

ADC Products
Adec, Inc.
AEL-EMTECH Corp., Lansdale, PA
AMI/Coast Magnetics
Berkshire Transformer Corp.
Beta Transformer Technology Corp.
B.G. Laboratories, Inc.
Dytek Laboratories, Inc.
Electronic Transformer Corp.
Epsey Mfg. & Electronics Corp.
Fernwood Transformer Co.
Freed Transformer Co., Inc.
Hadley, Robert M., Co., Inc.
Microtran Co., Inc.
Midland-Ross Corp., Grimes Division
OPT Industries, Inc.
Pico Electronics, Inc.
Sigmapower, Inc.
Titan Transformer Co.
Torwico Electronics, Inc.
Transformer Design, Inc.
TRW Inductive Products
Vanguard Electronics Co., Inc.
Zenith Transformer Co., Inc.

MIL-T-27535 FSC 5950
Transformer, Power, Isolation, Series Circuit

Amerace Corp., Elastimold Div.
Crouse Hinds/Sepco Corp.

MIL-T-21038 FSC 5950
Transformers, Pulse, Low Power

Epsey Mfg. & Electronics Corp.
JB Electronic Transformers Inc.
TRW Inductive Products

MIL-V-9999 FSC 6625
Voltmeters, Electronic

Hewlett-Packard Co., Loveland, CO.
Ballantine Laboratories

MIL-W-16878 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated

Brim Electronics
Daburn Electronics & Cable
Judd Wire
National Wire & Cable

MIL-W-22759 FSC 6145
Wire, Electric, Crosslinked, Fluoropolymer Insulated, Modified ETFE, Normal Weight, Nickle Coated, High Strength Copper Alloy, 200 Deg. C, 600 Volt

Judd Wire

MIL-W-5086 FSC 6145
Wire, Electric, Polyvinyl Chloride Insulated, Copper of Copper Alloy

Barcel Wire & Cable Corp.
Independent Cable, Inc.
ITT Suprenant Div.
Philadelphia Insulated Wire Co.
Plastoid Corp.
Prestolite Wire Division
Teledyne Thermatics

MIL-W-81381 FSC 6145
Wire, Electric, Polymide-Insulated, Copper or Copper Alloy

Barcel Wire & Cable Corp.
Champlain Cable Corp.
Independent Cable Corp,.
Teledyne Thermatics
Tensolite Co.
Thermax Wire Corp.

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

AVX

Mil-C-123

MILITARY PART NUMBER CROSS REFERENCE FOR MIL-C-123

MIL-C-123		MIL-C-39014		MIL-C-20		MIL-C-55681		AVX CATALOG
CKS #	M123/•	CKR #	M39014/•	CCR #	M20/•	CDR #	M55681	
CKS05	/1	CKR05	/01	CCR05	/35	N/A	N/A	MR05
CKS06	/2	CKR06	/02	CCR06	/36	N/A	N/A	MR06
CKS07	/3	N/A	N/A	CCR07	/37	N/A	N/A	MR07
CKS11	/4	CKR11	/05	CCR75	/27	N/A	N/A	MA10
CKS12	/5	CKR12	/05	CCR76	/28	N/A	N/A	MA20
CKS14	/6	CKR14	/05	CCR77	/29	N/A	N/A	MA40
CKS15	/7	CKR15	/05	CCR78	/30	N/A	N/A	MA50
CKS16	/8	CKR16	/05	CCR79	/31	N/A	N/A	MA60
CKS26	/9	CKR06	/02	N/A	N/A	N/A	N/A	CR06
CKS51	/10	N/A	N/A	N/A	N/A	CDR01	/1	0805
CKS52	/11	N/A	N/A	N/A	N/A	N/A	N/A	1210
CKS53	/12	N/A	N/A	N/A	N/A	CDR03	/1	1808
CKS54	/13	N/A	N/A	N/A	N/A	CDR06	/3	2225

Mil-C-39014 (Molded Radial Leads)

	Per Mil-Spec			Case Size					Capacitance Range	
AVX Style	MIL-C-11015	MIL-C-39014	MIL-C-20	Length (L)	Width (W)	Thickness (T)	Lead Spacing (LS)	Lead Diameter (LD)	MIL-C-39014	MIL-C-20
MR05	CK05	CKR05	CCR05/CC05	.190 ± .010	.190 ± .010	.090 ± .010	.200 ± .015	.025 ± .002	10-.10	1-3300
MR04	—	CKR04	CCR09/CC09	.190 ± .010	.190 ± .010	.090 ± .010	.100 ± .015	.025 ± .002	10-.10	1-3300
MR06	CK06	CKR06	CCR06/CC06	.290 ± .010	.290 ± .010	.090 ± .010	.200 ± .015	.025 ± .002	1200-1.0	360-.018
CR08	—	CKR08	—	.290 ± .010	.290 ± .010	.145 ± .015	.200 ± .015	.025 ± .002	1.2-2.0	—
MR07	—	—	CCR07/CC07	.480 ± .020	.480 ± .020	.140 ± .010	.400 ± .020	.025 ± .002	—	2200-.10
MR08	—	—	CCR08/CC08	.480 ± .020	.480 ± .020	.240 ± .010	.400 ± .020	.025 ± .002	—	3900-.068

Mil-C-39014 (Molded Axial Leads)

	Per Mil-Spec			Case Size			Capacitance Range	
AVX Style	MIL-C-11015	MIL-C-39014	MIL-C-20	Length (L)	Diameter (D)	Lead Diameter (LD)	MIL-C-39014	MIL-C-20
MA10	CK12	CKR11	CCR75/CC75	.160 ± .010	.090 ± .010	.019 ± .002	10-.10	1-680
MA20	CK13	CKR12	CCR76/CC76	.250 ± .010	.090 ± .010	.019 ± .002	5600-.047	82-1000
MA40	CK14	CKR14	CCR77/CC77	.390 ± .010	.140 ± .010	.025 ± .002	.012-.27	150-5600
MA50	CK15	CKR15	CCR78/CC78	.500 ± .020	.250 ± .015	.025 ± .002	.056-1.0	820-.027
MA60	CK16	CKR16	CCR79/CC79	.690 ± .020	.350 ± .015	.025 ± .002	.47-3.3	3900-.082

Mil-C-39014 (2-Pin DIP)

AVX Style	MIL-C-39014	Length (L)	Height (H_1)	Height (H_2)	Thickness	Capacitance Range
MD01	CKR22	.260 ± .020	.128 ± .007	.165 max.	.092 ± .006	1.0-.1
MD02	CKR23	.260 ± .020	.155 ± .007	.185 max.	.092 ± .006	560-.22
MD03	CKR24	.260 ± .020	.283 ± .007	.320 max.	.092 ± .006	.12-1.0

Mil-C-55681 (Chips)

AVX Style	Per MIL-C-55681	Length (L)	Width (W)	Thickness (T) Max.	Thickness (T) Min.	Capacitance Range
0805	CDR01	.080 ± .015	.050 ± .015	.055	.020	10-4700
1805	CDR02	.180 ± .015	.050 ± .015	.055	.020	220-.022
1808	CDR03	.180 ± .015	.080 ± .015	.080	.020	330-.068
1812	CDR04	.180 ± .015	.125 ± .015	.080	.020	1200-.18
1825	CDR05	$.180^{+.020}_{-.015}$	$.250^{+.020}_{-.015}$	.080	.020	3900-.33
2225	CDR06	.225 ± .020	.250 ± .020	.080	.020	6800-.47

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For specific capacitance ranges and other AVX Products . . . see pages **A**•1023-1026

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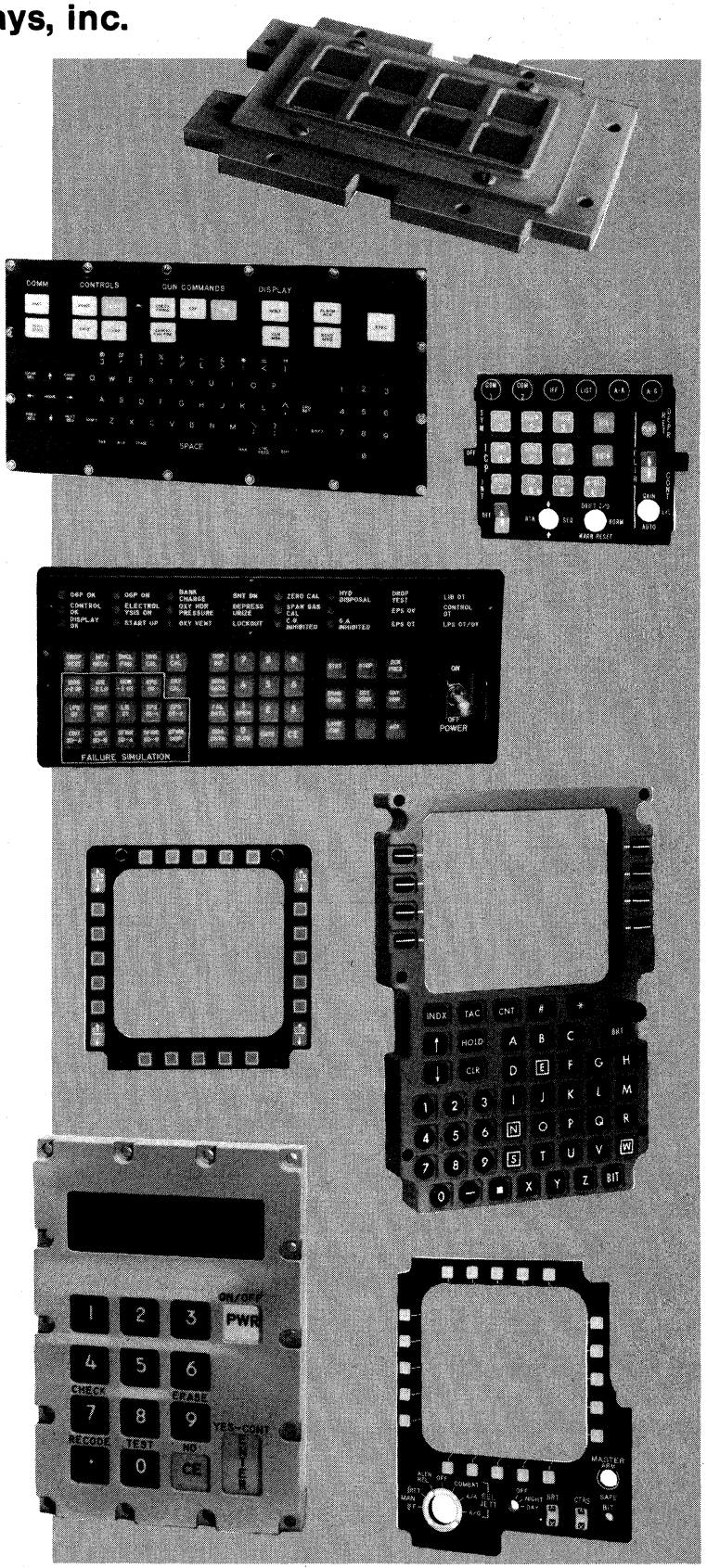

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MIL-R-83401							
MIL P/N	MIL Style	IRC Type	Config.	Resistance Range	Tolerance		TCR
M8340101 MXXXXXA	RZ010	M83401	14 Pin-3	22Ω - 100K	±2%	±5%	±300 ppm
M8340101 MXXXXXB	RZ010	M83401	14 Pin-1	22Ω - 100K	±2%	±5%	±300 ppm
M8340102 MXXXXXA	RZ020	M83401	16 Pin-3	22Ω - 100K	±2%	±5%	±300 ppm
M8340102 MXXXXXB	RZ020	M83401	16 Pin-1	22Ω - 100K	±2%	±5%	±300 ppm
M8340104 MXXXXXC	RZ040	M8340104	6 Pin 5 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340104 MXXXXXG	RZ040	M8340104	6 Pin 3 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340105 MXXXXXC	RZ050	M8340105	8 Pin 7 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340105 MXXXXXG	RZ050	M8340105	8 Pin 4 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340106 MXXXXXC	RZ060	M8340106	10 Pin 9 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340106 MXXXXXG	RZ060	M8340106	10 Pin 5 Res	33Ω - 100K	±2%	±5%	±300 ppm
M8340108 MXXXXXC	RZ080	M8340108	8 Pin 7 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340108 MXXXXXG	RZ080	M8340108	8 Pin 4 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340110 MXXXXXC	RZ090	M8340110	10 Pin 9 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340110 MXXXXXG	RZ090	M8340110	10 Pin 5 Res Low	22Ω - 100K	±2%	±5%	±300 ppm
M8340107 XXXXXXC	RZ070	4961	6 Pin 5 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340107 XXXXXXG	RZ070	4969	6 Pin 3 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340108 XXXXXXC	RZ080	4981	8 Pin 7 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340108 XXXXXXG	RZ080	4989	8 Pin 4 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340109 XXXXXXC	RZ090	4901	10 Pin 9 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340109 XXXXXXG	RZ090	4909	10 Pin 5 Res	100Ω - 100K	±.1%	±2%	±50 ±300 ppm
M8340101 XXXXXXA	RZ010	M989	14 Pin 7 Res	50Ω - 100K	±.1%	±1%	±25 ±150 ppm
M8340101 XXXXXXB	RZ010	M987	14 Pin 13 Res	50Ω - 50K	±.1%	±1%	±25 ±150 ppm
M8340102 XXXXXXA	RZ020	M999	16 Pin 8 Res	50Ω - 100K	±.1%	±1%	±25 ±150 ppm
M8340102 XXXXXXB	RZ020	M998	16 Pin 15 Res	50Ω - 50K	±.1%	±1%	±25 ±150 ppm
M8340101 XXXXXXA	RZ010	1989	14 Pin 7 Res	100Ω - 100K	±.1%	±2%	±25 ±300 ppm
M8340101 XXXXXXB	RZ010	1987	14 Pin 13 Res	100Ω - 70K	±.1%	±2%	±25 ±300 ppm
M8340102 XXXXXXA	RZ020	1999	16 Pin 8 Res	100Ω - 100K	±.1%	±2%	±25 ±300 ppm
M8340102 XXXXXXB	RZ020	1998	16 Pin 15 Res	100Ω - 70K	±.1%	±2%	±25 ±300 ppm
M8340103 XXXXXXA	RZ030	8989	14 Pin 7 Res	49.9Ω - 121K	±.1%	±2%	±25 ±300 ppm
M8340103 XXXXXXB	RZ030	8987	14 Pin 13 Res	49.9Ω - 121K	±.1%	±2%	±25 ±300 ppm
MIL-R-39017 - Precision MIL Qualified Metal Glaze							
RLR05/S		RGR05	1/8 @ 70°C	10Ω – 300KΩ	±1%	±2%	100
RLR07/S		RGR07	1/4 @ 70°C	10Ω – 3.01MΩ	±1%	±2%	100
RLR20/S		RGR20	1/2 @ 70°C	4.3Ω – 3.01MΩ	±1%	±2%	100
RLR32/S		RGR32	1 @ 70°C	10Ω – 2.7MΩ	±1%	±2%	100
MIL-R-55182 - Precision MIL Qualified Metal Glaze							
TH55		RNC55H/S	1/10 @ 125°C	10Ω – 2MΩ	±.1, .5, 1%		50
TK55		RNC55K/S	1/10 @ 125°C	10Ω – 2MΩ	±.1, .5, 1%		100
TJ55		RNC55J/S	1/10 @ 125°C	10Ω – 2MΩ	±.1, .5, 1%		25
TH60		RNC60H/S	1/8 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%		50
TK60		RNC60K/S	1/8 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%		100
TJ60		RNC60J/S	1/8 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%.		25
TH65		RNC65H/S	1/4 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%		50
TK65		RNC65K/S	1/4 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%		100
TJ65		RNC65J/S	1/4 @ 125°C	10Ω – 3.01MΩ	±.1, .5, 1%		25
MAR5		MAR5	1/10 @ 85°C	10Ω – 3.01MΩ	±.1, .5, 1%		25, 50, 100

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SPECIFICATION GUIDE

SPECIFICATION	CONDUCTOR	VOLTAGE	TEMPERATURE RATINGS	AWG SIZES
ZELRAD MIL-W-22759/32 thru 46	Tinned copper. Silver coated high strength copper alloy. Silver coated copper. Nickel coated high strength copper alloy. Nickel coated copper.	600	150 °C-200 °C	30-2/0
AERORAD MIL-W-81044/8 thru 13	Tinned copper. Silver coated high strength copper alloy. Silver coated copper.	600	150 °C	30-14
FLEXRAD 125 MIL-W-16878/14-16	Tinned copper.	600-3000	125 °C	30-12
PCA MIL-W-16878/1 thru 3	Tinned copper.	600-3000	105 °C	30-2

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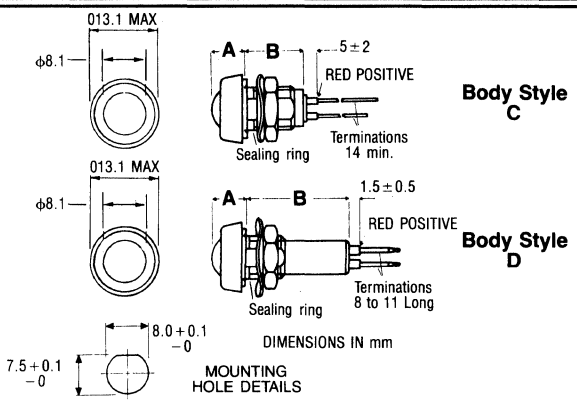


DESC PART NO. (SEE NOTE)	FEATURES								DIMENSIONS IN mm			OXLEY SIMILAR PART NO.
	HIGH BRIGHTNESS	SUNLIGHT READABLE	EMC MESH	SECURE IR FREE	WIDE ANGLE VIEWING	NARROW ANGLE VIEWING	REAR SEAL	ANTI-REFLECTION COATING	BODY STYLE	A	B	
85122-X01	●				●				C	6.5	11	PS/LH/8
85122-X02	●				●		●		D	6.5	19	STR/LH/8
85122-X03		●				●			C	5.5	11	PS/LH/8/RAF
85122-X04		●			●				C	5.5	11	PS/LH/8/RAPP
85122-X05		●				●	●		D	5.5	19	STR/LH/8/RAF
85122-X06		●			●		●		D	5.5	19	STR/LH/8/RAPP
85122-X07		●				●	●	●	D	5.5	19	STR/LH/8/HS/RAF
85122-X08		●			●		●	●	D	5.5	19	STR/LH/8/HS/RAPP
85122-X09		●	●			●	●	●	D	5.5	19	STR/LH/8/RAF/SES
85122-X10		●	●		●		●	●	D	5.5	19	STR/LH/8/RAPP/SES
85122-X11	●		●		●		●		D	6.5	19	STR/LH/8/SES
87019-X01		●		●			●	●	D	5.5	19	STR/LH/8/XIR
87019-X02		●	●	●			●	●	D	5.5	19	STR/LH/8/XIR/SES

NOTE: When ordering replace X in DESC No with letter to signify color R = Red, Y = Yellow, G = Green.

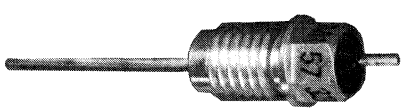
MIL-F-15733 Qualified EMI Suppression Filters

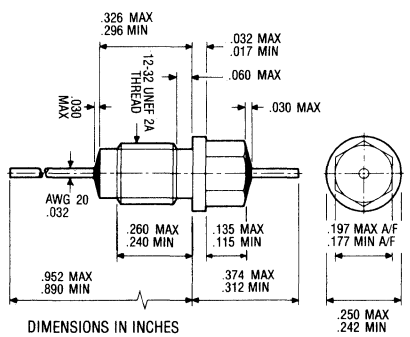
OXLEY chassis mounting pi-section EMI suppression filters are suitable for applications where high insertion loss is necessary from 10MHz to 10GHz, guaranteed over the military temperature range −55°C to 125°C. Fully qualified against MIL-F-15733 Revision G, all types are supplied with 168 hours burn-in (voltage conditioning) and 100% electrical testing, including insertion loss.

GENERAL CHARACTERISTICS

Dielectric	: CERAMOX K6000, : CERAMOX K3000
Body, Nut	: brass. QQ-B-626D
Finish	: silver to QQ-S-365
Lockwasher	: steel
Finish	: silver to QQ-S-365
Current rating	: 10A

When ordering please specify QPL designation eg. M15733/61-0007
Filters are supplied with lockwasher and hex nut.





QPL Designation (Style)	Oxley Type No.	Minimum Capacitance (pF)	Rated Voltage Vd.c.	Rated Voltage Vrms	Minimum Insertion Loss (dB) at 25°C 50 MHZ	100 MHz	200 MHz	500 MHz	1 GHz	10 GHz
M15733/61-0005	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0006	FLT8/P/1500	1500	200	140	32	45	58	70	70	70
M15733/61-0007	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0010	FLT8/P/5000	5000	100	70	50	65	70	70	70	70
M15733/61-0011	FLT8/P/5000/RP	5000	100	70	50	65	70	70	70	70

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MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

STANDARD RESISTOR MIL SPECIFICATION APPROVALS

RESISTORS:	RL standard military: 2% and 5% metal film resistor —RL07 (¼ watt) and RL20 (½ watt) —temperature coefficient: ±100 ppm/°C	MIL-R-22684
	RN standard military: 0.1% to 1% metal film resistor —RN50, RN55, RN60, RN65 styles	MIL-R-10509
	RLR established reliability: 1% and 2% metal film resistor —RLR05, RLR07 and RLR20 —temperature coefficient: ±100 ppm/°C —failure rate: S (.001% per 1000 hrs)	MIL-R-39017
	RNC established reliability: 0.1% to 1% metal film resistor —RNC50, RNC55, RNC60, RNC65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs.) —temperature coefficient: K (±100 ppm/°C), H (±50 ppm/°C), J (±25 ppm/°C) —non-hermetic seal	MIL-R-55182
	RNR/RNN established reliability: 0.1% to 1% metal film resistor —RNR55, RNR60, RNR65 —resistance tolerance: ±0.1%, 0.5%, 1.0% —failure rate: S (.001% per 1000 hrs) —temperature coefficient: C (±50 ppm/°C, E (±25 ppm/°C) —glass hermetic seal	MIL-R-55182
NETWORKS:	Single-In-Line (S.I.P.'s) —RZ040, RZ050, and RZ060 (High Profile); RZ070, RZ080, RZ090 (Low Profile) —resistance tolerance: ±1.0%, 2.0%, 5.0% —temperature coefficient: ±100 ppm and ±300 ppm/°C —resistance range: 10 ohm — 1M —6 pin, 8 pin, and 10 pin	MIL-R-83401/04/05/06/07/08/09
	Flat Packs —RZ030 —resistance tolerance: ±1.0%, 2.0%, 5.0% —temperature coefficient: ±100 ppm and ±300 ppm/°C —resistance range: 100 ohm — 100K —14 pin	MIL-R-83401/03
TRIMMER RESISTORS:	RJ24/RJR24 cermet trimmer —multiturn, ⅜" square —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ24 RJR24—approved to Failure Rate R	MIL-R-22097/MIL-R-39035
	RJ26/RJR26 cermet trimmer —multiturn, ¼" square —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard) RJ26 RJR26—approved to Failure Rate R	MIL-R-22097/MIL-R-39035
	RJ50 cermet trimmer —single turn, ¼" diameter round —resistance range: 10 ohm — 1M —resistance tolerance: ±10% —temperature coefficient: ±100 ppm/°C (standard)	MIL-R-22097

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STANDARD CAPACITOR MIL SPECIFICATION APPROVALS

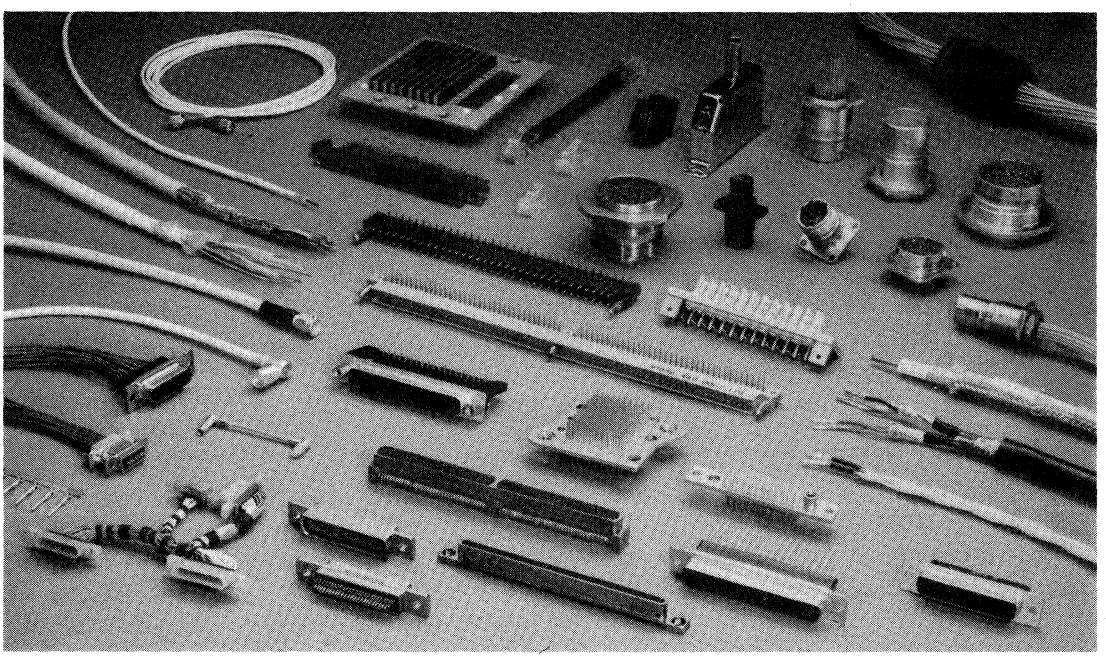
TANTALUM:

Wet Slug		MIL-C-3965
CL14/CL16	hermetic seal, screw mount, cylindrical case	
CL17/CL18	hermetic seal, stud mount, cylindrical case	
CL55	hermetic seal, rectangular module	
CL64/CL65	elastomer seal, axial lead, tubular case	
CL66/CL67	hermetic seal, axial lead, tubular case	
Wet Slug, established reliability		MIL-C-39006
CLR10	extended range, cylindrical case, solder lug terminal	
CLR14	extended range, cylindrical case, solder lug terminal	
CLR17	extended range, cylindrical case, solder lug terminal	
CLR65	glass-to-tantalum hermetic seal, axial lead, tubular case	
CLR79	hermetic seal, tantalum case, axial lead, tubular case	
CLR81	extended range, hermetic seal, tantalum case, axial lead, tubular case	
Wet Foil		MIL-C-3965
CL20/CL21	polar, etched foil, tubular case, axial lead	
CL22/CL23	non-polar, etched foil, tubular case, axial lead	
CL30/CL31	polar, plain foil, tubular case, axial lead	
CL32/CL33	non-polar, plain foil, tubular case, axial lead	
CL51	polar, plain foil, KSR, hermetic rectangular module	
CL52	non-polar, plain foil, KSR, hermetic rectangular module	
CL53	polar, etched foil, KSR, hermetic rectangular module	
CL54	non-polar, etched foil, KSR, hermetic rectangular module	
CL70/CL71	polar, high etched foil, tubular case, axial lead	
CL72/CL73	non-polar, high etched foil, tubular case, axial lead	
Wet Foil, established reliability		MIL-C-39006
CLR25	polar, etched foil, hermetic and non-hermetic, axial lead	
CLR27	non-polar, etched foil, hermetic and non-hermetic, axial lead	
CLR35	polar, plain foil, hermetic and non-hermetic, axial lead	
CLR37	non-polar, plain foil, hermetic and non-hermetic, axial lead	
CLR71	polar, high etched foil, hermetic and non-hermetic, axial lead	
CLR73	non-polar, high etched foil, hermetic and non-hermetic, axial lead	
Solid Slug		MIL-C-26655
CS12/CS13	hermetic seal, axial lead, tubular case	
Solid Slug, established reliability		MIL-C-39003
CSR09	polar, miniature, hermetic seal, axial lead, tubular case	
CSR13	polar, hermetic seal, axial lead, tubular case	
CSR21	polar, high frequency, hermetic, tubular case, axial lead	
CSR23	polar, extended range, hermetic seal, axial lead, tubular case	
CSR33	polar, extended range, hermetic seal, for low impedance application	
CSR91	non-polar, hermetic seal, axial lead, tubular case	
Solid Chip, established reliability		MIL-C-55365
CWR06	polar hybrid tantalum chip	

For information on Mepco/Centralab's RESISTORS/CAPACITORS, SEE PAGES A•1957-A•1960, A•1120-A•1124

INTERCONNECT SYSTEMS DIVISION
MICRODOT INC.

201 Progress Drive, Montgomeryville, PA 18936, (215) 699-5373, FAX 1-(215) 699-5536



The INTERCONNECT SYSTEMS DIVISION, MICRODOT INC. has a longstanding worldwide reputation as a respected supplier of a broad array of electronic/electromechanical connecting devices and specialty cable. The INTERCONNECT SYSTEMS DIVISION's charter encompasses the engineering and manufacture of a high-reliability MIL-Spec and commercial electronic/electromechanical connectors, as well as automotive switches, components and assemblies, specialty electronic cable and cable assemblies, and metal backpanels and plastic/metal headers. Products range from simple, low-cost wire-to-wire connectors, to highly sophisticated interconnect systems for electronic equipment.

PRODUCTS

MALCO

Malco-Montgomeryville & Malco South Pasadena manufactures an array of connector products:

- **High density microminiature 'D' connectors qualified to MIL-C-83513**
- **Coaxial connectors & cable**
- **Back Plane assembly & headers QPL'd to MIL-C-28754**
- **High density surface mount rectangular connectors up to 304 contacts.**
- **Custom rectangular connectors available with signal, power, coax, etc., and various configurations.**
- **High Density circular connectors**

CONNECTOR INDUSTRIES OF AMERICA

Circular Hermetically Sealed Environmental connectors are designed & fabricated to the following military specifications:

- **MIL-C-5015**
- **MIL-C-25955**
- **MIL-C-26500**
- **MIL-C-38999**
- **MIL-C-83723**
- **MIL-C-81703**

Custom hermetics are also manufactured to customer drawings

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MICRODOT INC

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FAX No. 1-(215) 699-5536

MALCO-South Pasadena
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South Pasadena, CA 91030
Phone No. (818) 799-9171
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639 North Wayne Avenue
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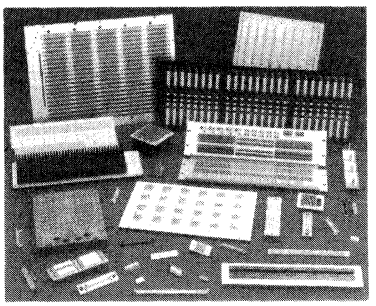
Back Panel Assemblies and Headers (QPL'd to MIL-C-28754)

Malco, the originator of the metal backplane technology produces aluminum metal plates for both card edge and metal to metal contact interfaces. Using a blade and tuning fork system, known as the wrappost assembly system panel, thousands of electrical terminations can be mounted on a single WASP plate. Malco features 3 amp contacts with .025" square wire wrapposts on 0.100", 0.125" and 0.150" centers as well as 6 amp contacts with .045" square wire, wrapposts on 0.200" centers.

- High density up to 100 contacts per square inch with each contact positioned to permit use with automatic wire wrapping machines.
- Malco offers a complete line of extruded, metal and molded headers.
- Extruded headers series 440 & 441 provide reliable interconnection between the back plane and printed circuit board, selective plating, increased rigidity and maximum utilization of space.

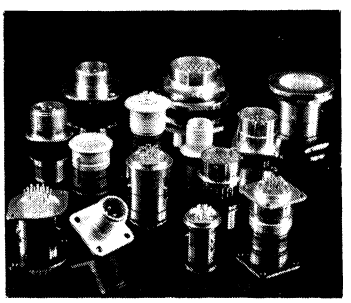


For additional information contact MALCO Montgomeryville, (215) 699-5373.

Mil Qualified
Circular Hermetic Receptacles

Circular hermetically sealed environmental connectors are designed and fabricated to specialized military and commercial specifications and drawings. Primarily utilized in military/aerospace applications subjected to severe environmental conditions such as heat, humidity, vibration and shock.

- Military specifications include Mil-C-5015, Mil-C-25955, Mil-C-26482, Mil-C-26500, Mil-C-38999, Mil-C-83723, Mil-C-81703.
- Mounting styles include bulkhead mount, square flange, round flange, and weld mount.

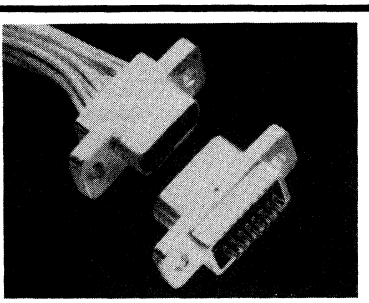


For additional information contact Connector Industries Of America, (513) 733-3680.

Microminiature D Connectors
(Qualified to Mil-C-83513)

Microminiature D Connectors (MCK series - metal shell and MCD Series - plastic shell) utilize a precision #24 AWG patented low force (5oz. max) twist pin reducing individual contact insertion forces by 33%, while maintaining all previous mechanical, electrical and environmental standards.

- 8 different insert arrangements – 9, 15, 21, 25, 31, 37, 51 and 100 contacts on .050 inch centerlines.
- Qualified to MIL-C-83513 requirements.
- Vertically and horizontally mounted transition blocks available.



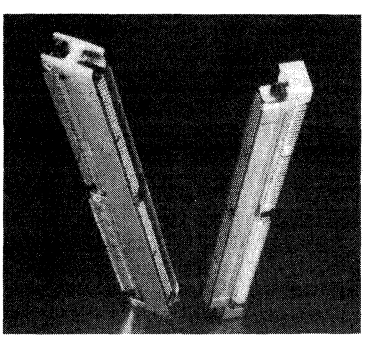
For additional information contact MALCO South Pasadena, (818) 799-9171.

High Density Military
H.D.S.M. Connectors

You know the problems . . . less board space . . . increased density . . . more and varied I/O. The Malco H.D.S.M. (High Density Standard Module) connector may be the solution now and through the 1990's.

The versatile H.D.S.M. provides a variety of contact types - signal - and coaxial and quantities - up to 304 High Rel Twist Pin contacts in 4 rows on .050" centers! Modular inserts allow the designer to specify a combination of contact types within the standard .360 x 4.600 shell.

The H.D.S.M. can be mounted on .500 centers. It is designed for either surface mounting or plated-through-hole mounting. Other termination options are available.



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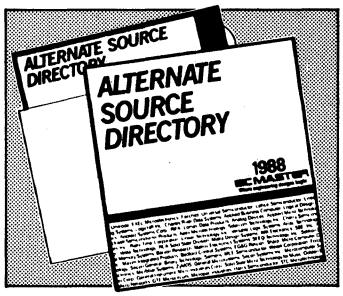

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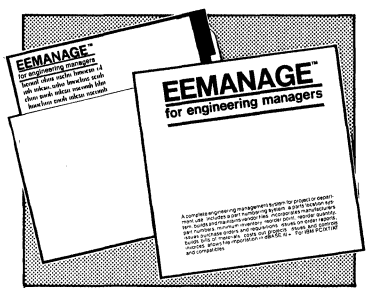

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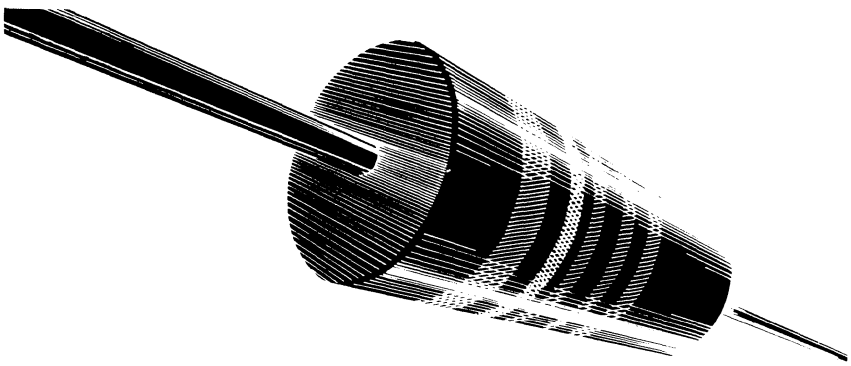
Nytronics Inductors



HI-REL . . .
Nytronics Inductors are fully qualified to the established reliability spec MIL-C-39010 in styles /1 through /10. But, Nytronics Inductors also meet the requirements of a **higher authority!** They are widely used in heart pacers to provide RF protection. . . . It's a life or death matter. . . . Literally.

AVAILABILITY . . .
Off-the-shelf from a distributor near you.

NCG part number. The military part number shall consist of the letter "M", the basic document number, and an assigned dash number as shown in the following:

M	39010/02	A	1R0	K	S
Military designator	Document sheet number	Class	Inductance	Inductance tolerance	Failure rate level

Class. The classes of coils denoting the maximum operating temperatures are identified by a single letter in accordance with MIL-C-39010 slash sheets.

Maximum operating temperature

Class	Temperature
A ------	105°C
B ------	125°C

UPDATE

UNITS HOURS: 579, 703, 590
Date: 6-30-88

New High Reliability Qualification	
MIL-C-39010-1	MIL-C-39010-6
MIL-C-39010-2	MIL-C-39010-7
MIL-C-39010-3	MIL-C-39010-8
MIL-C-39010-4	MIL-C-39010-9
MIL-C-39010-5	MIL-C-39010-10

BROAD LINE . . .

There's a Nytronics Inductor to meet every need from 0.10uH to 180kuH.

With sizes ranging from the world's smallest shielded inductor to the most complex variable inductor . . . shielded, unshielded and variable, in hundreds of off-the-shelf values . . . it makes good sense to check first with Nytronics or your local distributor.

FIXED SHIELDED INDUCTORS
Super Wee Ductor
MS75087, MS75088, MS75089
MS90537
Super Wee Wee Ductor MS21399-21401
Wee Ductor
Wee Wee Ductor
Pee Wee Ductor
Pee Cee Ductor
SDD

FIXED NON-SHIELDED INDUCTORS
Deci Ductor
Mili Ductor
MS75083, MS75084, MS75085
RFC-SS MS18130, MS14046, MS90538
RFC-S MS21389, MS21390
MS75008, MS75101, MS90539
RFC-M MS21388
RFC-L MS21380
Pee Dee Ductor

VARIABLE INDUCTORS
Wee V-L (Shielded) MS21381, MS21402
H Wee V-L (Shielded) MS21381, MS21402
VIV (Non-Shielded)
VIH (Non-Shielded)
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(803) 393-5421 — TWX 810-665-2182

SI UNITS

RELATIVE QUANTITY SYMBOLS

$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2} or mg

Technitrol

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Telephone (215) 426-9105 • Telex 834245
FAX (215) 426-2836

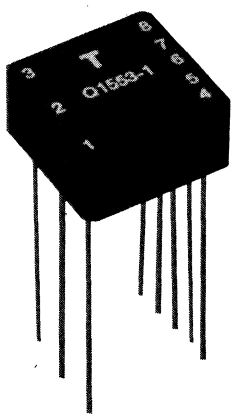
MIL-T-21038/27/MIL STD 1553B INTERFACE TRANSFORMERS

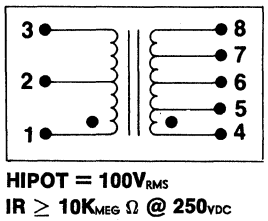
SUMMARY SPECIFICATIONS

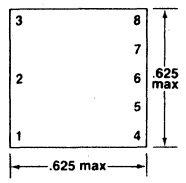
Droop ..... ≤ 20%
Impedance ≥ 3KΩ ..... −55° to +130°C
Overshoot ..... ± 1 V Peak max
Common Mode Rejection (CMR) ..... ≥ 45db
Frequency Range—No Load ..... 75 KHz to 1 MHz

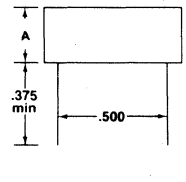
NOW AVAILABLE AS QPL STANDARD 21038/27 FOR USE IN MIL STD 1553B APPLICATIONS

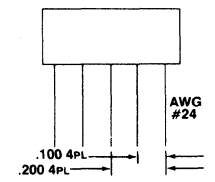
WIDE RANGE OF MIL-SPEC SURFACE MOUNT COMPONENTS AVAILABLE
(See page A-1628. For complete information, call or write for Catalog No. 1002SM.)





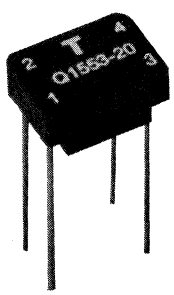


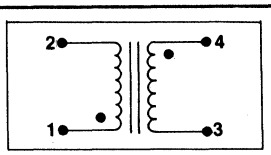


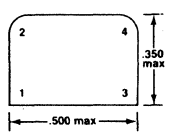


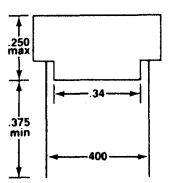
HIPOT = 100V_{RMS}
IR ≥ 10K_{MEG} Ω @ 250V_{DC}

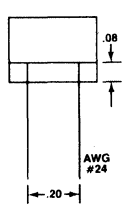
MIL-T-	PART NO.	TURNS RATIO	PRI-MARY	SECOND-ARY	% DROOP	CMR (Typical)	"A" (Max.)
21038/27-01	Q1553-1	1CT : 1CT ±3% 1CT : .707CT ±3%	1-3 1-3	4-8 5-7	4	51dB	.300
21038/27-02	Q1553-2	1.4CT : 1CT ±3% 2CT : 1CT ±3%	1-3 1-3	4-8 5-7	4	49dB	.250
21038/27-03	Q1553-3	1.25CT : 1CT ±3% 1.66CT : 1CT ±3%	1-3 1-3	4-8 5-7	8	48dB	.250
21038/27-04	Q1553-4	2.3CT : 1CT ±3% 3.2CT : 1CT ±3%	4-8 5-7	1-3 1-3	12	50dB	.300
21038/27-05	Q1553-5	2.12CT : 1CT 1.5CT : 1CT	4-8 5-7	1-3 1-3	20 Max.	45dB	.250





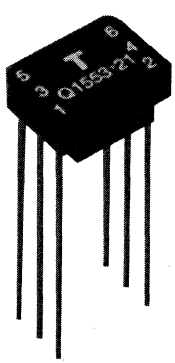


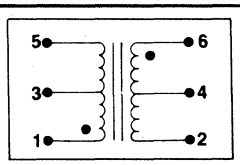


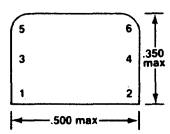


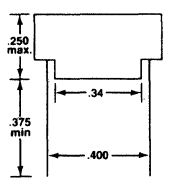
HIPOT = 100V_{RMS}
IR ≥ 10K_{MEG} Ω @ 250V_{DC}

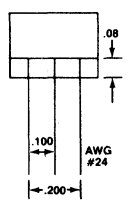
MIL-T-	PART NO.	TURNS RATIO	PRIMARY	SECONDARY	% DROOP	CMR (Typical)
21038/27-05	Q1553-20	1 : 1.41 ±3%	1-2	3-4	10	50dB











HIPOT = 100V_{RMS}
IR ≥ 10K_{MEG} Ω @ 250V_{DC}

MIL-T-	PART NO.	TURNS RATIO	PRIMARY	SECONDARY	% DROOP	CMR (Typical)
21038/27-06	Q1553-21	1CT : 1CT ±3%	1-5	2-6	10	50dB
21038/27-07	Q1553-22	1CT : 1.41CT ±3%	1-5	2-6	6	50dB
21038/27-08	Q1553-23	1CT : 1.66CT ±3%	1-5	2-6	12	52dB
21038/27-09	Q1553-24	1CT : 2CT ±3%	1-5	2-6	12	50dB

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types• transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol

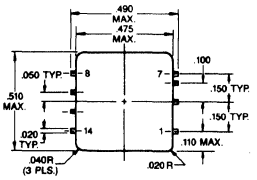
1952 East Allegheny Avenue
Philadelphia, PA 19134
Telephone (215) 426-9105 • Telex 834245
FAX (215) 426-2836

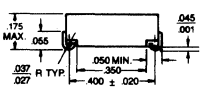
MILITARY HI-RELIABLITY DELAY LINES

FOR MORE DETAILS SEE OUR PAGES A-1620–A-1628 OR CONTACT FACTORY FOR COMPLETE DELAY LINE CATALOG NO. 1001A, OR FOR SURFACE-MOUNT, CATALOG NO. 1002SM.

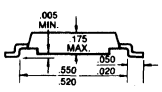
Technitrol Delay Lines have been selected by many military programs because they are unmatched in performance and reliability. Designed primarily for high-performance applications, the STTLDL has high output stability over a wide range of temperature and input-voltage variations.

ACTIVE CHIP CARRIER



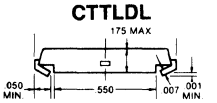


BJTTLDL

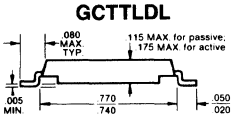


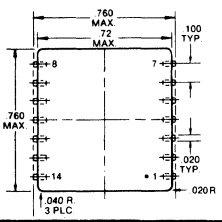
GBTTLDL

CTTLDL

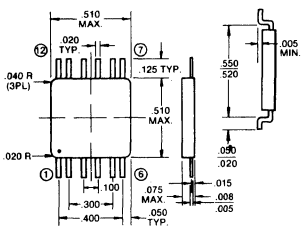


GCTTLDL

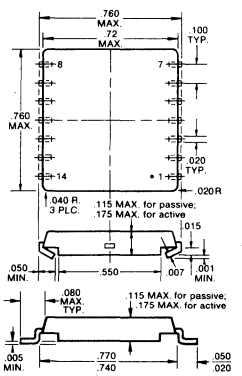




PASSIVE CHIP CARRIER

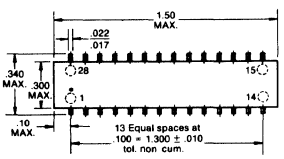


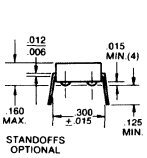
BF10

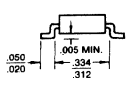


CF10

20 TAP

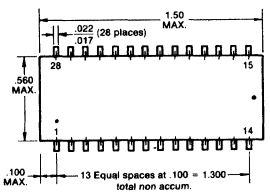


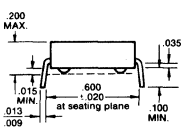




LF20

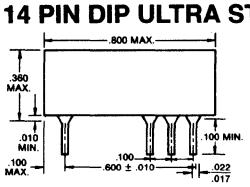
20 TAP UP TO 2μs

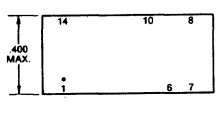


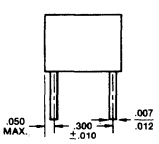


LF20

14 PIN DIP ULTRA STABLE 1% DELAY VARIANCE

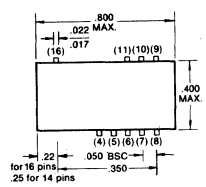


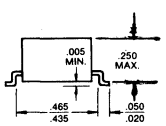




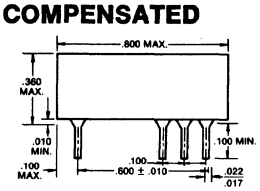
STTLDL

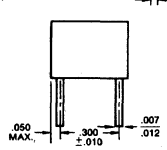
TTL PROGRAMMABLE



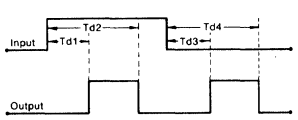


PULSE WIDTH REG. TEMP. & VOLTAGE COMPENSATED

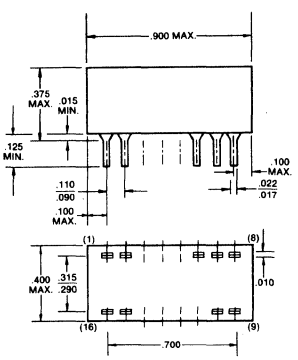




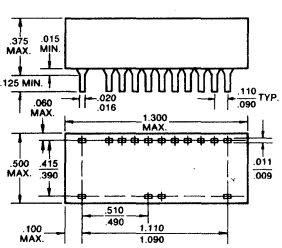
DELAYED PULSE WIDTH REGULATOR



10K ECL/PROG.



100K ECL/ PROG.



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Technitrol

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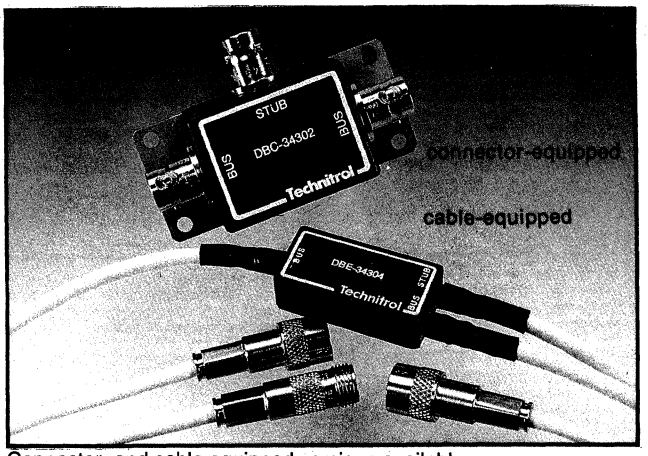
MIL-STD-1553B DATA BUS COUPLERS

All Technitrol data bus couplers incorporate QPL transformers and meet all the requirements of Mil-Std-1553B.



Connector- and cable-equipped versions available.

Summary Specifications

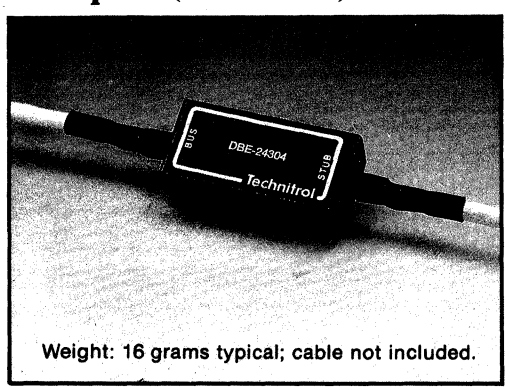
Droop	≤ 20%
Impedance ≥ 3KΩ	−55° to +130°C
Overshoot	± 1 V Peak max
Common Mode Rejection (CMR)	≥ 45db
Frequency Range—No Load	75 KHz to 1 MHz

For complete 1553B transformer and coupler information, call or write for Catalog No. 2001A.

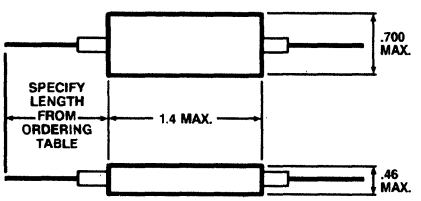
Cable-Equipped Couplers:

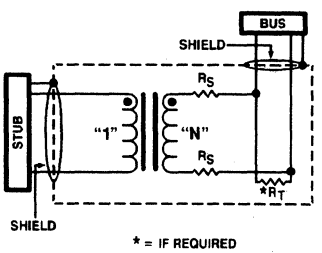
- Use QPL coupling transformers.
- Industry's smallest and lightest bus couplers.
- EMI and EMP shielding standard.
- Allow direct installation in cable runs and wire-bundle mounting.
- Permit decreased stub lengths.
- Supplied with flying leads of specifiable length and shielding.
- Cable terminations with contacts or cable-end connectors available.
- Immersion protection available, compliant with Mil-Std-810.
- Provide high installation-positioning flexibility.

Two port: (one bus/one stub)

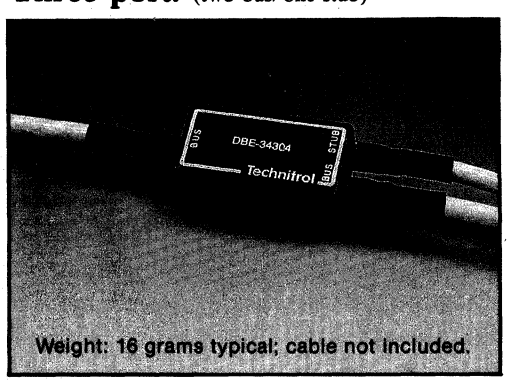


Weight: 16 grams typical; cable not included.

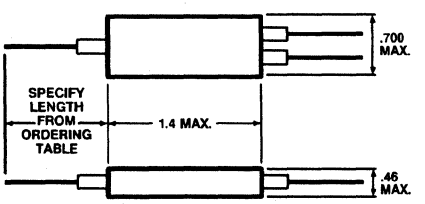


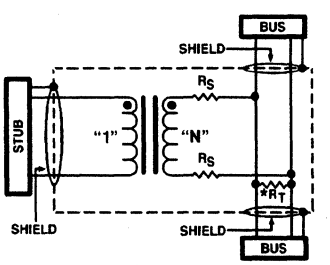


Three-port: (two bus/one stub)



Weight: 16 grams typical; cable not included.





Dimensions provided in inches.

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types• transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse, and MIL-variable types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

Technitrol Mil-Spec delay lines, bus couplers, and transformers. They perform to spec.

Technitrol military-grade components do what they're supposed to — meet the specifications required, are tested for full compliance, and are shipped with our outstanding reputation behind them. Compare our randomly picked samples with others. You'll see how Technitrol stacks up.

Active delay modules and passive delay lines

- Ultra-stable delay modules for TTL, Schottky TTL, FAST, and low-power Schottky TTL circuits. ±1% repeatability over −55 to +125°C at rated voltage input ±10%. Such outstanding stability available only from Technitrol.
- 5 to 500 ns delays.
- Several high-performance TTL and ECL modules with −55 to +125°C temperature range.
- Programmable modules available.
- J-lead, gull wing, and flat-pack.
- High-performance passive delay lines.
- **Now — QPL to Mil-Std-790 for Established Reliability!**

Mil-Std-21038/27 Mil-Std-1553 data-bus interface transformers

- Meet Mil-Std-1553B.
- Meet MAC Air specifications A3818, A5690, A5232, and A4905.
- Surface-mount and flat-pack available.
- Wide selection of standard models.
- Custom designs.

Mil-Std-1553 data-bus couplers

- Single- and dual-stub-terminal models.
- Single- and dual-bus-terminal models.
- Use of our Mil-Std-1553 interface transformers within the couplers provides a large choice of coupling characteristics.

MIL-T-21038 pulse transformers

- Grades 5 or 7, Class S, life expectancy X.
- Surface-mount and flat-pack available.
- Wide selection of standard models.
- Custom designs.

MIL-T-27 transformers, Grades 4, 5, and 6

- Scott T.
- High-voltage.
- High-voltage pulse.
- 400 Hz.
- Voltage-regulating/ferroresonant.
- Custom, to your specifications.

Technitrol

1952 East Allegheny Avenue
Philadelphia, PA 19134 USA
Telephone (215) 426-9105
Telex 834245
Fax (215) 426-2836

Technitrol products: Manchester encoder/decoders • pulse transformers • data bus couplers • pulse-width regulators • delay lines including digital, fixed-constant-distributed, fixed-lumped-constant, programmable, and trimmer types • transformers including audio, autotransformer, chopper, constant-voltage, dc-to-dc-conversion, decade, differential, discriminator, driver, ferroresonant, filament, 400 Hz, high-voltage, input, instrument, interstage, inverter, isolation, magnetic-amplifier, matching, microminiature, microphone, mixing, modulation, output, plate, power, pc-mounting, pulse, rf, rectifier, reference, Scott T, servo, synchro-control, telephone-coupling, toroidal, transistor, voltage-dividing, voltage-regulating, voltage-stabilizing, wideband, MIL-audio, MIL-power, MIL-rf, and MIL-pulse types • saturable reactors • filter reactors • square-wave oscillators • magnetic amplifiers • coils including foil-wound, high-Q/low frequency, toroidal, and transformer types.

See our Delay Lines Pages Vol. A
Contact factory for full catalogs

RTS SYSTEMS
INCORPORATED

CONFERENCE-LINE INTERCOMMUNICATIONS

TW Intercom System

A high performance two-wire conference-line (party-line) intercommunication system designed for use in broadcast, teleproduction, aerospace operations, and industrial applications.

User Stations

- Eight different packages available
- Headset and headset/speaker stations available
- Each station (10,000 ohms) bridges the line (200 ohms)
- Up to 75 units on a line without loading
- Two channels on three-conductor cable
- Full-duplex operation: simultaneous talk and listen to and from each station
- Powerful headphone amplification
- Dynamic and/or carbon headset capability
- Mic-level limiting
- 12-volt power operation capability
- Many options available

Power Supplies

- PS8 powers 12 user stations
  Two channels – one dry channel at 200 ohms audio impedance – one powered channel at 32 volts at 200 ohms audio impedance
- PS31 powers 30 headset user stations
  Three powered channels at 32 volts at 200 ohms audio impedance

System Interface Units

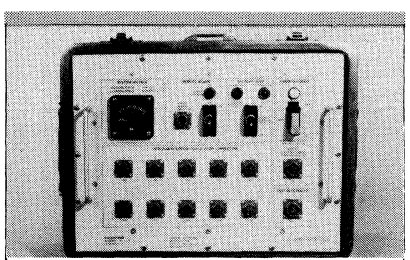
- Interface between two-wire, three-wire, and four-wire lines
- Works with virtually any impedance, level, or type of line

Special Designs

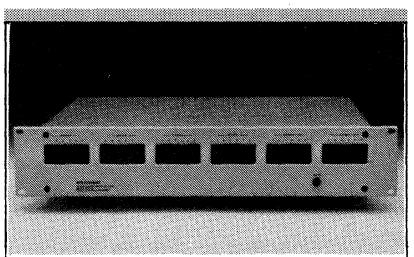
- A number of standard products are available for special applications including station-isolate, source assignment, retrofit user stations, multiple channels, etc.
- Modified standard product and custom products available to customer specifications

RTS SYSTEMS
INCORPORATED

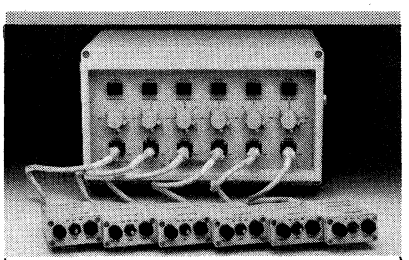
INTRINSICALLY SAFE / MULTI-CHANNEL GROUND SUPPORT INTERCOMMUNICATIONS



ICS 100A Central Electronics



TCC100 Test Control Electronics



MPS100 Nose Pit Switch Box | HCU265 Headset Station

Fuel Tank Entry Intercom System

Self-standing battery-backed I/C system intended for use with up to 10 ground support personnel; normally, 5 outside and 5 inside fuel tank. (System includes externally controllable alarm tone.) Applications include military and commercial aircraft fuel tank entry and ground support intercommunications. Custom product and systems available to meet customer specifications.

Non-Hazardous Area Intercom Systems

Conventional multi-station, multi-channel and single-channel I/C Systems for use in:

- simulators
- test flight operations
- ground test firing ranges
- mobile communications centers
- trainers
- aircraft assembly and test
- satellite tracking operations

Hazardous Area Intercom Systems

Portable and permanent installation ground support I/C equipment for checking out systems on fueled aircraft:

- Manufacturing support equipment for aircraft assembly
- Preliminary checkout and test
- Ramp operations – final checkout (typically interfaced with conventional non-hazardous I/C system)

RTS SYSTEMS ▫ 1100 W. Chestnut St. ▫ Burbank, CA 91506 ▫ (818) 840-7119 ▫ Telex 194855 ▫ TWX 910-498-4987 ▫ Fax (818) 843-7953

F SERIES
MILITARY CONNECTOR

HISTORY AND FACILITIES

Texas Instruments Connector Systems Department, an established vendor of high performance two piece printer circuit connectors, had serviced the MIL-C-55302 connector industry from the main Attleboro, Massachusetts site until 1979. At that time the new Mansfield facility was acquired and is set in one of the northeast's major new business complexes.

F SERIES PRODUCTS

10-70 Position (2 Rows)
- Straight plugs
- Right angle plugs
- Straight receptacles
- Right angle receptacles
- 15 sizes available

50-160 Position (3 Row)
- Straight receptacles
- Right angle plugs
- 7 sizes available

90, 100, 120 Position (2 Row)
- Straight receptacles
- Right angle plug
- 3 sizes available

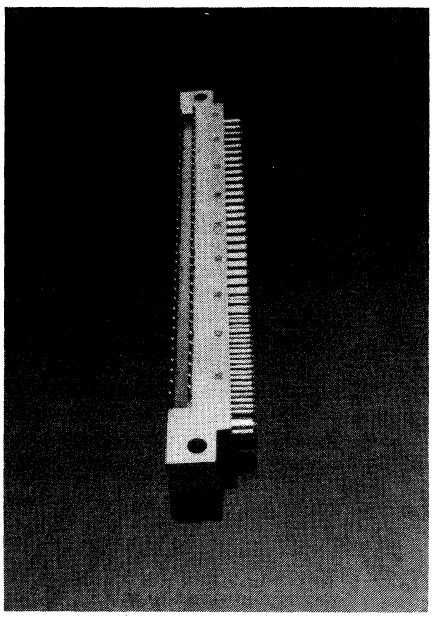
Speciality Connectors
- Single row (3-22 positions)
- Crimp pin and socket (10-70)
- 114 pin platform
- Quarter round series
- Others

(All connectors available with and without mounting ears)

AVAILABLE FEATURES

All connectors produced to MIL-C-55302 requirements.
- A variety of low and standard insertion force gold plated contacts are available.
- Available in diallyl phthalate or Ryton R4 molded body insulators.
- Hardware available in either stainless steel or a mil-approved alloy alternative.
- All connectors may be selectively loaded.
- Combinations of various styles, materials and sizes total in the millions.

The wide selection of body styles, contact designs, and assembly hardware available in this connector line means custom connectors designed to meet the needs of many applications.



APPLICATIONS

There is a wide range of possible electronic applications for TI Military connectors:
- Civic and Military Avionics Equipment
- Military Weaponry/Electronics
- Communications – Airborn and Ground Based
- Data Processing
- Missiles
- Aerospace Electronics
- Instrumentation
- Ground Support Equipment
- Radar Electronics

For further information write or call:
Texas Instruments Incorporated
Connector Product Marketing, MS 14-3
Attleboro, Massachusetts 02703
Tel: (508) 699-3800, Ext. 5234, 5370, 5338, 5242

TI invented the integrated circuit microprocessor, and the microcomputer which have made TI synonymous with reliability, affordability and compactness. The F Series Connectors carry on TI's tradition of technology leadership.

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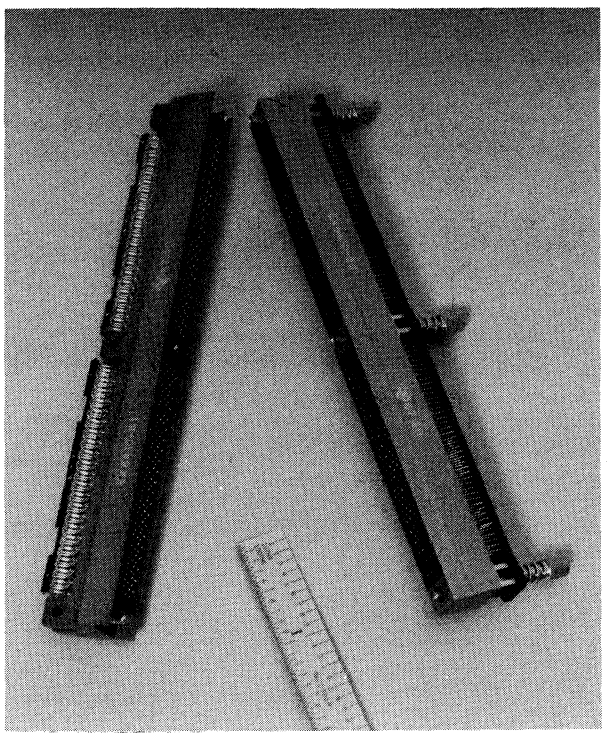
TEXAS INSTRUMENTS
34 Forest Street • Attleboro, Massachusetts 02703

UHD, ULTRA HIGH DENSITY TWO-PIECE, SMT, MILITARY CONNECTOR

More programs have begun to use surface mount packaging techniques in order to save space and weight. The choice of connectors available to implement these designs is limited.

A major effort in the connector industry has been to develop a connector for the 3/4 ATR (size 6) line replaceable module (LRM). TI's Micro Electronics Packaging Department of the Defense Systems and Electronics Group and TI's Connector Systems Department have jointly developed the UHD family of surface mount connectors for LRM applications. The UHD connector is sized for the 3/4 ATR card. Optimum sizing provides a maximum of 344 contacts. The basic connector is of molded construction and is adaptable to fiber optic or coax contacts. It is designed to provide minimum card spacing where pin shielding is not required. A metal shell version is available. The uniquely designed motherboard (receptacle) connector utilizes an integral termination "organizer" and provides for plus or minus .020" lateral float with minimum force during the thermal clamping cycle. This insures intimate surface contact at the chassis to card thermal interface. Limited UHD production and preliminary specifications are now available. DESC drawings are now being initiated. Second sources are being secured at this time. The connector is available in half-length sizes with 172, 128, or 84 pins and full length sizes with 344, 256, or 168 pins.



DESIGN FEATURES:

3 Amp current rating
Maximum of 344 high reliability screw machine contacts
Selective loading for optimum flexibility
2 oz. average mating force contacts
Full and half size versions
Stackable on .400 inch centers
Designed to meet Mil-C-55302 requirements
Standard Mil-C-55302 hardware for 1000 keying positions
Surface mount daughtercard with alignment tooling availability
Thru hole motherboard mounting with integral lead organizer
High performance Ryton insulator material
Compatible with vapor phase reflow (+ 230°C)
.020" lateral adjustment capability

ADDITIONAL FEATURES

Metal shells
Interfacial seal
Fiber optics
Coax contacts

For more information about this family of connectors, contact:
Texas Instruments Incorporated
CSD Marketing, MS 14-3
Attleboro, Massachusetts 02703
Tel: (508) 699-3800, Ext. 5234, 5370, 5338, 5242

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TEXAS INSTRUMENTS
34 Forest Street • Attleboro, Massachusetts 02703

TWO-PIECE MILITARY CONNECTOR PRODUCTS .075″ CENTERLINE × .0375″ OFFSET STRAIGHT AND RIGHT ANGLE PLUGS, STRAIGHT RECEPTACLES

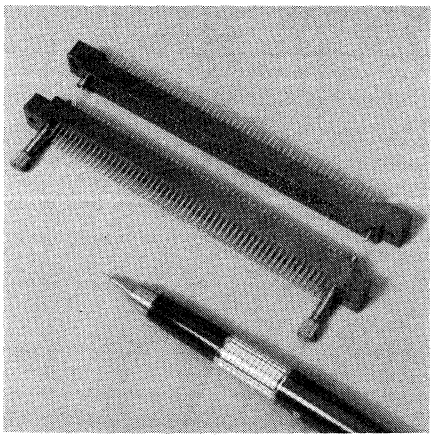
An increasing number of new programs are being designed which exceed the traditional .100℄ MIL-C-55302 product offerings. Also, mature programs are being redesigned which will require increased I/O capability in the same or less available space.

In order to meet the needs of today's designer, Texas Instruments has begun introduction of a new .075″ centerline military connector series.

The wide selection of body styles, contact designs, assembly hardware, selective loading, and special variations available provides maximum flexibility.

The MIL-C-55302 qualification has begun and slash sheet approval is expected during 1989.

Samples and specifications are available now!



DESIGN FEATURES

A. Materials and Finishes:
1. Contact area:
   a. Beryllium copper per QQ-C-530, base material
   b. Gold plate, 50 microinch minimum, per MIL-G-45204 – Type II, Grade C, Class I, over nickel in contact engagement area, 20 microinch min. on termination. Selective plating options available.
2. Insulator: Polyphenylene sulfide molding compound – per MIL-C-55302
3. Hardware: Stainless steel or non-corroding alloy per MIL-C-55302

B. Performance:
1. Contact rating: 3 AMPERE
2. Test Voltage:
   700 Vrms 60Hz at sea level
   200 Vrms 60Hz at 70,000 ft. altitude
3. Oversize pin exclusion: .034 diameter test pin
4. Insulation Resistance: 4000 Megaohms min. at 500 VDC
5. Durability: 500 mating – unmating cycles
6. Contact Resistance: .010 ohms max. avg., .020 ohms individual max.
7. Insertion/withdrawal forces for socket contacts: 2.0 ounce typical insertion force; 0.5 ounce minimum withdrawal

For more information contact:
Texas Instruments Incorporated
CSD Marketing, MS14-3
Attleboro, Massachusetts 02703
Tel: (508) 699-3800, Ext. 5234, 5370, 5338, 5242

PART NUMBER SYSTEM

80 pos. Recept. 80 pos. R/A plug 80 pos. St. plug	3 Row – .075″℄	AAA 080 XXXX XXXX A00 AAB 080 XXXX XXXX A00 AAC 080 XXXX XXXX A00
100 pos. Recept. 100 pos. R/A plug 100 pos. St. plug	2 Row – .075″℄	AAD 100 XXXX XXXX A00 AAE 100 XXXX XXXX A00 AAF 100 XXXX XXXX A00
122 pos. Recept. 122 pos. R/A plug 122 pos. St. plug	3 Row – .075″℄	AAA 122 XXXX XXXX A00 AAB 122 XXXX XXXX A00 AAC 122 XXXX XXXX A00
152 pos. Recept. 152 pos. R/A plug 152 pos. St. plug	3 Row – .075″℄	AAA 152 XXXX XXXX A00 AAB 152 XXXX XXXX A00 AAC 152 XXXX XXXX A00
206 pos. Recept. 206 pos. R/A plug 206 pos. St. plug	3 Row – .075″℄	AAA 206 XXXX XXXX A00 AAB 206 XXXX XXXX A00 AAC 206 XXXX XXXX A00
210 pos. Recept. 210 pos. R/A plug 210 pos. St. plug	4 Row – .075″℄	AAH 210 XXXX XXXX A00 AAJ 210 XXXX XXXX A00 AAK 210 XXXX XXXX A00

Special Variation Number

Hardware Code

	2 Row/3 Row	4 Row
Guide Set	A003	A006
Fixed Jack Set	A010	A005
Turning Jack Set – .490″ length – slotted screw	A001	A008
Turning Jack Set – .700″ length – slotted screw	A011	A004

Contact Type Code

Length	Straight Receptacle		Right Angle Plug			Straight Plug	
	2 Row/3 Row	4 Row	2 Row	3 Row	4 Row	2 Row/3 Row	4 Row
.109″	A001	A024	A017	A005	A028	A008	A031
.140″	A002	A025	A018	A006	A029	A009	A032
.172″	A003	A026	A019	A007	A030	A010	A033
Solder Cup	A004	A016	—	—	—	A011	A022

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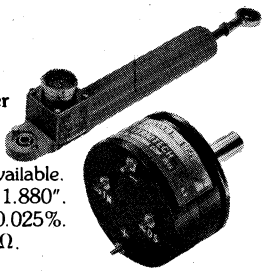
TEXAS INSTRUMENTS
34 Forest Street • Attleboro, Massachusetts 02703

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

POTENTIOMETERS



employing Vernitech's unique conductive film and precious metal wipers...respond to wiper motions as small as .000005"

Rotary Single Turn
Linear, non-linear, sine/cosine available.
Sizes 0.5", L 0.5" to Dia 5.0", L 1.880".
Linearity or conformity ±2% to 0.025%.
Resistance range 1KΩ to −250KΩ.

Rotary Multi-Turn
10 to 100 turns available.
Sizes Dia 0.5", L 1.5" to Dia 2.0", L 2.625".
Linearity or conformity ±0.5% to 0.015%.
Resistance range 1KΩ to 500KΩ.

Linear Motion
Electrical stroke lengths 1" to 60".
Linearity or conformity ±0.2% to 0.01%.
Resistance range 250Ω/in to 250KΩ/in.

CLUTCHES AND BRAKES

(electromagnetic)
hundreds of models and sizes available from stock.

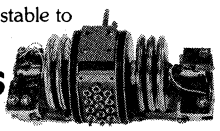
Precision Instrument Type
Sizes 5, 8, 11, 13, 15, and 18.
Standard length and wafer types. Spring and magnetic.
Meet MIL-E-5272C. Zero backlash.
Torque 5 to 150 oz. in. Response time 5 to 142 ms.

Industrial Types — open frame
Sizes 8, 12, 17, 22, 26. Torque to 75 in. lb.
Response time 6-30 ms at rated voltage.

Industrial Types — enclosed frame
Hybrid or special units designed for particular applications when MIL-SPECS and close tolerances are not essential, but where having a complete "self-contained" unit is desirable: cassette tape decks, analog devices actuators, etc.

Fail Safe
Braking action occurs 10 ms after coil is de-energized or power fails. Sizes 8, 17, 30, and 45.
Torque up to 50 in. lb. Zero backlash. Adjustable to compensate for wear.

PRESSURE TRANSDUCERS



potentiometer type,

featuring infinite resolution, long life, and high reliability through the use of conductive film resistance elements, multiple wipers, and direct coupling of pressure sensing element to potentiometer wipers.

Pressure ranges from 0.1 to 10,000 psi in gage, absolute and differential types.
Linearity to ±0.3%. Air speed, altitude and low cost types available.

MOTORS

Over 1500 Standard Designs or Custom Designed to your requirements.

Synchronous — for laser scanning
Sizes 5, 8, 11, 15, 18, 20, 25, 35.
Speeds 100 to 48,000 rpm.
5 through 1600 Hz. 2, 4, 8, 12 poles.

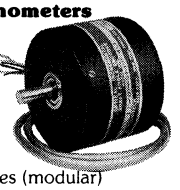
Servo
Viscous damped — sizes 8, 10, 11, 15, 18.
Speeds 3000 to 10,000 rpm.
Inertially damped — sizes 8, 11, 15, 18.
Speeds 3000 to 9500 rpm.

Stepper
Sizes 5, 8, 11, 15. Stepping angles 7.5°, 15°, 45°, 90°.
Stepping rates 100, 110, 125, 130, 175, 180, 225, 240, 260, 400, 725, 800, 1000 pps.

Precision Motor Generators Sizes 8, 10, 11, 15, 18, 23.

Integrating and Computer Motor Tachometers
Sizes 8, 10, 11, 15, 18, 23.

SHAFT ANGLE ENCODERS



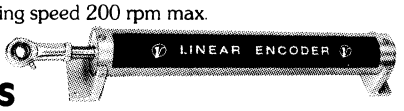
featuring precision chrome on glass discs for highest accuracy.

Optical Incremental
VOE 005 — Dia. 0.500", 0.550" L. To 256 pulses (modular)
VOE 05 — Dia. 0.500", 0.85" L. To 256 pulses
VOE 11 — Dia. 1.062", L. 1.80". To 1024 pulses
VOE 015 — Dia. 1.510", L. 0.88". To 1080 pulses (modular)
VOE M15 "Dial Coder" — panel mounted, 1.500" dia., L. 1.08" 127-256 pulses
VOE 023 — Dia. 2.25", L. 80". To 1250 pulses (modular)
VOEL 023—Dia. 2.25", L. 88". To 1000 pulses (modular)
VOE 23 — Dia. 2.250", L. 1.875". To 1250 pulses (available sealed)
VOE L 23 "Thrift-Line" Dia. 2.250" L. 1.875". To 1024 pulses
VOE 25 — Dia. 2.500", L. 2.500". To 3000 pulses (available sealed)

Optical Absolute
VOE 23: Binary, Gray or BCD to 512 counts per turn.
Counting speed: 3000 rpm.
VOE 30: Single or multi-turn; Binary, Gray or BCD. To 1024 counts per turn. Max count (2^{19}) in 512 turns.
Counting Speed: 30KHz.

Contacting Absolute
Sizes 11, 18, 23, & 31. Binary, Gray, and BCD. Single or multi-turn. Max count (2^{19}) in 2048 turns. 64 to 1024 counts per turn. Operating speed 200 rpm max.

LINEAR ENCODERS



BINARY, GRAY OR B.C.D. OUTPUT CODES
1", 2", 4", 8", 12", 24", 36" and 48" STROKE LENGTHS
RESOLUTIONS TO 12 BITS. TTL COMPATIBLE OUTPUT

SYNCHRO CONVERTER MODULES

Tracking Synchro-to-Digital and Resolver-to-Digital Converters
Economy Series VSD/VRD. Precision Series VSDH/VRDH
Compact, solid state, high performance converters employing type 11 servo loops for lag free tracking at rates to 3600°/sec. Resolution 10 bits, 12 bits, or 14 bits.

Digital-to-Synchro and Digital-to-Resolver Converters Series VDS/VDR: Accept shaft angle data in digital form for conversion to analog at accuracies up to ±4' ARC.

Tracking Synchro-to-Linear DC Converter Module
Series VSDCH/VRDCH: Accept 3-wire synchro or 4-wire resolver input data, convert it to DC analog voltage proportional to synchro angle of input. Accuracy ±6' ARC (typ.).

Tracking Angle Position Indicator
VNST-104: Tracking Synchro-to-Digital Converter, can also be used as a control element. Four decade 0.8" red LED display. Display accuracy ±6' arc (typical). Tracking rate 3600°/sec max. Parallel binary or BDC output.
Self contained line operated power supply.

Custom designs available to your specifications.

Refer to sections 3500, 4750, 5500 for additional product listings.

VERNITECH
300 Marcus Blvd., Deer Park, NY 11729
516-586-5100 • TWX 510-227-6089 • FAX 516-242-7940

Quality trimmer and precision potentiometers, attenuators and custom resistive devices.

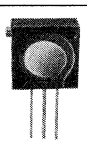
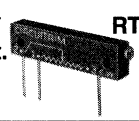
VERNITRON CORPORATION
VRN
INTERNATIONAL DIVISION

2801 72nd Street North
P.O. Box 44000
St. Petersburg, Florida 33743

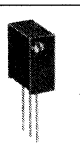
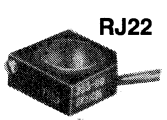
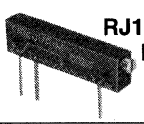
PHONE 813/347-2181 TWX 310-681-5306 TELEX 6815306 FAX 813/347-7520

VRN CIRCUITRIM® MILITARY TRIMMER POTENTIOMETERS

MIL-R-27208/MIL-R-39015* WIREWOUND TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
3/8" Square	RT24 RTR24	23	10-10K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1/2" Square 	RT22 RTR22	24	50-20K	±5%	1.0W	±50	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect. 	RT12 RTR12	22	10-20K	±5%	1.0W	±50	2 PC pin styles, flexible leads (side adjust)

MIL-R-22097/MIL-R-39035** CERMET TRIMMERS

Size	Series	No. Turns	Std. Res. (Ω)	Tol.	Pwr. Rating	Temp. Coeff.	Termination
1/4" Square	RJ50 RJR50	1	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/4" Square	RJ26 RJR26	16	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
3/8" Square 	RJ24 RJR24	24	10-1M	±10%	.5W	±100	3 PC pin styles (top & side adjust)
1/2" Square 	RJ22	24	10-1M	±10%	1.0W	±100	3 PC pin styles, flexible leads (top & side adjust)
1 1/4" Rect. 	RJ12 RJR12	22	100-1M	±10%	1.0W	±100	2 PC pin styles, flexible leads (side adjust)

*Failure rate: RTR12 & RTR22 approved to P level; RTR24 approved to R level
**Failure rate: Approved to R level
FOR COMMERCIAL EQUIVALENTS, SEE OUR LISTING IN VOL. A, SECTION 4750

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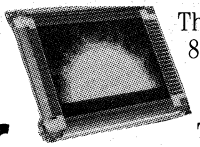

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That's because the 8050 is without a doubt the brightest, most readable display in its class.

It's the first 10-inch, AC-memory, flat panel display to deliver 640 x 400 resolution with an extraordinary 44 foot-lamberts of brightness. Along with a contrast ratio of greater than 20:1. All in a package just over one inch thick.

In fact, the only thing more impressive than these numbers is looking at the display yourself. Then you'll really appreciate its exclusive solid black background. And the brightness and flicker-free clarity of text and graphics.

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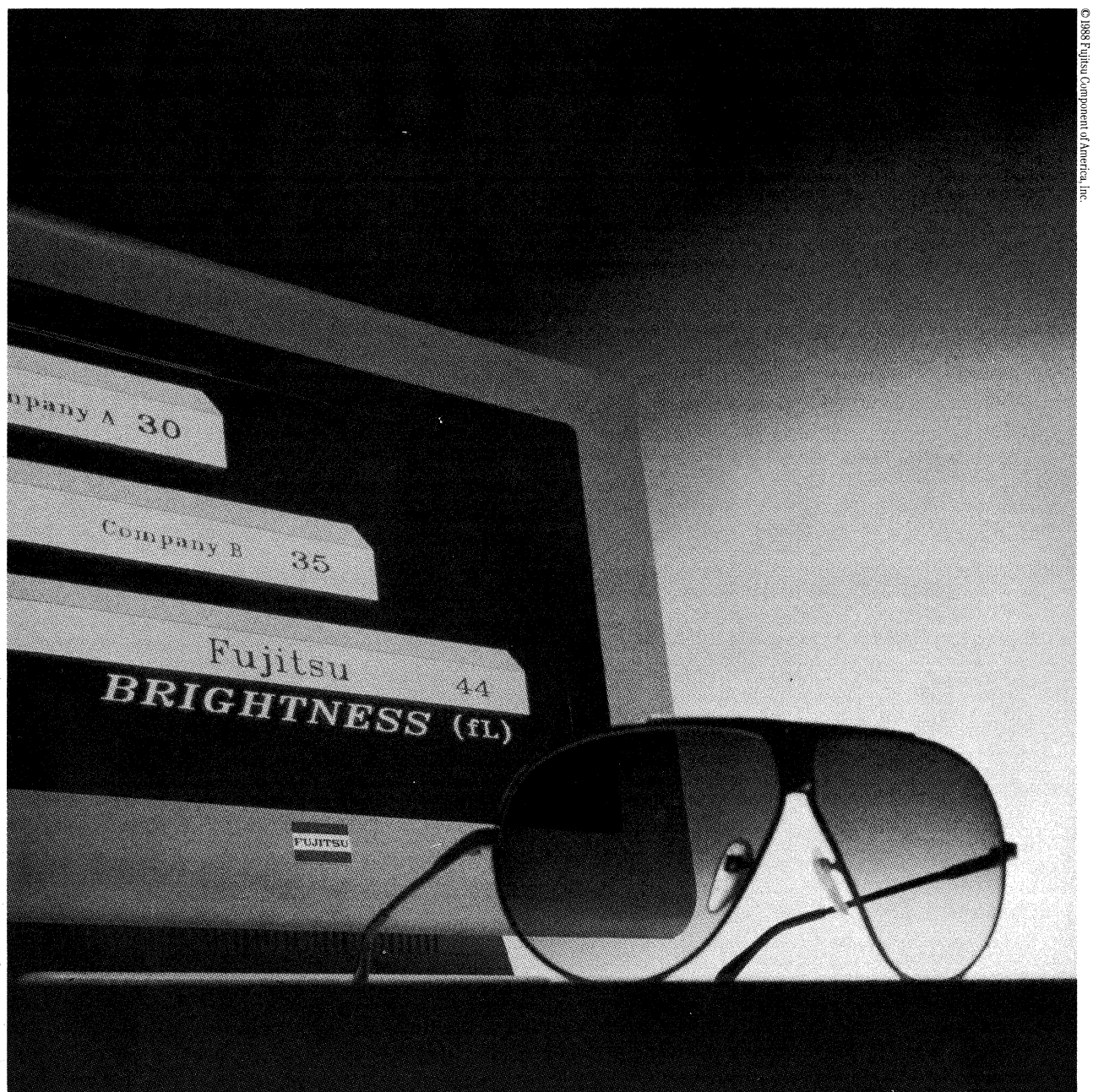

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DISPLAYS

Manufacturer	Sarting EEM Page No.	Single Character	Multi-character	Multi-line	Height			Segmented	Dot Mtrx	Graphics	Light Type						Custom Design	Panels. Back, Edge Lighted
					1/2" or less	>1/2	1 In. or more				Electro-magnetic	In-candescent	LED	LCD	Plasma/ Planar Gas Discharge	Vacuum Fluorcent		
Altair	B•1034	▫	▫	▫	▫	▫	▫	▫	▫				▫		▫			
Amperex	B•1037	▫	▫		▫	▫	▫		▫					▫			▫	
AND	B•1038	▫	▫	▫	▫	▫	▫	▫	▫	▫	▫			▫				
Applied Data	B•1041																▫	
Babcock	B•1042	▫	▫	▫	▫	▫	▫	▫	▫	▫					▫	▫		
Canyon	B•1044		▫		▫	▫	▫	▫	▫				▫		▫		▫	
Cherry	B•1045		▫	▫		▫	▫	▫	▫	▫					▫		▫	
Control Displays	B•1046											▫	▫				▫	▫
Dale	B•1047	▫	▫	▫	▫	▫	▫	▫	▫	▫					▫		▫	▫
DCI	B•1054	▫	▫	▫	▫	▫	▫	▫	▫	▫				▫			▫	
Densitron	B•1052		▫	▫	▫	▫	▫		▫	▫				▫	▫		▫	▫
Digitran/Computron	B•1055																CRT	
Dio-Rey	B•1056	▫	▫	▫		▫	▫	▫	▫			▫	▫				▫	▫
Endicott Research	B•1063																Power Supplies	
ERA/Refac	B•1067			▫					▫			▫	▫	▫			▫	▫
Excel Technology	B•1068	▫	▫		▫	▫	▫	▫		▫				▫				
Fujitsu Microelectronics	B•1070	▫	▫	▫						▫					▫			
Hamlin	B•1071	▫	▫	▫	▫	▫	▫	▫	▫					▫			▫	
Homalite	B•1072																Filters	
IDEC	B•1073						▫						▫				▫	
Industrial Electronic Engineers	B•1074		▫	▫	▫	▫	▫	▫	▫			▫	▫	▫	▫	▫		▫
Inter-Market	B•1153											▫	▫					
IVO Industries	B•1076		▫	▫	▫	▫	▫	▫	▫				▫					
Ledtronics	B•1079	▫	▫	▫	▫	▫	▫	▫	▫	▫			▫					
NEC Electronics	B•1080		▫	▫	▫	▫	▫	▫	▫						▫	▫		
NES, Inc.	B•1083	▫	▫			▫		▫					▫				▫	
Polaroid/Polarizer	B•1084																Filters	
Seiko Instruments	B•1085		▫	▫	▫	▫	▫		▫	▫				▫			▫	▫
Sharp Elctrnc./Display	B•1086								▫	▫				▫			▫	▫
Shelly Assocs.	B•1092	▫	▫	▫	▫	▫	▫	▫	▫	▫		▫	▫	▫			▫	▫
Staver	B•1093	▫					▫	▫	▫	▫	▫							
Visual Communications	B•1099																	
VL Electronics	B•1103	▫	▫	▫	▫	▫	▫	▫		▫				▫			▫	

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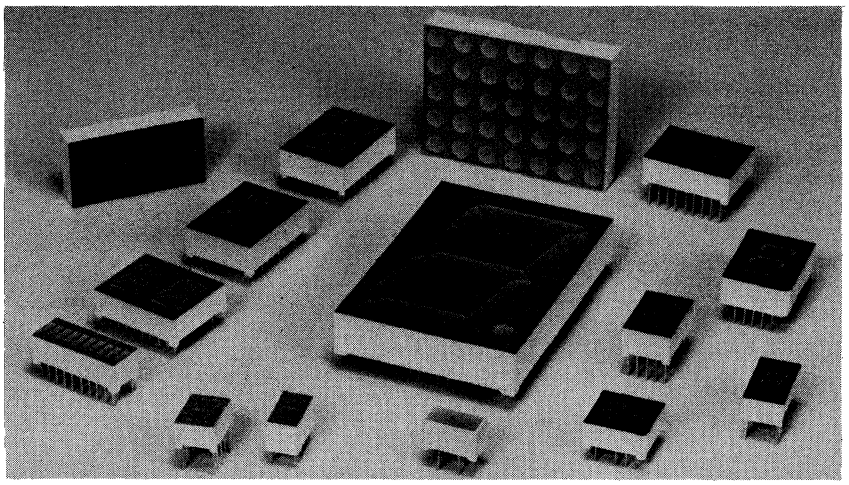
Altair Corporation offers a complete assortment of Numeric and Alphanumeric LED Displays compatible with most major manufacturers. All units are available in High Efficiency Red, Standard Red (GaAsp or Gap), Green, Yellow, and Orange. The light output of each unit is measured and bin categorized so that each shipment or lot will not contain units extremely high or low in brightness for consistent and even product. All units shown are completely epoxy encapsulated and offer clear, bold segments for maximum light output. Call for more information on pinouts or complete specifications. We believe you will be completely satisfied with the quality/price performance of these products.



Part Numbering System

Example: LDA043H09H = Common Anode .43″ HI-EFF. Red 7-Segment Display, HP Pin Compatible

LDX——
- C = Common Cathode
- A = Common Anode
- J = Dot Matrix
- L = Bar Graph Array
- B = Light Bar

X
X —— Digit Height
X
X —— Emitted Color
X —— Package Style and Definition
X —— Pin Compatibility Code

TYPICAL OPERATING SPECIFICATIONS (Ta = 25°C)

Emitted Color	V_F(V) I_F = 10mA Typ.	V_F(V) I_F = 10mA Max.	V_R Min.(V) I_R = 100μA	λ_P(nm)	P_D (mW)	I_V(μcd) @ 10mA Min.	I_V(μcd) @ 10mA Typ.	I_F(mA) Max.	Operation and Storage Temperature
Red (GaAsP)	1.7	2.0	3.0	655	50	260	550	30	
Green	2.2	3.0	5.0	567	60	640	1320	30	−40°C
Yellow	2.1	3.0	5.0	585	60	600	1250	30	~
Orange	2.1	3.0	5.0	635	60	670	1400	30	+85°C
Red (GaP)	2.0	3.0	5.0	700	60	420	870	30	
Hi-Eff. Red	2.1	3.0	5.0	635	60	670	1400	30	

Emitted Colors	
R	Red (GaAsP)
G	Green
Y	Yellow
E	Orange
P	Red (GaP)
H	Hi-Eff. Red

Pin Compatibility Codes	
G	General Instrument
H	Hewlett Packard
T	Texas Instrument
L	Siemens Litronix
R	Refac
I	IEE
F	Fairchild
S	Sanyo
A	Toshiba
N	New Product

7 SEGMENT — SINGLE DIGIT MODELS

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
.30″	01	T, H	TIL3XXX Series, HP5082-7XXX Series
.30″	03, 04	G	MAN3XXX Series
.36″	06	F	FND3XX Series
.39″	07	L	HD11XX Series
.40″	08	G	MAN4XXX Series
.43″	09	H	HP5082-7XXX Series
.50″	11	T	TIL3XX Series
.56″	13	G	MAN6XXX Series
.60″	14	S, A	SLX16X Series, TLX30X Series
.63″	15	I	LR18XX Series
.80″	17	H	HDSP-XXXX Series
.80″	45	G	Man 84XXX Series
1.02″	19	I	LR17XX Series
2.30″	38	N	NEW 2.3 inch

7 SEGMENT — MULTI DIGIT MODELS

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
.30″	21	A	TLR32X Series (Dual Digit)
.40″	22	A	TLR32X Series (Dual Digit)
.50″	23	L	DL72X Series (Dual Digit)
.50″	25	N	New 1½ Digit
.56″	26	G	Man6XXX (Dual Digit)
.56″	27	G	Man 6XXX (1½ Digit)
.56″	41	N	3 Digit
.56″	42	N	4 Digit

SEGMENTED ALPHANUMERIC — SINGLE AND DUAL DIGIT MODELS

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
.39″	28	L	HD14101X Series (14 Seg.)
.54″	30	I	LR378X Series (Dual Digit 14 Seg.)
.80″	29	R	16 Seg.

DOT MATRIX ALPHANUMERIC — 5 x 7, 5 x 8, 8 x 8 MODELS

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
.30″	31	I	LR1704X Series (5X7)
.70″	32	I	LR7057X Series (5X7)
1.16″	33	I	LR1257X Series (5X7)
1.20″	40	N	New (8X8)
2.0″	34	I	LR2057X Series (5 x 7)
2.3″	35	N	New (8 x 8)
2.4″	36	N	New (5 x 8)

10 BAR GRAPH ARRAY

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
0.2″	39	G, H	MV5X164 Series, HDSP48XX Series (0.07″ x 0.2″)

LIGHT BAR

Char. Ht. (In.)	Pkg. Style	Pin Compatibles	Compatible Series
.50″	43	G	MV5X173 (.25″ x .5″)

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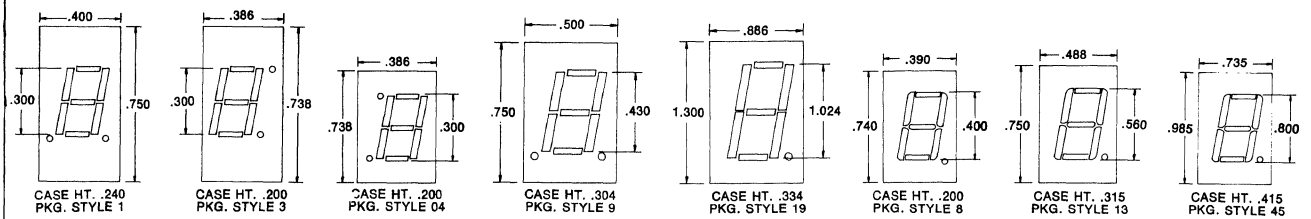
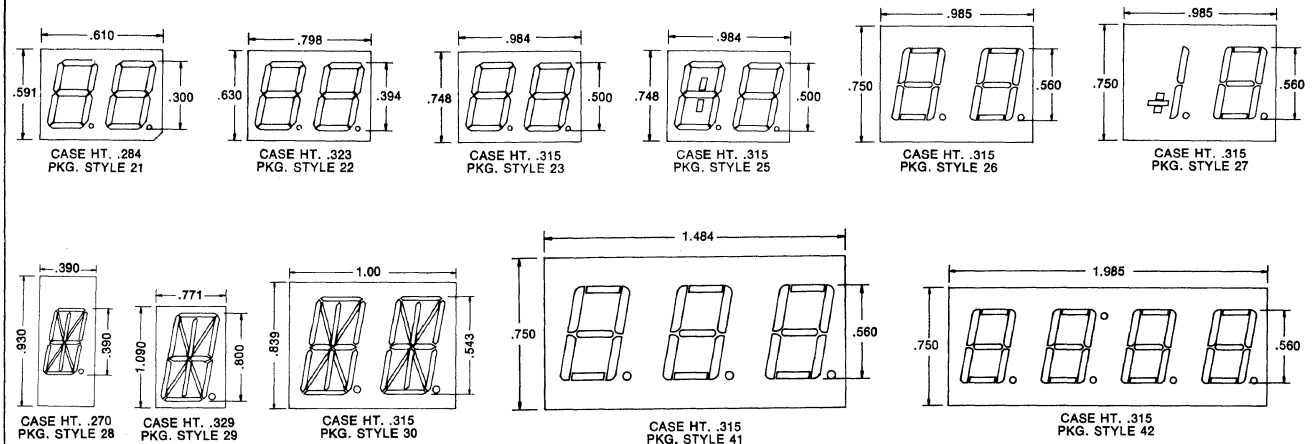
Package Styles

NOTE: Package drawing sizes are not relative or to scale. Consult dimension information before ordering.

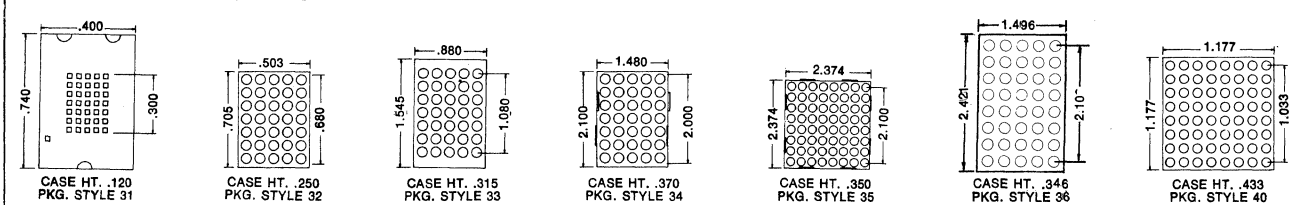
Single Digit Models



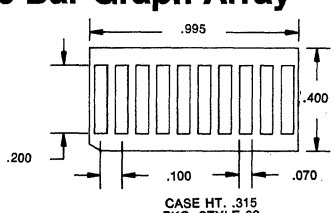
Multi Digit Models



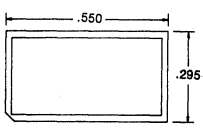
Dot Matrix Models



10 Bar Graph Array



Light Bar



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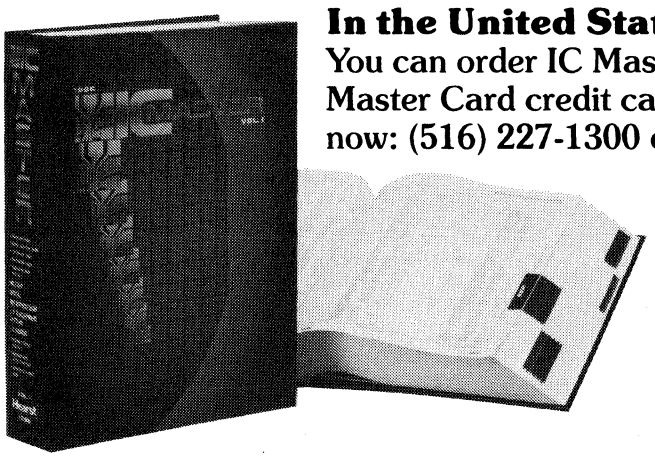

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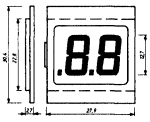
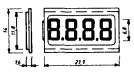
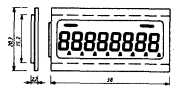
LTD 261


LTD 202


LTD 201

LTD 229

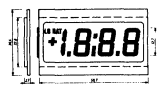

LTD 211

LTD 262

LTD 233

LTD 234

LTD 101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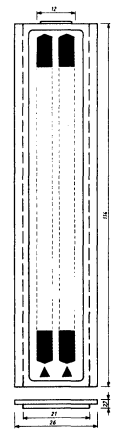
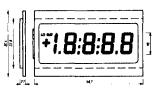
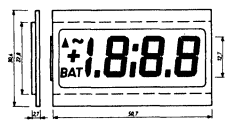

LTD 351

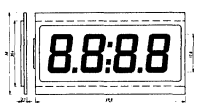

LTD 227

LTD 226

LTD 203


LTD 221

LTD 241


LTD 242

LTD 264

LTD 321

LCDs are shown here at the same relative scale. Codes used in the table below include: 1st col. = angle of digits (5°, 6°); Digits—Number of full digits (3.5 = 3½); Decimal—T = Trailing, L = Leading; 6.3 mm single glued on pins = P; E = Elastomer; RF = Reflective; TF = Transflective.

Angle	Part Number	Digit #	Digit H	Digit W	Dec	Package Type	Package OH	Package OL	Mode	Op Temp −°C	Op Temp +C°	Typ Char Op I Vrms	Typ Char Op I nA/mm²	Note
GENERAL PURPOSE LCD														
6°	LTD261R-12	1	76.0	48.0	T	P	95.3	76.2	RF	10	60	4.5	15	
6°	LTD261R-22	1	76.0	48.0	T	P	95.3	76.2	RF	25	80	4.5	10	
6°	LTD202R-12	2	12.7	7.0	L	P	30.4	27.9	RF	10	60	4.5	15	
6°	LTD202R-22	2	12.7	7.0	L	P	30.4	27.9	RF	25	80	4.5	10	
0°	LTD201R-11	4	6.8	3.7	L	E	14.0	23.9	RF	10	60	4.5	15	
6°	LTD229R-12	6	12.7	7.0	L+	P	35.4	69.8	RF	10	60	4.5	15	:@3,5
6°	LTD229R-22	6	12.7	7.0	L+	P	35.4	69.8	RF	25	80	4.5	10	:@3,5
6°	LTD211R-11	8	6.0	3.2	T	E	20.3	38.0	RF	10	60	3.1	15	2 Indicators
6°	LTD211R-21	8	6.0	3.2	T	E	20.3	38.0	RF	25	80	4.35	10	2 Indicators
6°	LTD262R-12	8	12.7	7.0	L+	P	35.4	93.8	RF	10	60	4.5	15	:@3,5,7
6°	LTD262F-22	8	12.7	7.0	L+	P	35.4	93.8	TF	25	80	4.5	10	:@3,5,7
6°	LTD262R-22	8	12.7	7.0	L+	P	35.4	93.8	RF	25	80	4.5	10	:@3,5,7
5°	LTD233R-11	16	6.0	3.2	T	E	20.3	69.8	RF	10	60	3.1	15	
5°	LTD233R-21	16	6.0	3.2	T	E	20.3	69.8	RF	10	60	4.35	10	
6°	LTD234R-11	16	6.0	2.5	T	E	20.3	69.8	RF	10	60	3.3	22	
6°	LTD234R-21	16	6.0	2.5	T	E	20.3	69.8	RF	20	70	4.6	15	
SPECIAL PURPOSE—CLOCK, CALCULATOR, POS, ETC.														
5°	LTD101R-11	3+	8.9	5.08	No	E	22.9	50.8	RF	10	60	4.5	15	12/24 c/k,al,am,pm
5°	LTD101F-11	3++	8.9	5.08	No	E	22.9	50.8	TF	10	60	4.5	15	12/24 c/k,al,am,pm
6°	LTD222R-12	3.5+	12.7	7.0	L+	P	35.4	50.7	RF	10	60	4.5	15	:@2,±,10bat
6°	LTD222F-22	3.5+	12.7	7.0	L+	P	35.4	50.7	TF	25	80	4.5	10	:@2,±,10bat
6°	LTD227R-22	3.5+	12.7	7.0	L+	P	35.4	50.7	RF	25	80	4.5	10	:@2,±,10bat
6°	LTD222R-11	3.5+	12.7	7.0	L+	E	30.6	50.7	RF	10	60	4.5	15	:@2,±,10bat
6°	LTD222R-21	3.5+	12.7	7.0	L+	E	30.6	50.7	RF	25	80	4.5	10	:@2,±,10bat
6°	LTD227R-12	4.5+	10.0	5.5	L+	P	30.6	50.7	RF	10	60	4.5	15	:@2,3,±,10bat
6°	LTD227R-11	4.5+	10.0	5.5	L+	E	30.6	50.7	RF	10	60	4.5	10	;@2,3,±,10bat
6°	LTD226R-12	4+	12.7	6.8	L+	P	30.4	50.7	RF	10	60	4.5	15	:@2,▲
6°	LTD226R-11	4+	12.7	6.8	L+	E	30.4	50.7	RF	10	60	4.5	10	:@2,▲
6°	LTD203R-11	4+	8.0	7.0	L+	E	20.3	38.0	RF	10	60	4.5	15	:@2,▲,±,B
6°	LTD203R-21	4+	8.0	7.0	L+	E	20.3	38.0	RF	25	80	4.5	10	:@2,▲,±,B
6°	LTD221R-12	3.5++	12.7	7.0	L+	P	30.4	50.8	RF	10	60	4.5	15	:@2,▲,±,~,BAT
6°	LTD221R-22	3.5++	12.7	7.0	L+	P	30.4	50.8	RF	25	80	4.5	10	:@2,▲,±,~,BAT
6°	LTD241R-12	3.5++	17.8	10.0	L+	P	43.0	69.8	RF	10	60	4.5	15	:@2,▲,±,~,BAT
6°	LTD242R-12	3.5++	17.8	10.0	L+	P	43.0	69.8	RF	10	60	4.5	10	:@2,▲,±,~,BAT
6°	LTD264R-12	5+	25.0	13.5	L+,	P	51.0	114	RF	10	60	4.5	15	½,error,no sale
6°	LTD264R-22	5+	25.0	13.5	L+,	P	51.0	114	RF	10	60	4.5	10	½,error,no sale
DOT MATRIX MODULES (5 x 8)														
	LTN111R-10	1 × 16	5.73	3.07	—	—	36.0	80.0	RF	0	50	5V	—	
	LTN211R-10	2 × 16	4.86	2.96	—	—	44.0	84.0	RF	0	50	5V	—	
	LTN241R-10	2 × 40	4.85	3.20	—	—	33.5	182.0	RF	0	50	±5V	—	

Part Number	# Seg	# Rows	Seg H	Seg W	Package Type	Package OH	Package OL	M	Op Temp −°C	Op Temp +C°	Typ Char V rms	Typ Char I hA/mm²	Note
LCD BAR GRAPHS													
LTD321R-12	20	2	5.0	2.80	5D	35.4	69.8	RF	10	60	4.5	15	◀◀,▶▶
LTD351R-11	103+	2	5.0	0.9	E	26.0	114	RF	10	60	3.1	15	overflow>,▶
LTD351R-21	103+	2	5.0	0.9	E	26.0	114	RF	25	80	4.35	10	overflow>,▶

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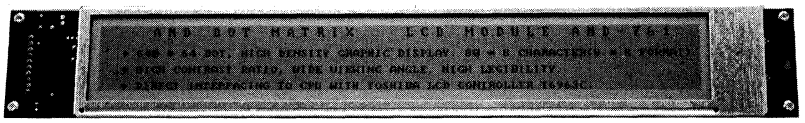

Type No.	Number of Characters/ Dots	Character/Dot Size (mm)	Viewing Area (mm)	Outline Dimension (mm)	Driving Voltage (V)	Power Consum. (mW)	Electro-luminescent Attachable (See Note 1)	Controller
Character Displays with Controller/RAM								
AND241	16 × 1	3.15 W × 7.9 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+ 5	4	No	HD44780 or equivalent
AND671	16 × 1	3.15 W × 5.76 H	64.5 W × 13.8 H	80 W × 36 H × 12 D	+5	5	Yes	
AND673-JO (AND671 with LED BACKLIGHTING)							—	
AND691	24 × 1	3.2 W × 7.95 H	100 W × 13.8 H	126 W × 36 H × 12 D	+5	10	Yes	
AND601	40 × 1	3.2 W × 7.95 H	154.8 W × 17.5 H	182 W × 33.5 H X 13 D	+5	10	Yes	
AND491	16 × 2	2.95 W × 4.29 H	64.5 W ×15 H	80 W ×36 H × 12 D	+5	10	Yes	
AND501	20 × 2	3.2 W × 5.55 H	83 W × 18.6 H	116 W × 37 H × 12.5 D	+5	10	Yes	
AND771	24 × 2	3.21 W × 5.07 H	93.5 × 16.5 H	118 W × 36 H × 12 D	+5	10	Yes	
AND591	40 × 2	3.2 W × 5.55 H	154.8 W × 17.5 H	182 W × 33.5 H ×13 D	+5	12	Yes	
AND731	16 × 4	2.96 W × 4.51 H	61.8 W × 26.6 H	87 W × 60 H × 12 D	+5	17.5	Yes	
AND721	20 × 4	2.96 W × 4.51 H	76 W × 27 H	98 W × 60 H × 12 D	+5	15	Yes	
AND1001	40 × 4	3.95 W × 5.55 H	199 W × 44 H	221 W × 76 H × 12.5 D	+5/−5	—	No	T6963C
Graphic Displays with Controller/RAM								
AND1021	120 W × 64 H	0.44 W × 0.56 H	62.5 W × 43.5 H	85 W × 70 H × 20 D	+5/−8.5	35	Yes	T6963C
AND1021-EO	(AND1021 - With Electroluminescent Panel Installed)						—	T6963C
AND682	160 W × 64 H	0.41 W × 0.41 H	75 W × 32 H	125 W × 50 H × 18 D	+5/−12	40	No	T6963C
AND711A	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/−8.5	60	Yes	T6963C
AND711A-EO	(AND711A - With Electroluminescent Panel Installed)						—	T6963C
AND1013	160 W × 128 H	0.56 W × 0.56 H	101 W × 82 H	129 W × 104.5 H × 14 D	+5/−8.5	45	Yes	T6963C
AND1091	240 W × 128 H	0.66 W × 0.66 H	179.9 W × 101.5 H	241 W × 125.3 H × 12 D	+5/−8.5	50	Yes	T6963C
AND1101	160 W × 32 H	0.46 W × 0.46 H	82 W × 21 H	140 W × 40 H × 12 D	+5/−5	—	Yes	T6963C
Graphic Displays without Controller								
AND612	640 W × 32 H	0.34 W × 0.4 H	250 W × 21 H	320 W × 48 H × 14 D	+5/−7	20	No	(T6963C)*
AND761	640 W × 64 H	0.34 W × 0.38 H	251 W × 34.8 H	320 W × 47 H × 14 D	+5/−13	55	No	(T6963C)*
AND341AK	128 W × 128 H	0.42 W × 0.42 H	63.6 W × 63.6 H	93.2 W × 86.6 H × 12 D	+5/−8.5	90	No	(T6963C)*
AND531A	128 W × 128 H	0.60 W × 0.60 H	89.2 W × 89 H	132.2 W × 111 H × 13 D	+5/−8.5	50	Yes	(T7755)*
AND972	480 W × 128 H	0.49 W × 0.55 H	255.5 W × 81 H	274 W × 114.4 H × 20 D	+5/−13	80	Yes	(T7755)*
Character Displays with SUPER TWIST Nematic with Controller/RAM								
AND771ST	24 × 2	3.21 W × 5.07 H	93.5 W × 16.5 H	118 W × 36 H × 12 D	+5	10	Yes	HD44780
Graphic Displays with SUPER TWIST Nematic with Controller								
AND711AST	240 W × 64 H	0.49 W × 0.49 H	132 W × 39 H	180 W × 65 H × 12 D	+5/−8.5	—	Yes	T6963C
AND711AST-EO	(AND711AST - With Electroluminescent Panel Installed)						—	T6963C
AND1021ST	120 W × 64 H	0.44 W × 0.56 H	62.5 × 43.5 H	85 W × 70 H × 20 D	+5/−8.5	35	Yes	T6963C
Graphic Displays with SUPER TWIST Nematic without Controller								
AND341AKST	128 W × 128 H	0.42 W × 0.42 H	63.6 W × 63.6 H	93.2 W × 86.6 H × 12 D	+5/−8.5	90	No	(T6963C)*
AND932ST	640 W × 200 H	0.345 W × 0.345 H	249 W × 82 H	293 W × 97.6 H × 14 D	+5 −22.5	—	No	(T7779)*
AND561ST	640 W × 200 H	0.32 W × 0.46 H	231 W × 105 H	275 W × 126 H × 14 D	+5/−22.5	—	Yes	(T7779)*
AND1181ST	640 W × 400 H	0.32 W × 0.32 H	230 W × 146 H	276 W × 168 H × 14 D	+5/−22.5	—	Yes	(T7779)*

Note 1. To order units with the Electroluminescent attachable feature, use −30 as a suffix to the type number, i.e. AND671-30, AND711AST-30.

*Recommended controller

AND

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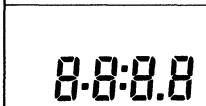
Liquid Crystal Display Panels

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

Display Font	Digit Height (inches)	Part Number	Package Dimensions L x W (inches)
	0.5	FE1901	1.2 x 1.2
	0.2 0.5 0.7 1.0	FE2201 FE0201 FE0501 FE0701	1.6 x 0.7 2.0 x 1.2 2.75 x 1.5 3.7 x 1.8
	0.5	FE0203	2.0 x 1.2
	0.4	FE0801	2.0 x 0.95
	0.3 0.5	FE0101 (pinless only) FE1011	1.57 × 0.7 2.0 × 1.2
	0.35 0.5 0.5 0.7 1.0	FE0804 FE0202 FE0204* FE0502 FE0703	2.0 x 0.95 2.0 x 1.2 2.0 x 1.2 2.75 x 1.5 3.7 x 1.8

Display Font	Digit Height (inches)	Part Number	Package Dimensions L x W (inches)
	0.5	FE0205	2.0 x 1.2
	0.4	FE0206	2.0 x 1.2
	0.4	FE0208	2.0 x 1.2
	0.3 0.5 0.7	FE0803 FE0401 FE0601	2.0 x 0.95 2.75 x 1.2 3.7 x 1.5
	0.5	FE1001	3.7 x 1.2
	0.15	FE0405	2.75 x 1.2

* TRIPLEX

Ordering Information:

1. Select model number.
2. Select connector type (see configuration chart).
3. Select viewing mode (see configuration chart).
4. Consult factory to verify any additional options.
5. Consult factory for availability of selected configuration.

Configuration Chart

Viewing Mode	Configuration	
	Pinned	Pinless
Transmissive	A	F
Reflective Frosted	K	M
Reflective Aluminum Foil	D	I
Transflective	E	J

Part Number FEXXXX X-XX

Model Number: ——

Liquid Crystal Material — Polarizer Options ——

Leave digit blank — Standard Grade (-20 to +60°C) — Standard Polarizer

W-_U — Wide Temperature (-30 to +85°C) — High Temp./High Humidity Polarizer

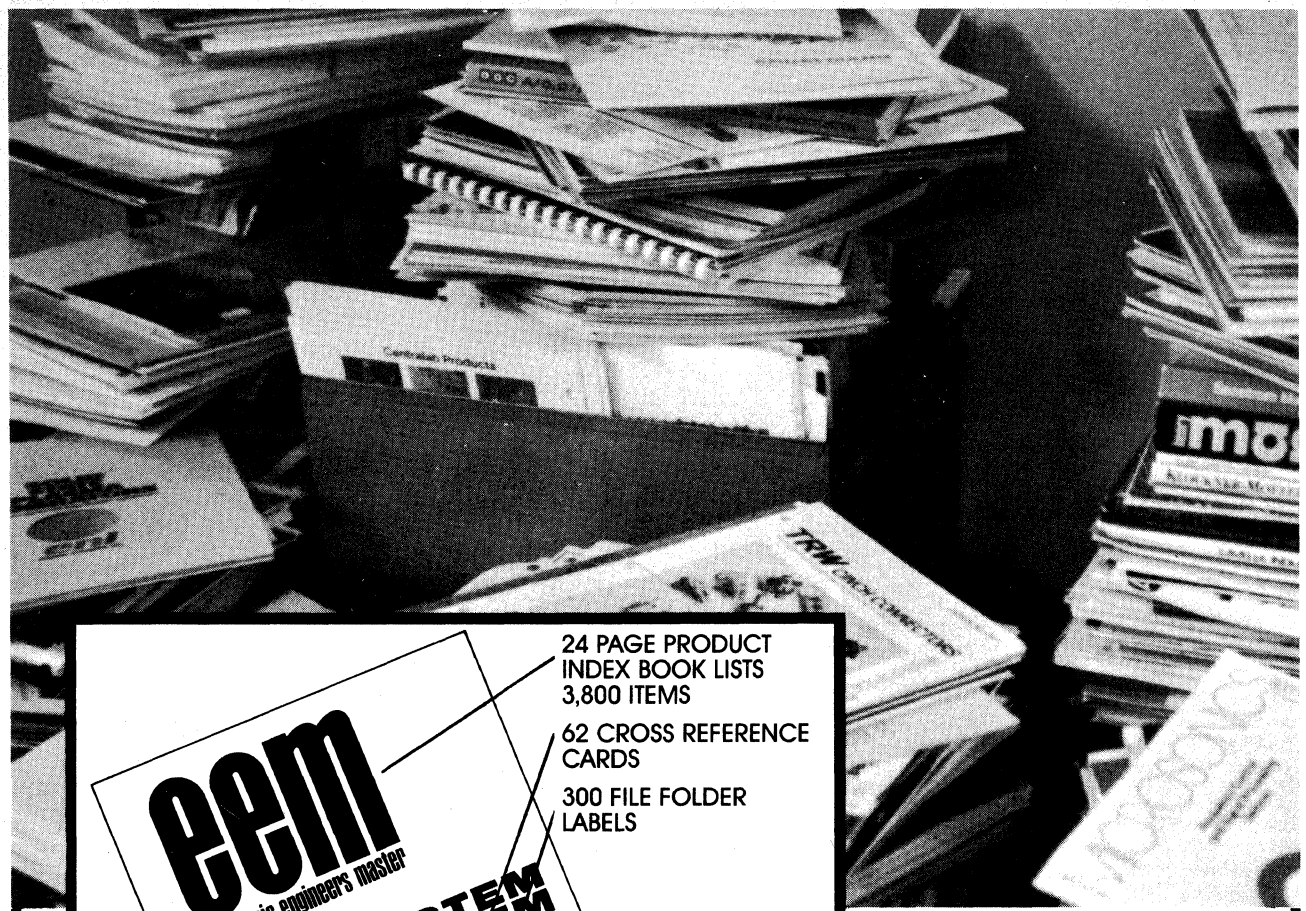
Viewing Mode (see configuration chart): ——

Example: Model FE0203, with wide temperature fluid, pinned reflective foil configuration and high temp./high humidity polarizer: FE0203W-DU

Additional display fonts are available. Contact our representatives or consult factory with your needs.

FOR COMPLETE INFORMATION PLEASE CALL OR WRITE FOR OUR LATEST DATA BOOK

FOR LISTING OF OUR REPRESENTATIVES AND DISTRIBUTORS PLEASE SEE EEM'S YELLOW PAGES



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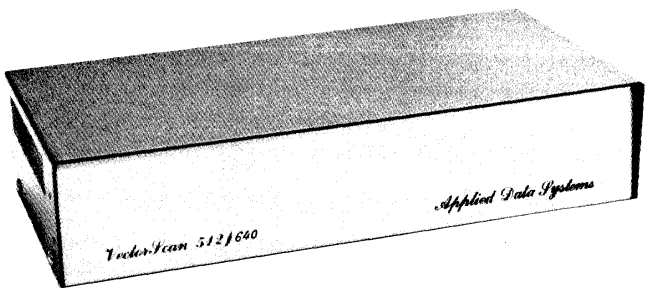
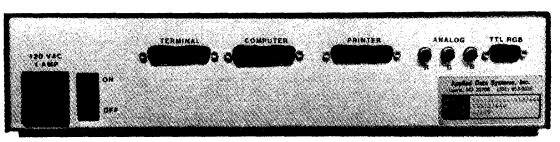
VectorScan 512/640

Graphic Controller with RS-232 Interface



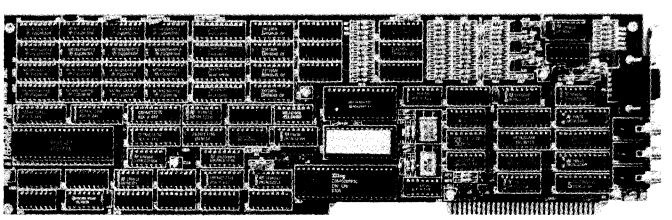


FEATURES:

- 512/640/640 x 480/350/400 x 4 bits per pixel resolution to display up to 16 colors/intensities simultaneously from a 4,096 color palette.
- Supports Interlaced and Non-Interlaced monitors.
- Internal 8 MHZ Processor and firmware.
- Color mapping register for selective image viewing, highlighting, and limited animation.
- Graphic image creation in any language on any operating system.
- 512K bytes of self-contained on-board video RAM.
- 4 independent image buffers which can be selectively displayed and modified.
- Provide image hardcopy on many dot matrix printers.
- A loop-through feature that saves an RS232 port, displays commands on your terminal, and enables remote workstation connection over RS-232 circuits.

VectorScan PC512/PC640

Graphic Controllers for the IBM-PC/XT/AT



- 512/640/640 x 480/350/400 x 4 bits per pixel resolution to display up to 16 colors/intensities simultaneously from a 4,096 color palette.
- Supports Interlaced and Non-Interlaced monitors.
- Emulates an IBM-PC printer adapter.
- Easy to install plug-in style board.
- Color mapping register for selective image viewing, highlighting and limited animation.
- Graphic image creation in any language on any operating ystem.
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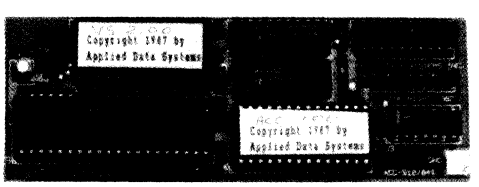
VectorScan Accelerator



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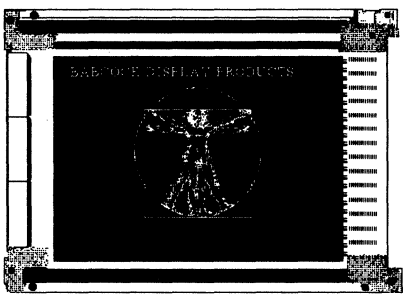

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NEW MESSENGER PLASMA DISPLAY SUBSYSTEMS

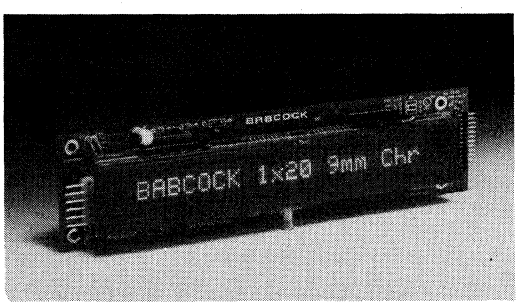
DM series subsystems operate with a +5 Vdc power supply and accept TTL level parallel ASCII or graphic data. Multiline 5 X 7 format.

MODEL NUMBER	ROWS BY COLUMNS	AVAILABLE CHAR. HEIGHTS
DM-0416	4 X 16	0.33" (8,4mm)
DM-0832	8 X 32	0.25" (6,4mm)
DM-1240	12 X 40	0.21" (5,3mm)

NEW VL VACUUM FLUORESCENT DISPLAY SUBSYSTEMS

VL series subsystems offer full features and low cost for high volume applications.

MODEL NUMBER	ROWS BY COLUMNS	AVAILABLE CHAR. HEIGHTS
14-Segment Format		
VL-0116	1 X 16	0.35" (9mm)
VL-0132	1 X 32	0.24" (6mm)
5 X 7 Dot Matrix Format		
VL-0120	1 X 20	0.20" (5mm) & 0.35" (9mm)
VL-0132	1 X 32	0.20" (5mm)
VL-0140	1 X 40	0.20" (5mm)
VL-0220	2 X 20	0.20" (5mm)
VL-0240	2 X 40	0.20" (5mm)
VL-0640	6 X 40	0.20" (5mm)



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Azure Vacuum Fluorescent Subsystems

Vacuum Fluorescent subsystems operate on a single +5 Vdc power supply and accept TTL level parallel or serial ASCII data. RS-232 is optional.

MODEL NUMBER	ROWS BY COLUMNS	AVAILABLE CHAR. HEIGHTS
14-SEGMENT FORMAT		
VS-0116	1 X 16	0.35" (9mm) & 0.20" (5mm)
VS-0120	1 X 20	0.35" (9mm)
VS-0132	1 X 32	0.24" (6mm)
VS-0216	2 X 16	0.22" (5,5mm)
5 X 7 DOT MATRIX FORMAT		
VF-0120	1 X 20	0.20" (5mm) & 0.35" (9mm) & 0.57" (15mm)
VF-0140	1 X 40	0.20" (5mm)
VF-0216	2 X 16	0.12" (3mm) & 0.43" (11mm)
VF-0220	2 X 20	0.20" (5mm) & 0.43" (11mm)
VF-0240	2 X 40	0.20" (5mm)
VF-0420	4 X 20	0.43" (11mm)
VF-0640	6 X 40	0.20" (5mm)

Plasmaflex Screened Image Components

Screened Image Plasma components operate with a single +180 Vdc (nominal) power supply. High voltage driver/decoders and dc/dc converters are available.

MODEL NUMBER	NO. OF CHARACTERS	CHAR. HEIGHT
NUMERIC		
SP-431-001	4	2.00" (50,8mm)
SP-432	6	2.00" (50,8mm)
SP-450-022	6	0.50" (12,7mm)
SP-450-019	8	0.70" (17,8mm)
CLOCK		
SP-431	4	2.00" (50,8mm)
ALPHANUMERIC		
SP-462	4	2.00" (50,8mm)
SP-452	16	0.50" (12,7mm)
SP-450-026	16	0.50" (12,7mm)
SP-450-018	20	0.50" (12,7mm)
DOT MATRIX		
SP-480-006	8	1.00" (25,4mm)
SP-480-002	20	0.47" (11,9mm)
SP-480-001	40	0.24" (6,1mm)

Messenger Plasma Subsystems

SM series subsystems operate with a single +5 Vdc power supply and accept parallel TTL level ASCII data. SM & SG canned message subsystems also accept TTL level or RS-232 level serial data.

MODEL NUMBER	ROWS BY COLUMNS	AVAILABLE CHAR. HEIGHTS
SINGLE LINE, 5X7 DOT MATRIX FORMAT		
SM-810-001	1 X 40	0.24" (6,1mm)
SM-810-002	1 X 20	0.47" (11,9mm)
SM-810-004	1 X 20	0.47" (11,9mm)
CANNED MESSAGE, 5X7 DOT MATRIX FORMAT		
SM-0120-C1	1 X 20	0.47" (11,9mm)
SM-0140-C1	1 X 40	0.24" (6,1mm)
CANNED MESSAGE, 14-SEGMENT FORMAT		
SG-0220-C1	2 X 20	0.45" (11,4mm)

Marathon Raised Cathode Components

Raised Cathode Plasma components operate with a single +180 Vdc (nominal) power supply. Accessory high voltage driver/decoders and dc/dc converters are available.

MODEL NUMBER	NO. OF CHARACTERS	CHAR. HEIGHT
Numeric		
SP-102	*	1.00" (25,4mm)
SP-101	1	1.00" (25,4mm)
SP-324	4	0.23" (5,8mm)
SP-325	5	0.23" (5,8mm)
SP-330 Series	1*, 2, 2*, 3	0.33" (8,4mm)
SP-350 Series	1*, 2, 2*, 3, 3*, 4	0.55" (14,0mm)
SP-358	4	0.55" (14,0mm)
ALPHANUMERIC		
SP-252	2	0.55" (14,0mm)
SP-103	1	1.00" (25,4mm)

***= the digit "1", w/plus & minus sign**

CANYON electronics

READOUT ASSEMBLIES

MINI-PAK DISPLAY ASSEMBLIES

The MINI-PAK® series are gas discharge or LED readout modules, specifically designed for use on low-to-medium volume industrial or commercial instruments. The display and associated electronic drive are packaged in a black thermoplastic case available in two styles; a rear panel mount and a front panel mount. The modules are available in 1½-, 2-, 2½ and 3-digit configuration that can be mounted individually or stacked horizontally to form any number of digits. The MINI-PAK® series are designed for direct interface compatibility with TTL or LSI integrated circuits with 4 line output information in the 8-4-2-1 BCD code format.

GAS DISCHARGE SERIES CE-1000/CE-2000

The MINI-PAK® series CE-1000/CE-2000 include a 0.55" high character gas discharge display and the BCD to seven segments Decoder/Driver. The interface terminals are brought out to 14 pin dual-in-line header or socket. All components are soldered to the P.C. Board.

GAS DISCHARGE SERIES CE-3000/CE-4000

The MINI-PAK® series CE-3000/CE-4000 include a 0.55" high character gas discharge display and socket mounted BCD to seven segments Decoder/Driver. The interface terminals are brought out to wire wrap pins. The gas discharge display can be very easily and efficiently replaced, thereby, minimizing down time.

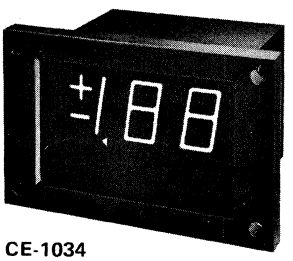
LED SERIES CE-5000/CE-6000

The MINI-PAK® series CE-5000/CE-6000 include a socket mounted 0.43", 0.625" or 0.8" character high LED display, a socket mounted BCD to seven segments Decoder/Driver and current limitting resistors, whenever applicable. The interface terminals are brought out to wire wrap pins. The series is available with or without latch or in 5 mA, 15 mA or 20 mA per segment.

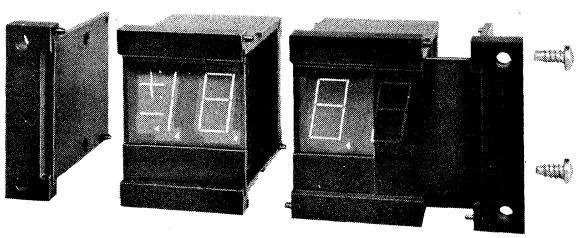
FOR CUSTOM MADE ASSEMBLIES, LARGER CHARACTERS OR OTHER REQUIREMENTS, CONSULT FACTORY

DOUBLES YOUR OPTION TO YOUR PANEL DESIGN WITH THE MINI-PAK® LED AND GAS DISCHARGE DISPLAYS.

CE-2037



CE-1034



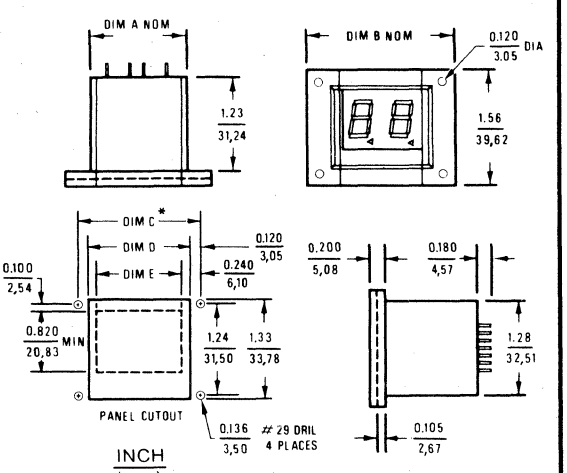
INSTALLATION DRAWING

CE-6037

CE-5034

MECHANICAL SPECIFICATIONS

NO DIGITS	BEZEL WIDTH DIM. B NOM.		PANEL CUTOUT † DIM. D		PANEL CUTOUT †† DIM. E	
2	1.94	49,28	1.38	35,1	1.14	28,96
3	2.48	62,99	1.92	48,8	1.68	42,68
4	3.04	77,22	2.48	63,0	2.24	56,90
5	3.58	90,93	3.02	76,70	2.78	70,62
▲ 6	4.12	104,65	3.56	90,42	3.32	84,33
7	4.68	118,87	4.12	104,7	3.88	98,56
▲ 8	5.22	132,59	4.66	118,4	4.42	112,27



▲ Assumes maximum 3 digits modules per assembly.

† D Dimension applies to CE-1000/3000/5000 series.

†† E Dimension applies to CE-2000/4000/6000 series.

CANYON ELECTRONICS 2001 W. North Lane, Phoenix, Arizona 85021 (602) 944-4421 FAX (602) 943-0739

CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
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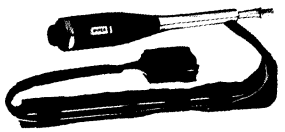
Automotive Products

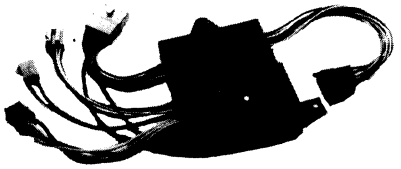


Washer wiper

Power mirror

Door lock

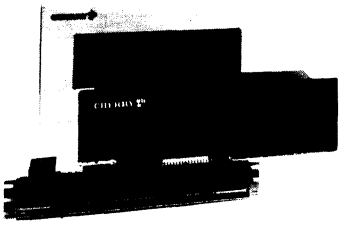
Window lift



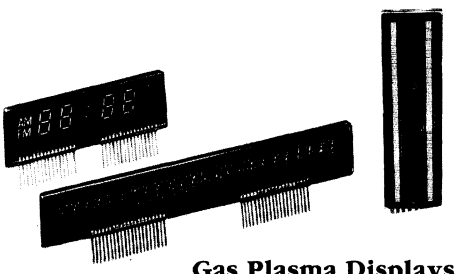
Memory seat module

Quality, Engineering and Service are the backbone of Cherry Automotive. Bolstered by 35 years experience, Cherry designs and manufactures a broad range of electrical and electronic components, assemblies and systems. Cherry's facility features a high degree of vertical integration, automation, just-in-time technology and robotics. Cherry maintains quality by controlling its in-house moldings, stampings, printed circuit boards, springs and automation. Our CAD, CAM, CIM automotive test lab, surface mount technology and plastics lab are second to none in the industry. A long time supplier to the Big Three, Cherry's Detroit metro based office staff serves our customers' needs.

Displays



Industrial Control Products including intelligent and non-intelligent alphanumeric displays, display accessories and thumbwheel and pushwheel assemblies.

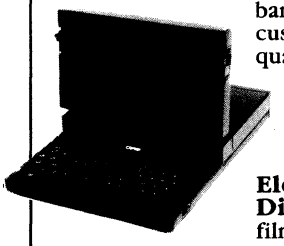


Gas Plasma Displays
7 Segment Numeric (4 to 11 digits)

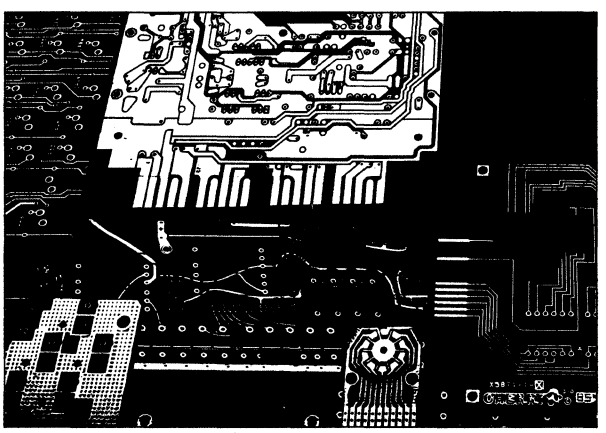
14 Segment Numeric (to 24 characters)

One and four line non-intelligent displays requiring ASCII input.

Also—Bar Graph Displays—flat panel indicators containing one or two bars. Four basic standards plus custom designs in production quantities.



Electroluminescent Displays—High luminance, Thick film, Flat panel DC EL Display Systems. 640 x 200 Pixel organization. Simple, rugged and reliable construction.



Printed Circuit Boards

Cherry has been providing quality printed circuit boards for over 20 years. Our facility supplies high reliability plated through hole, multilayer, double-sided and single-sided printed wiring boards.

Surface mount or conventional lead designs. Full panel or selective plating finishes. High density, fine line small hole designs in a variety of finishes including gold, palladium, rhodium, copper, solder or nickel.

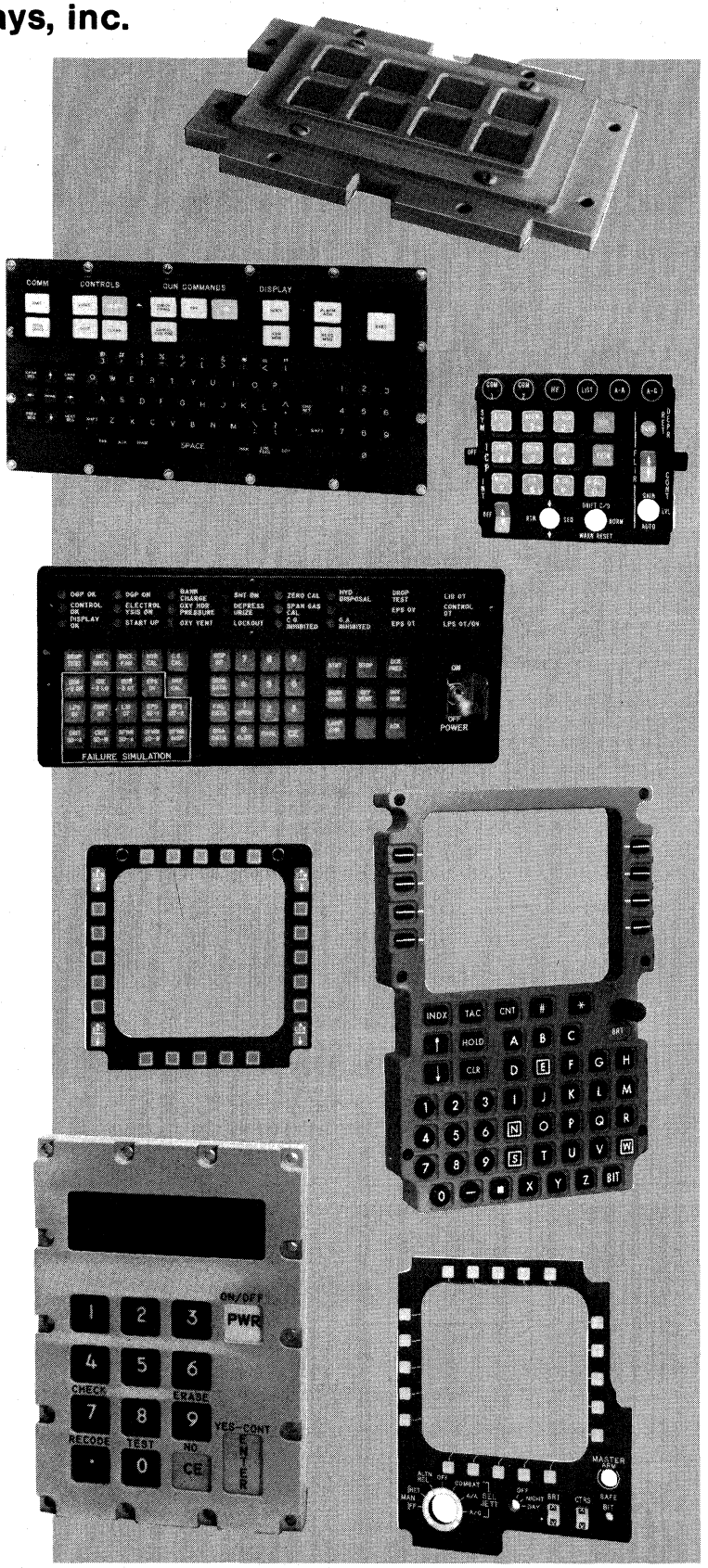
State-of-the-art operation includes extensive use of automated equipment and the latest technological methods that result in on-time, cost effective product delivery.

Unique wet processing capabilities have been acknowledged as one of the best in industry.

control displays, inc.

CUSTOM MIL. SPEC./HIGH RELIABILITY **KEYBOARDS** & INTEGRATED **PANELS**

Control Displays specializes in custom keyboards and lighted panels. Our dedicated workforce with over 20 years of experience will provide the necessary engineering assistance from start to finish on your program. Our products are currently installed on spacecraft, military and commercial aircraft, surface ships, submarines, tanks, rocket launchers, helicopters, and command and control installations. Whether you provide a complete baseline specification or simple sketch our state-of-the-art facilities enable us to design, produce, and deliver on schedule.



ENVIRONMENTALS

- TEMPEST
- EMI/RFI/EMP
- RAD HARDENED
- STATIC DISCHARGE
- SHOCK
- VIBRATION
- HI/LOW TEMP.
- SAND & DUST
- SALT SPRAY
- CHEMICAL
- RAIN
- HUMIDITY
- WATERPROOF
- FUNGUS
- ALTITUDE
- DECOMPRESSION

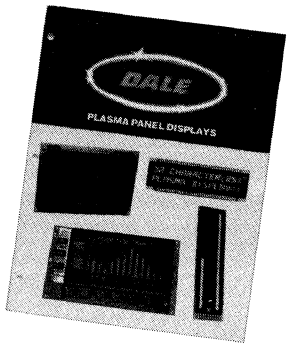
OPTIONS

- INCANDESCENT
- ELECTROLUMINESCENT
- LED
- NVIS
- DEAD FRONT
- REPLACEABLE LAMPS
- INTEGRATED SWITCHES
- ENCODING
- TACTILE ACTION
- FULL TRAVEL
- FLUSH/RECESSED KEYS
- CUSTOM KEY STROKE
- LEGENDS
- WINDOWS

3075 ADVANCE LANE COLMAR, PA 18915 TEL: (215) 822-3383 FAX: 215/997-1232

DALE® PLASMA PANEL DISPLAYS AND MODULES

Dale Flat Panel Plasma Displays provide wide viewing angles, high contrast and reliable, cost-effective operation for a wide range of uses. Many models are available with drive electronics and controllers for "turn-key" installation in your application. In addition to supplying the standard models listed here, we are ready to give immediate attention to your special requirements. Our screened image technology makes it easy to meet custom requirements — allowing maximum freedom to display symbols, messages and characters unique to your application. For complete information and design assistance, contact the factory.



Write for your copy of **New Display Catalog**

STANDARD MODELS

SEGMENTED DISPLAYS

PD-04A200, 4 characters, 2.00″ high

PD-16A040, 16 characters, .400″ high

PD-32A025, 32 characters, .250″ high

DISPLAYS WITH DRIVE ELECTRONICS/ INTERFACES

APD-016M040, 16 character dot matrix module with controller

APD-32A025, 32 character segmented module

PDS-200, Standard Bus interface card for APD-32A025

APD-192G088, 192 column x 88 row dot matrix, graphics module

APD-192G088-1, APD-192G088 with controller and DC-DC converter

APD-240M026, 240 character (6 x 40) dot matrix module

APD-240M026A, 240 character (6 x 40) enhanced brightness dot matrix module

APD-240M026A-1, APD-240M026A with controller and DC-DC converter

APD-256M026, 256 character (8 x 32) dot matrix module

APD-256M026-1, APD-256M026 with controller and DC-DC converter

BAR GRAPH DISPLAYS

PBG-16101, 101 element dual linear bar graph

PBG-12201, 201 element dual linear bar graph

PBG-12203, 203 element dual linear bar graph

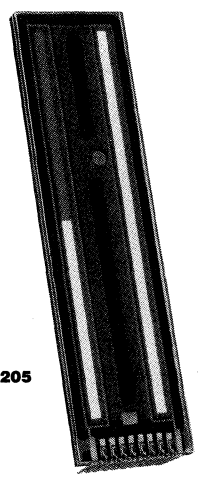
PBG-12205, 201 element dual linear bar graph

PBG-C7005, 201 element single linear bar graph, extra long column

PBG-C7008, 201 element dual linear bar graph, extra long columns

DALE® LINEAR BAR GRAPH DISPLAYS

Dale linear bar graphs are flat panel plasma indicators each displaying one or two separate bar graphs. Depending on the model, they contain 101, 201 or 203 elements with resolution of 1/2% and 1%. At normal viewing distances, their glow blends into a continuous but precisely controlled bar length. The unique scanning technique minimizes the number of drivers required.



Model PBG-12205

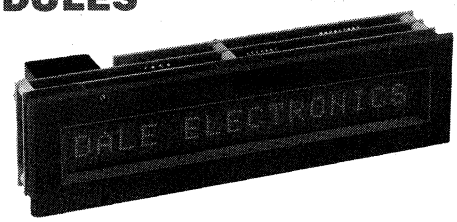
APPLICATIONS

- Process Control
- Depth Indicators
- Panel Meters
- Level Indicators
- Analog Indicators

	PBG-12201	PBG-12203	PBG-12205	PBG-16101	PBG-C7005	PBG-C7008
Elements	201	203	201	101	201	201
Resolution	1/2%	1/2%	1/2%	1%	1/2%	1/2%
Segment Length	.100″	.150″	.100″	.100″	.250″	.120″
Segment Width	.011″	.010″	.011″	.020″	.020″	.020″
Segment Spacing	.020″	.020″	.020″	.050″	.050″	.0394″
Column Length	4.000″	4.040″	3.937″	5.000″	10.000″	7.874″
Columns	2	2	2	2	1	2
Drivers Required	6	12	8	6	7	8
Light Output	35 fl	30 fl	70 fl	60 fl	30 fl	30 fl
Viewing Angle	120°					
Color	Neon Orange					

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 · Phone 402-564-3131

DALE® PLASMA PANEL DISPLAY MODULES



MODEL APD-016M040

16 character display with drive electronics and controller

The APD-016M040 display module is a 1 line by 16 character 5 x 7 dot matrix display. It includes drive electronics, a microprocessor-based controller consisting of a character generator, control logic and a 32 character refresh memory. The controller can be programmed for either parallel or serial interface. An on board DC-DC converter develops the necessary panel voltages from a single 5V input.

FEATURES

- 16 (1 x 16) alphanumeric characters (5 x 7 dot matrix)
- Bezel and filter included
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Enhanced replacement for Burroughs SSD1000-0061 (optionally-0041)

SPECIFICATIONS

OPTICAL

Viewing Area: .40″ [10.2] W x 6.69″ [169.1] L

Number of Characters: 16

Character Size: .28″ [7.1] W x .40″ [10.2] H

Dot Size: .036″ [.91] dia.

Dot Pitch: .061″ [1.55]

Character Spacing: 2 blank columns between successive characters — .147″ [3.73]

Brightness: 80 ft./lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% non-condensing

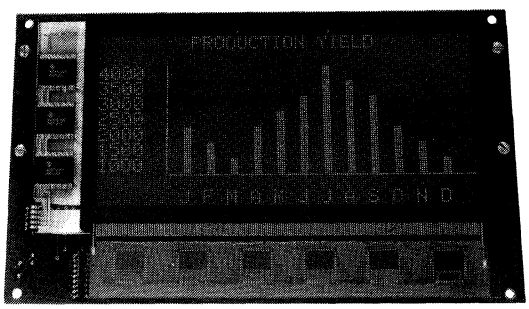
Mechanical Shock: 50G 1/2 Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

MODEL APD-192G088-1

192 by 88 graphics display with drive electronics and controller

The APD-192G088-1 is a full field dot matrix display with 192 columns and 88 rows. It includes drive electronics and a microprocessor based controller. The controller maintains all the refresh memory, character generation and control logic with parallel or serial interface and a DC to DC converter to generate the necessary panel voltage. Chip-on-glass construction eliminates hundreds of connections for increased reliability and reduced cost.



FEATURES

- 192 x 88 full field dot matrix
- Chip-on-glass drivers
- Parallel and serial interfaces
- High brightness
- Wide viewing angle
- Low input voltage
- Compact size
- Software dimming
- All functions software accessible
- Character graphics available

SPECIFICATIONS

OPTICAL

Viewing Area: 7.66″ [194.6] x 3.50″ [88.9]

Pixel Size: .020″ [.51]

Pixel Pitch: .040″ [1.02]

Brightness: 80 ft./lamberts

Color: neon orange

Viewing Angle: 120° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% R.H. non-condensing

Mechanical Shock: 50G 1/2 Sine Wave, 11 msec duration, 5 shocks in each of 6 directions

Vibration: .018″ [.46] displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate, along each side of the 3 major axes.

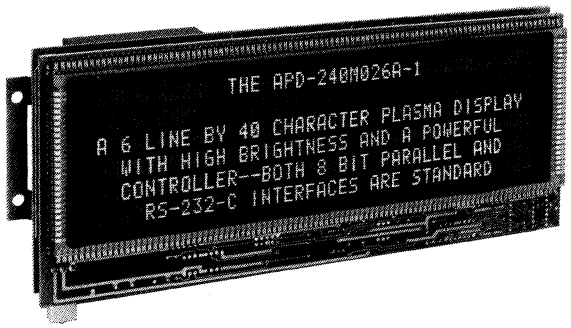
For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 • Phone 402-564-3131

DALE® PLASMA PANEL DISPLAY MODULES

MODEL APD-240M026A-1

240 character display with drive electronics and controller

The APD-240M026A-1 display module displays up to 240 alphanumeric 5 x 7 dot matrix characters arranged in 6 lines of 40 characters each. The module includes drive electronics, a microprocessor-based controller consisting of refresh memory, character generator and control logic with parallel or serial interface and a DC to DC converter to develop the necessary panel voltage.



FEATURES

- 240 (6x40) alphanumeric characters (5x7 dot matrix)
- 128 USASCII character set + 128 user programmable character set
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Software dimming

SPECIFICATIONS

OPTICAL

Viewing Area: 2.26″ [57.40] W x 8.33″ [211.66] L

Number of Characters: 240

Character size: .14″ [3.56] W x .26″ [6.60] H

Dot Size: .020″ [.51] dia.

Dot Pitch, Vertical: .040″ [1.016]

Dot Pitch, Horizontal: .030″ [.762]

Character Spacing: 2 blank columns of dots between successive characters

Brightness: 100 foot lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% non-condensing

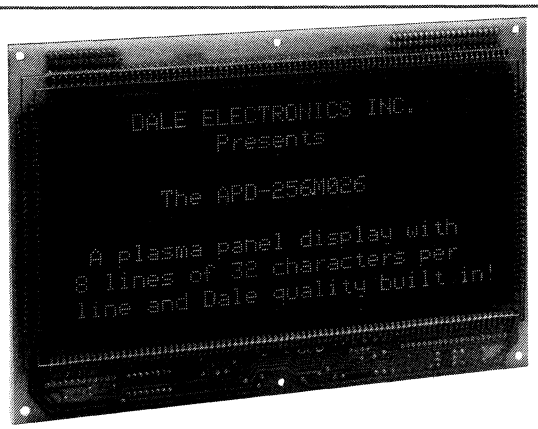
Mechanical Shock: 50G 1/2 Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

MODEL APD-256M026-1

256 character display with drive electronics and controller

The APD-256M026-1 display module displays up to 256 alphanumeric 5 x 7 dot matrix characters arranged in 8 lines of 32 characters each. The module includes drive electronics, a microprocessor-based controller consisting of refresh memory, character generator and control logic with parallel or serial interface and a DC to DC converter to develop the necessary panel voltage.



FEATURES

- 256 (8x32) alphanumeric characters (5x7 dot matrix plus underbar)
- 128 USASCII character set + 128 user programmable character set
- Parallel and serial interfaces
- High brightness
- Wide viewing angle (150°)
- Low input voltage
- Compact size
- Software dimming

SPECIFICATIONS

OPTICAL

Viewing Area: 3.30″ [83.82] W x 7.62″ [193.55] L

Number of Characters: 256

Character Size: .18″ [4.57] W x .26″ [6.60] H

Dot Size: .020″ [.51] dia.

Dot Pitch: .040″ [1.016]

Character Spacing: .060″ [1.52]

Brightness: 100 ft./lamberts

Color: neon orange

Viewing Angle: 150° cone

ENVIRONMENTAL

Operating Temperature: 0°C to +55°C

Storage Temperature: −55°C to +85°C

Relative Humidity: 10-90% non-condensing

Mechanical Shock: 50G ½ Sine Wave, 11 ms duration, 5 shocks in each of 6 directions

Vibration: .018″ displacement amplitude from 10 to 50 Hz, 2G acceleration from 50 to 2000 Hz logarithmic sweep rate. 30 min. duration along each side of the 3 major axes.

For complete information, write or phone
DALE ELECTRONICS, INC., 2064 12th Avenue, Columbus, Nebraska 68601 · Phone 402-564-3131

SI UNITS

RELATIVE QUANTITY SYMBOLS

≠	not equal to
≈	approximately equal to
∝	proportional to
<	smaller than
≤	smaller than or equal to
«	much smaller than
>	larger than
≥	larger than or equal to
»	much larger than
≡	identical to or equivalent
↑	increases
↓	decreases

PREFIXES FOR SI UNITS

Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

SI UNITS

Quantity	Symbol	SI Unit	Symbol	Derivation
height	h	metre	m	fundamental unit
image distance	υ	metre	m	fundamental unit
inductance, mutual	M	henry	H	induced e.m.f./rate of change of current
inductance, self	L	henry	H	—
intensity of radiation	I	*a number*	—	—
latent heat	L	joule	J	quantity of heat
latent heat, specific	l	J kg^{-1}	—	quantity of heat
latent heat, molar	L_m	joule mol^{-1}	J	quantity of heat
length	l	metre	m	fundamental unit
magnetizing force	H	ampere-turns	—	—
magnetic moment	m	Wb m	—	torque in unit magnetic field
magnification, linear	m	*a ratio*	—	—
mass	m	kilogramme	kg	fundamental unit
mass number	A	*a number*	—	number of neutrons + protons
molar volume	V_m	(dm^3)	—	volume of 1 mole
molar solution	M	*a ratio*	—	moles/dm^3
moment of force	—	N m	—	force × perp. distance
neutron number	N	*a number*	—	number of neutrons
number	n	—	—	—
number of molecules	N	—	—	—
number turns on coil	n	*a number*	—	—
number order spectrum	p	*a number*	—	—
object distance	u	metre	m	fundamental unit
peak current	I_o	ampere	A	see current
peak e.m.f.	E_o	volt	V	see e.m.f.
period	T	second	s	fundamental unit
permeability	μ	H m^{-1}	—	henry/metre
permeability, vacuum	μ_o	H m^{-1}	—	—
permeability, relative	μ_r	*a ratio*	—	$\mu = \frac{\mu}{\mu_o}$
permittivity	ε	F m^{-1}	—	farad/metre
permittivity, vacuum	ε_o	F m^{-1}	—	farad/metre
permittivity, relative	ε_r	*a ratio*	—	$\varepsilon_r = \frac{\varepsilon}{\varepsilon_o}$
potential, electric	V	volt	V	energy/charge
potential difference	V	volt	V	energy/charge
power	P	watt	W	J s^{-1}
pressure	p	pascal	Pa	N m^{-2}: force/area
radius	r	metre	m	fundamental unit
reactance	X	ohm	Ω	E_o/I_o
refractive index	n	*a ratio*	—	—
resistance	R	ohm	Ω	p.d./current
resistivity, electrical	ρ	ohm-metre	—	resistance × length
relative density	d	*a ratio*	—	ρ_{sub}/ρ_{water}
r.m.s. current	$I_{r.m.s}$	ampere	A	see current
r.m.s. voltage	$V_{r.m.s}$	volt	V	see e.m.f.
slit separation	s	metre	m	fundamental unit
tension	T	newton	N	see force
temperature, Celsius	θ	degree C	°C	from kelvin
temp. interval	θ	degree	° or K	—
temp. absolute	T	kelvin	K	fundamental unit
thickness	d	metre	m	fundamental unit
time	t	second	s	fundamental unit
torque	T	Nm	—	see moment
turns ratio	T	*a ratio*	—	n_{sec}/n_{prim}
(unit of electricity)	—	kW h	—	kilowatt × hour
velocity	u,υ	ms^{-1}	—	distance/time
velocity, angular	ω	$second^{-1}$	s^{-1}	angle/time
velocity, e.m.waves	c	m s^{-1}	—	—
velocity of sound	υ	m s^{-1}	—	—
volume	V	metre cubed	m^3	l × b × h
wavelength	λ	metre	m	fundamental unit
work	w	joule	J	force x distance (Nm)
weight	W	newton	N	kg m s^{-2}or mg

VISUAL DISPLAYS

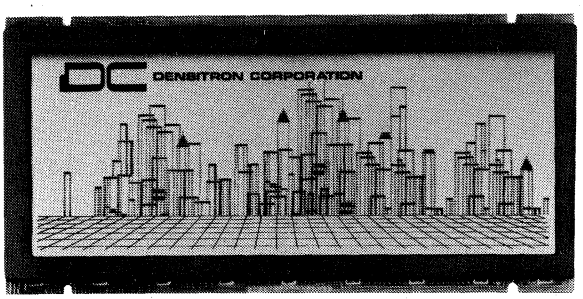
The Largest Variety of LCD Modules in the Industry

Character LCD Modules

- Industry standard 8-bit parallel controller
- **SUPERTWIST** modules for high contrast and wide viewing angle.
  Most **SUPERTWIST** models have 0°C to +50°C operating range.
- **LED backlight** modules offer long life and excellent readability in all lighting conditions.
- ½" and ⅓" character height modules
- **Extended temperature** modules operate from –20°C to +70°C
- Negative image modules (on all models) produce **light-emitting displays** with light characters on a dark background
- **Electroluminescent backlighting avail.**
- Second source for most common sizes
- Competitive pricing

Graphic LCD Modules

- All modules available with **SUPERTWIST** fluid for high contrast and wide viewing angle.
- **Extended temperature fluid** (–20°C to +70°C operating) available on smaller (≤ 128 lines) modules
- **Electroluminescent** or **fluorescent backlight** allows viewing in all lighting conditions.
- May be formatted as text only in formats from 4x20 to 50x80.



CHARACTER FORMATS

CHAR. ROWS \ CHAR. COL'S.	8	16	20	24	32	40	80
1	●	●	●	●	●	●	●
2	●	●	●	●	●	●	●
4		●	●	●		●	●

GRAPHIC FORMATS

DOT ROWS \ DOT COL'S.	120	128	240	256	480	640
32	●					
64	●		●		●	
128				●	●	
200						●
400						●
480						●

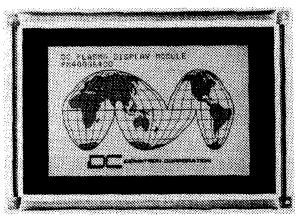
DENSITRON CORPORATION OF AMERICA
INFORMATION DEVICE DIVISION 2540 West 237th Street, Torrance, California 90505 U.S.A.
Phone: (213) 530-3530 Facsimile: (213) 534-8419 (G2/G3) Telex (II): 910-349-6200 DENSITRON TRNC

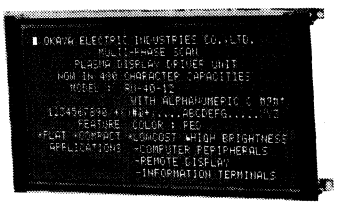
DENSITRON CORPORATION
Kyowa Nanabankan 5F No. 1-11-5 Omori-Kita, Ota-ku, Tokyo 143 Japan Cable: "DENTROROSE" Tokyo
Phone: (03) 767-9701~8 Facsimile: (03) 767-9709 (G2/G3) Telex: J26914 DENSITRO J

DENSITRON EUROPE LIMITED
Unit 4, Airport Trading Estate Biggin Hill, Westerham, Kent TN16 3BW, England
Phone: (0959) 76600 Facsimile: (0959) 71017 Telex: 957134

from DENSITRON!

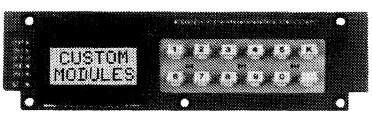
Plasma, Custom Displays and Support Electronics





Plasma Modules

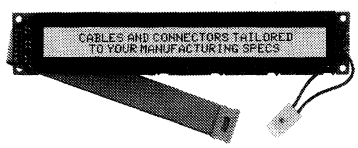
- Graphic modules in computer screen sizes
- Character modules with optional controllers
- High-brightness modules – 700cd/m^2



Formats

CHARACTER	
1 x 16	6 x 40
1 x 22	8 x 32
2 x 16	12 x 40
4 x 16	

GRAPHIC	
16 x 101	128 x 256
16 x 135	200 x 640
96 x 192	350 x 720
96 x 240	400 x 640



Custom Modules

- Integrate a display with other front panel components. Densitron can build to your specifications.

Value-added Capability

- Steamline production with a display tailored to your assembly. Densitron can add cables, connectors and other accessories to your displays in a cost-effective manner.

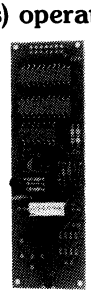
Controllers for Graphic Modules

- Small graphic LCD modules (≤128 lines) have an optional 8-bit parallel controller.
- Large graphic LCD modules (≥200 lines) can be controlled by IBM PC* compatible interface cards.
- Large graphic Plasma and LCDs have terminal emulation controllers available.
- Consult Densitron for more information.

**IBM PC is a registered trademark of International Business Machines.*

RS232 Interface Card for LCDs

- Operates with all character modules and small graphic modules (≤128 lines) operated in the alphanumeric mode
- Permits **remote operation**
- Facilitates hook-up – **no other hardware required**
- Software controllable backlight
- **Options include:**
  On-board EL lamp inverter
  Contrast adjustment
  –5VDC supply



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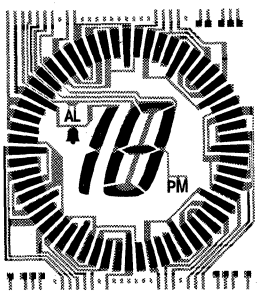
CUSTOM DISPLAYS

WITH CUSTOM DESIGN SUPPORT

Display graphics are limited only by your imagination.

Liquid crystal technology is ideal for creative visual displays of all kinds. Our engineers can help you design indicators which are alpha, numeric, pictorial or any combination of these. Discuss your ideas with our friendly engineers—we'll help you create the display you have in mind.

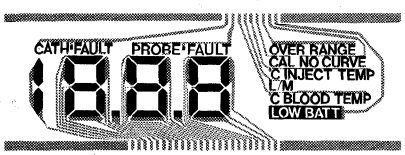


A clock display with digital hours and analog minutes.

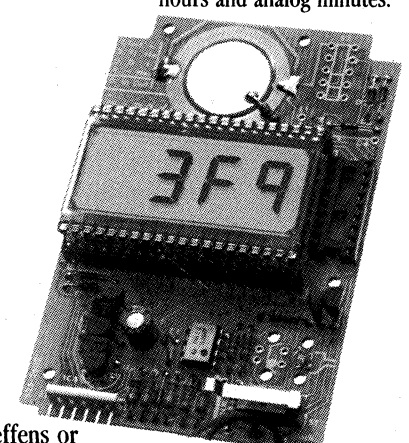
Advanced LCD technology

DCI uses the latest production methods and fabrication techniques to produce displays with:

- Wide Temperature Range
- Excellent visual Contrast
- Broad viewing angle
- Low power consumption
- High Reliability
- Tremendous design latitude



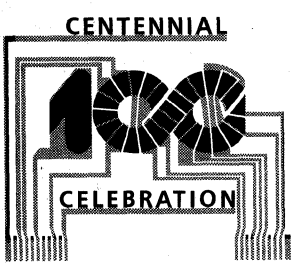
An alpha-numeric instrument display with switchable legends.



Ask us about our turnkey production capability: circuit design, prototype, assembly and packaging.

Specification experts

Whether you have defined requirements or only an idea you'll find our engineers ready and able to help. Regardless of how unique, different or unusual your need we can custom-make a display for your application. Call Rob Steffens or Bill Cook at (913) 782-5672 for the support you need.



Use graphic elements for emphasis.

The custom specialists

DCI INCORPORATED

14812 WEST 117TH STREET / OLATHE, KANSAS 66062
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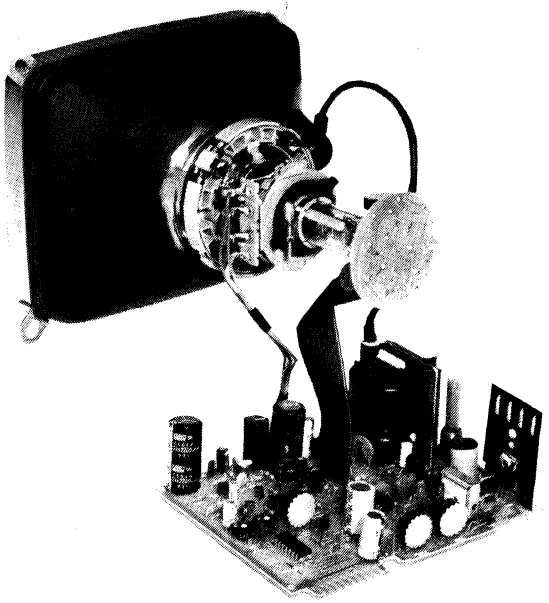

High Performance Monitors For General Purpose And High Resolution Applications

GENERAL DESCRIPTION – Model 300DMX – 90°, 64KHz Monochrome Display Module... from $198*.

State-of-the-art video performance in popular sized 9, 12 and 14 inch, 90 degree CRT monitors.

Exceptional resolution and focus uniformity distinguish these products in the class of full page, high density character displays. Landscape and portrait formats available. Energy efficiencies at high scan rates are unsurpassed by any competitive system. This product line is competitively priced and costs less than many standard 110 degree systems on the market.

Performance

- Resolution at 64KHz:
  - 1250 @ 50 Hz
  - 1040 @ 60 Hz non-interlaced
- Broad Time range: Vertical–40 to 100 Hz
  Horizontal–40 to 70 KHz
- ECL, DAC and multi-Bit video signal inputs full Grey scale display
- BiPolar sync compatibility
- Energy efficient–24VDC power requirement
- Deflection system
  - Compatible with all 90° CRT's
  - Dual axis, dynamic focus correction
  - CRT performance enhanced by elevated operating potentials
  - HV fault sensing auto shutdown
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels. See bipolar sync option.

GENERAL DESCRIPTION – Model 118 DMX–110° Monochrome Display Module... from $125*.

Model 118 is designed for high density, large screen, monochrome applications where superb performance, wide deflection angle CRT's are required. Landscape or portrait formats available.

Performance Characteristics

- Time Base Range: Horiz.; 15 KHz to 35 KHz
  Vert.; 40Hz to 100Hz
- Video System
  - Bandwidth to 50 MHz
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes.
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels.
- Deflection System
  - CRT high acceleration voltage range from 12 to 18KV.
  - Dual axis dynamic focus correction.
  - Linearity 10% or better, horizontal and vertical axis.
  - HV fault sensing auto shutdown.
- System power requirement
  24 VDC at 1.0-1.5 A max.

GENERAL DESCRIPTION – Model 115 – 90°, Monochrome Display Module... from $85*.

Model 115 is a **high performance,** general purpose monitor compatible with the full range of 20mm CRT's. Landscape or portrait formats available.

Performance Characteristics

- Time base range:
  - Vertical: 40-100 Hz
  - Horizontal: 15-40 KHz (see options)
- Sync compatibility
  - Horizontal and vertical are positive edge triggered at TTL levels.
- Video System
  - Bandwidth: 50MHz (min.)
  - Digitally balanced and phase corrected for inverse video display
  - Analog display of multilevel video attributes
  - Discrete dual intensity capability
- Deflection System
  - CRT high acceleration voltage range from 9 to 16KV
  - Linearity 10% or better, horizontal and vertical axis
  - HV fault sensing auto shutdown
- System power requirement
  12-15V DC at 700 mA to 1.5 A max.

Mechanicals

CRT Satellite PCB (circular)
- Model 115DMX 2.0" (50.8mm)
  118DMX 2.1" (53.34mm)
  300DMX 2.1" (53.34mm)

Main Sweep PCB† (rectangular)
- Model 115DMX 5.7" (144.8mm) x 4.55" (114.3mm)
- Model 118DMX 7.00" (77.80mm) x 4.55" (115.57mm)
- Model 300DMX 7.00" (77.80mm) x 4.55" (115.57mm)

Safety

- All models are UL, CSA, DHHS, FCC certifiable

Environmental Specifications

- Operating temperature: 65°C to –20°C
- Storage temperature: 80°C to –55°C
- Operating altitude 30,000 ft. max.

Configurations

- Kit form–Pre-aligned CRT packaged with display electronics circuit (PCB) board
- Chassis assembly–As above with standard or custom sheet metal designs
- Cabinet model–Complete display and power electronics integrated and supplied in a finished housing.

Available Options

- Bipolar sync interface
  Provides buffered sync compatibility to any combination of positive or negative going signals.
- Composite signal interface
  Provides A/D conversion of low level composite sync and video wave forms and adds vertical and horizontal retrace blanking signals
- Low power, auto standby capability
  CRT controller can logic switch monitor to energy conserving (40 mA) standby mode. (Model 115 only)
- CRT options (115 DMX)
  - Data grade 5," 7," 9," 10," 12," and 14" sizes
- CRT options (300 DMX) 9," 12," and 14" sizes
- CRT options (118 DMX)
  - Data grade 12," 15," 17," 19," and 23" sizes
- CRT options–all units
  - High contrast optical enhancements
  - All EIA and special phosphors

Optional Power Supply(s)

- Hybrid single rail switcher
  120/240V AC (selectable), 50/60Hz compatibility
  - Output: single output regulated for 12, 15, 18, or 24 VDC.
- Full range international switcher
  - Input: 90-265 VAC continuous
    Available as single or multiple (4) outputs with up to 120 watts total.
- Additional features:
  - Soft start limits in-rush current
  - Over voltage and current foldback protection
  - Input line filter limits EMI to meet FCC 20780 Class B
  - Holdup time up to 20 nanoseconds power fail
  - High efficiency operation 75-80% typical.

Above specifications represent nominal performance. Please check for current performance capability.

*OEM quantity price for monitor and kit configuration effective Jan. 1988. Prices subject to change. Consult factory.

†The unit can be signal driven through a standard card edge connector or alternately via 10-pin or 20-pin square wire terminals.

COMPUTRON DISPLAY SYSTEMS
A DIVISION OF
XCEL CORPORATION
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845 Bonnie Lane, Elk Grove Village, IL 60007
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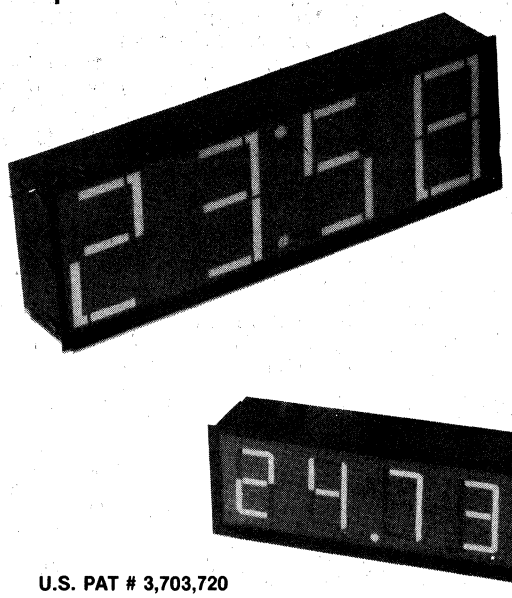
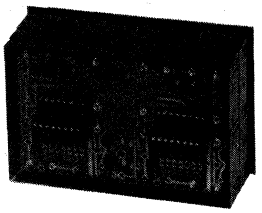
DIO-REY

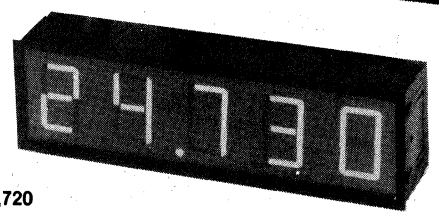
THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

LARGE CHARACTER DIGITAL DISPLAYS



NEW
LOW COST MODELS
WITH **NEW** FEATURES





U.S. PAT # 3,703,720

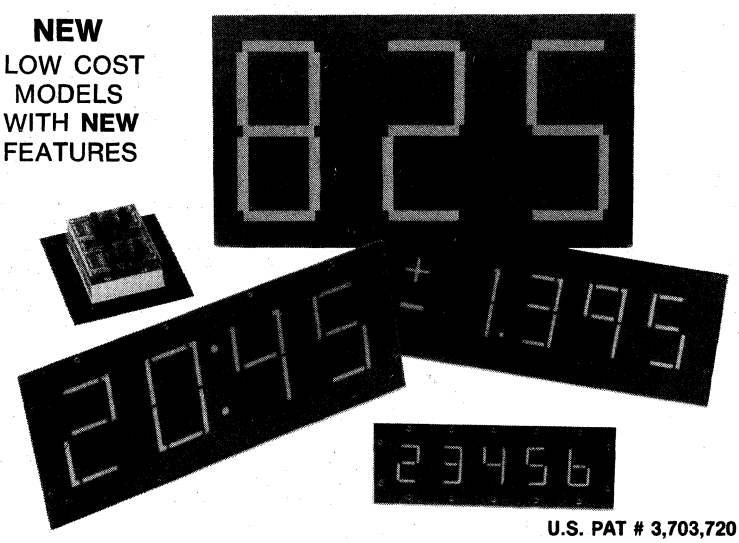
DESIGNER SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68631	1.0 IN.	30 FT.
68632	2.0 IN.	60 FT.
68633	2.8 IN.	85 FT.

FEATURES

- Supplied in attractive, multi-digit assemblies
- Ready to install into rectangular panel cutout
- Assembly includes bezel & anti-glare front panel
- High-Efficiency Red Std; white, amber, yellow, green & blue optional
- Low power: .6 watt/1″ digit; 1.5 watt/2″ digit for LED displays
- TTL or CMOS logic boards are part of assembly—Memory opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Serviced from front without tools
- Logic Socketed; socketed lamps used in incandescent models
- Solderless, plug-in I/O

NEW
LOW COST MODELS
WITH **NEW** FEATURES



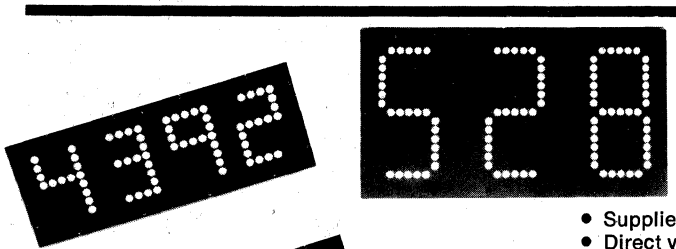
U.S. PAT # 3,703,720

INDUSTRIAL SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68731	1.0 IN.	30 FT.
68732	2.0 IN.	60 FT.
68733	2.8 IN.	85 FT.
68736	5.6 IN.	170 FT.

FEATURES

- Supplied in multi-digit assemblies w/anti-glare front panel
- Flange mounting w/gasket for NEMA environments
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- High-Efficiency Red Std; white, amber, yellow, green & blue opt'l
- ± sign, colons, fixed or floating decimal are standard options
- Logic Socketed; socketed lamps used on incandescent models
- Solderless, plug-in I/O



U.S. PAT # 3,703,720

OUTDOOR SERIES

SERIES	DIGIT HT.	VIEW'G DIST.
68832	2.0 IN.	60 FT.
68833	2.7 IN.	80 FT.
68836	5.5 IN.	150 FT.

FEATURES

- Supplied in 1 to 8 digit assemblies w/anti-glare front panel
- Direct viewed filaments for sunlight or stage light applications
- Flange mounting w/gasket for NEMA environments
- High-Efficiency Red Std for outdoors; amber Std for color camera applications
- TTL or CMOS drive logic boards are part of assembly—Memory opt'l
- ± sign, colons, fixed or floating decimal are options
- All wear parts (lamps and logic) socket mounted
- Solderless, Plug-in I/O

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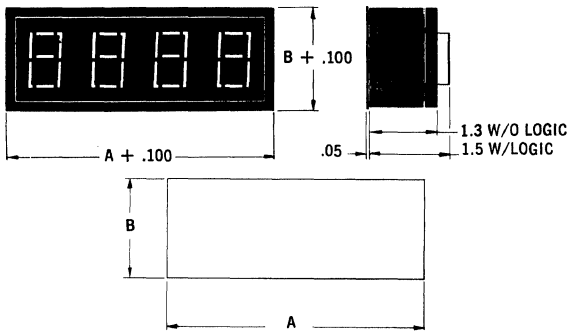
DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

MOUNTING INFORMATION

6863X DESIGNER SERIES

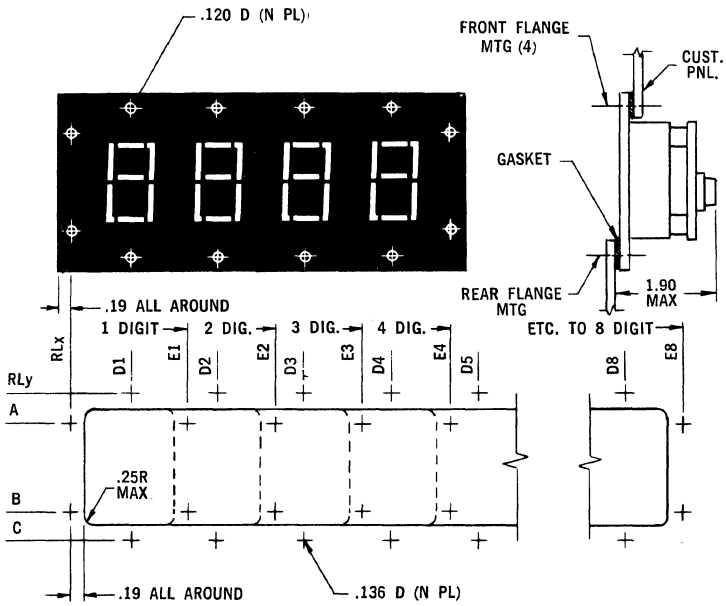


CUTOUT DIMENSIONS
ALL TOLERANCES +.015, −.000

No. of Digits In Assy*	Series 68631 B = 1.630 A	Series 68632 B = 2.380 A	Series 68633 B = 3.130 A
1	1.253	1.629	2.010
2	2.381	3.511	4.650
3	3.509	5.393	7.290
4	4.637	7.275	9.930
5	5.765	9.157	12.570
6	6.893	11.039	15.210
7	8.021	12.921	17.850
8	9.149	14.803	20.490

* ± sign equals one digit

6873X INDUSTRIAL SERIES & 6883X OUTDOOR SERIES



NOTES:

(1) Segments on all OUTDOOR Series are dot type. See photos.

(2) Two dimensions for a given Dim. Code indicate 2 mounting hole locations.

(3) ± sign equals one digit.

(4) Front Flange Mtg available on 2″ & 3″ models only.

CUTOUT DIMENSIONS *ALL DIMENSIONS OFF RLX & RLY*

DIM. CODE (2)	SERIES 68731	68732 & 68832	68733 & 68833	68736 & 68836
A	.375	.750	.750	1.125
				3.375
B	1.500	2.625	3.375	5.625
C	1.875	3.375	4.125	6.750
D1	.750	1.500	1.500	.750
				3.000
D2	1.875	3.375	4.125	5.250
				7.500
D3	3.000	5.250	6.750	9.750
				12.000
D4	4.125	7.125	9.375	14.250
				16.500
D5	5.250	9.000	12.000	18.750
				21.000
D6	6.375	10.875	14.625	23.250
				25.500
D7	7.500	12.750	17.250	27.750
				30.000
D8	8.625	14.625	19.875	32.250
				34.500
E1	1.500	2.625	3.000	3.750
E2	2.625	4.500	5.625	8.250
E3	3.750	6.375	8.250	12.750
E4	4.875	8.250	10.875	17.250
E5	6.000	10.125	13.500	21.750
E6	7.125	12.000	16.125	26.250
E7	8.250	13.875	18.750	30.750
E8	9.375	15.750	21.375	35.250

NO. OF DIGITS	N (Qty. of Mtg. Holes)			
1	6	6	6	10
2	8	8	8	14
3	10	10	10	18
4	12	12	12	22
5	14	14	14	26
6	16	16	16	30
7	18	18	18	34
8	20	20	20	38

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DIO-REY
THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SPECIFYING INFORMATION

GENERATING PART NUMBERS

68X 3X – XX – X X – X – X – X

SERIES
DESIGNER 6
INDUSTRIAL 7
OUTDOOR 8

DIGIT HT.
1″ 1
2″ 2
3″ 3
5½″ 6

LOGIC CODE (SEE TABLE 1)

NO. OF DIGITS

DISPLAY FORMAT
88 ..... 8 A
8.8. ..... .8 B
±88 ..... 8 C
±8.8. ..... .8 D
88:88:88 or 88:88 E
88 ..... 80 F
OTHER F'MATS (4) X

LAMP CODE (SEE TABLE 2)

COLOR FILTER (6)
1 WHITE (3)
2 RED (4)
3 AMBER (7)
4 YELLOW (3) (5)
5 GREEN (3) (5)
6 BLUE (3)

GASKET (1)
O NONE
F FRONT FLANGE MT'G (2)
R REAR FLANGE MT'G

NOTES:
(1) Gasket not available on Designer Series.
(2) Not available on 68X31 (1″) & 68X36 (5½″) Series.
(3) Not available on Outdoor Series.
(4) Std LED Color; Std outdoor color (Incandes't).
(5) Opt'l LED color.
(6) All colors available w/opt'l incandescent lamps.
(7) Std stage lighting and color camera color.

EXAMPLE: A Designer Series with 2″ digits; TTL, BCD to 7-Bar decoder-drivers without leading zero blanking; 3 digits, ± sign and floating decimal point (± 8.8.8 format); 12 volt, red LEDs and red color filter would have part #68632-D1-3D-P12-2-0. If the unit had a single decimal to the left of the least significant digit, it would be called out as: "#68632-D1-3X-P12-2-0; ±88.8 format."

LAMP & DRIVE LOGIC OPTIONS

TABLE 1

LOGIC TYPE	TTL		CMOS W/LATCH MEMORY								CMOS				NONE
LOGIC CODE DASH NO.	-D1	-D2	-M1	-M2	-M3	-M4	-M5	-M6	-M7	-M8	-C1	-C2	-C3	-C4	-00
W/O Lead'g Zero Blank'g	●														W/O LOGIC
W/Lead'g Zero Blank'g		●													
1 Latch Per Digit			●	●	●	●									
1 Latch Per Display							●	●	●	●					
Latch Inactive											●	●	●	●	
Blanking User Driven					●	●			●	●			●	●	
Blanking Inactive			●	●			●	●			●	●			
Test User Driven				●		●		●		●		●		●	
Test Inactive			●		●		●		●		●		●		
Requires External Connections		●					●	●	●	●					
Bridge "T" Condition	R	R	C	R	C	R	C	R	C	R	C	R	C	R	
Bridge "B" Condition	R	(9)	C	C	R	R	C	C	R	R	C	C	R	R	
Bridge "S" Condition	R	(9)	R	R	R	R	R	R	R	R	C	C	C	C	
DIP Plug Cable Type	XPOO		XPMX				XPOO				XPOO				

DISPLAY	0	1	2	3	4	5	6	7	8	9	*	*	*	*	*	
BINARY INPUTS 8	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
1 = High 4	0	0	0	0	1	1	1	1	0	0	0	0	1	1	1	1
0 = Low 2	0	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1
1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1

DRIVE LOGIC NOTES

The 68X31 Series use SN7447A (TTL) or 4511B (CMOS), BCD to 7 Bar decoder drivers. The 68X32, 68X33 & 68X36 Series use SN74LS48 (TTL) or 4511B (CMOS), decoders which drive ULN2003A, 7 channel darlington drivers.

As with all CMOS devices, options with user driven inputs must be switched high or low during operation.

The logic supply current for TTL options is 30ma, typ., per digit except for the 68X31 Series where 55ma per digit is required.

TABLE CODES

* *With CMOS logic options, the display will blank if BCD input is greater than 9.*
● *Has the function.*
Blank *Does not have the function.*
C *Closed.*
R *Open.*

TABLE 2

LAMP TYPE	LAMP CODE	VOLTS (2)	Ma PER LAMP	MAX. AMPS/DIGIT (3) 68631 68731	68632 68732	68832	68733	68833	68736 68836	AVG. LIFE (K HRS.)
RED LED	P5/P12(7)	5.0/12.0(6)	25	.18	.18(10)		.18(10)		.35	100+
INCAN-DESCENT	J1	5.0	60	.42	.84		.84		1.26	10(5)
	K1(4)	12.0	39	.27	.54	.70	.54	.97	.82	10(5)

NOTES:
(1) Use with High Efficiency Red only.
(2) Input DC volts to lamp drivers.
(3) With figure 8 displayed.
(4) Use with all 6883X Outdoor Series.
(5) Reducing voltage by 6% doubles life.
(6) 5 V req'd for 1″ model; 12 V req'd for 2″, 3″ & 5½″ models.
(7) For 1″ models w/ CMOS Decoders, lamp code is ZP5.
(8) Std LED orientation for 2″, 3″ & 5½″ is common anode. Common cathode opt'l. CC & CA are std for 1″.
(9) See DISPLAY/DIP PLUG CABLE SCHEMATIC.
(10) A 5V regulator for logic power is optional on units with 12V lamps.

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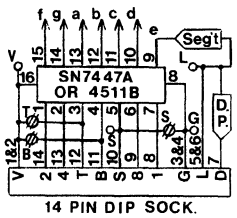
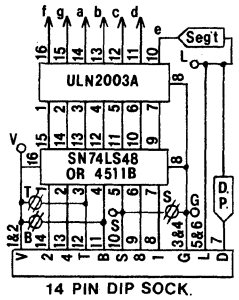
NUMERIC SCHEMATICS
ALPHA NUMERICS

1"
68631 & 68731 SERIES



2", 3", and 5½"
68632, 68732, 68633
68733 & 68736 SERIES



DRIVE LOGIC TERMINAL DESIGNATIONS

— FUNCTION —

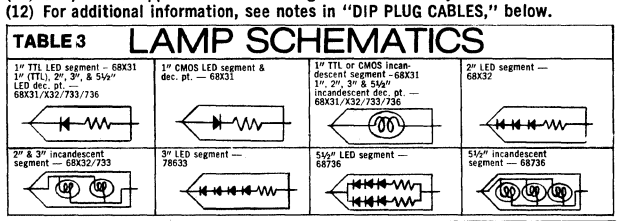
TERMINAL CODE	TTL (1) (68X3X-DX Series)	CMOS (3) (8) (68X3X-CX & -MX Series)
1, 2, 4 & 8	BCD INPUTS	BCD INPUTS
B	BLANKING INPUT (2)(6)	BLANKING INPUT (4) (6)
D	DECIMAL POINT (10)	DECIMAL POINT (10)
G	GROUND	GROUND
L	LAMP POS. COMM.	LAMP COMM. (5)
S	NONE	LATCH (11)
T	LAMP TEST (6)	LAMP TEST (4) (6)
V	LOGIC POS.	LOGIC POS.

DRIVE LOGIC SCHEMATICS

The 1" LED display is supplied w/comm. anode for TTL decoders or comm. cathode for CMOS decoders. Common anode LED's are used in 2", 3", and 5½" units with either type of logic because the ULN2003A, 7 channel, Darlington driver is employed. — TTL or 5V CMOS logic is Std. for 1" displays; 12V CMOS is opt'l. TTL or 5-15V CMOS logic is standard for the 2", 3", 5½". Latch memory is Std. on all CMOS displays. The schematics for the various lamps used in all the indoor series are shown in Table 3. Consult factory for outdoor lamp schematics. The Std termination for each digit is a 14 pin DIP socket. This I/Os the BCD, logic & lamp power, and, when specified, strobe, blanking, lamp test & decimal point. Additional connection points for logic & lamp power, strobe & decimal point are provided on the drive logic board for applications requiring larger power lines or separate strobe &/or decimal point inputs (-M1 thru -M4). The L, V & G lines are bussed for all digits on ea. P.C. Bd.

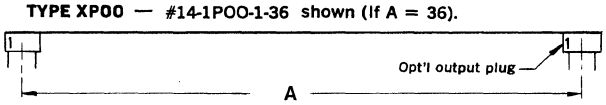
NOTES: (1) See specifications of SN7447A or SN74LS48 for details.
(2) Not available if leading zero suppression is specified.
(3) See specifications of 4511B for details.
(4) The T and/or B inputs are strapped high for CMOS logic options calling for inactive test or blanking.
(5) Positive EXCEPT for 68X31-CX & 68X31-MX where L is Gnd.
(6) Test & Blanking are active low functions if specified "User Driven."
(7) Regulated power supplies recommended for lamps & logic.
(8) Handle CMOS logic at a conductive work station until wired into system.
(9) For ± sign: BCD 7 = +, BCD 6 = − (Control w/1 bit; Strap 2 & 4 bits high & 8 bit low.)
(10) Dec. pts. & colons are user driven thru term'l D. Connect D to G on all series except 1" w/CMOS where D goes to V.
(11) S input is strapped low for CMOS logic without memory.
(12) For additional information, see notes in "DIP PLUG CABLES," below.

TABLE 3 LAMP SCHEMATICS

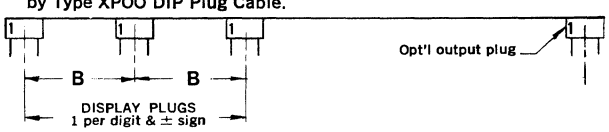


DIP PLUG CABLES

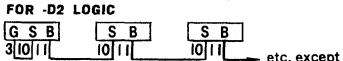
TYPE XP00 — #14-1P00-1-36 shown (If A = 36).



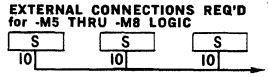
TYPE XPMX — #14-2PM1-3-24 shown (For 1" & 2" Displays; A = 24"; B = 2"). Strobe &/or Dec. Pt. connections will be made by Type XP00 DIP Plug Cable.



EXTERNAL CONNECTIONS REQ'D FOR -D2 LOGIC



EXTERNAL CONNECTIONS REQ'D for -M5 THRU -M8 LOGIC



STANDARD INTERFACE CABLES

Interface Type	Cable Type
820 Serial Receiver	14-XPMX-X-XX (1) 14-XP00-1-XX (2)
821 A/D Converter	14-XP00-1-XX
822 Decade Counter	14-XP00-1-XX
823 Clocks & Timers	14-XP00-1-XX

(1) For data & power (2) For Strobes

WIRE LIST/COLOR CODE

COLOR/LINE #	PIN #	FUNCT'N
Brown 1	Pin 14	BCD 2
Red 2	Pin 1	V
Orange 3	Pin 13	BCD 4
Yellow 4	Pin 2	V
Green 5	Pin 12	T
Blue 6	Pin 3	G
Violet 7	Pin 11	B
Gray 8	Pin 4	G
White 9	Pin 10	S
Black 10	Pin 5	L
Brown 11	Pin 9	BCD 8
Red 12	Pin 6	L
Orange 13	Pin 8	BCD 1
Yellow 14	Pin 7	D.P.

Using type XP00 & XPMX DIP Plug Cables will simplify the installation of the 68X3X Series Displays. This leads to lower installed cost & ease of servicing. They include 14 pin DIP plugs to mate with the drive logic board & optional output plugs, assembled to color coded flat cable (See Table).

EXTERNAL CONNECTIONS IN XP00 & XPMX DIP PLUG CABLES

-D2 Logic Code (XP00 Plug Cable) For -D2 Logic Code (Leading zero blanking): Strap S term'l of MSD(1) to G (If -D2 Logic Code is specified for display this has been done by closing Bridge S). The B line of the MSD(1) is connected to the S line of the next LSD(1). This B to S connection is repeated on the following digits except the LSD(1) of the display assembly (If -D2 Logic Code is specified for 2" or 3" displays, Solder Bridges Z are closed between all digits except the last two LSDs).— See schematic "External Connections Req'd for -D2 Logic," to the left.)

-M5 thru -M8 Logic Codes (XP00 Plug Cable) Buss the S Lines from ea. digit (2).

-M1 thru -M4 Logic Codes (XPMX Plug Cable) As supplied, pins 10 (S) & 7 (D) are removed from all the plugs in these cable assy's. Strobe &/or dec. pts. may be brought out by #14-1P00-XX.

(1) MSD = Most significant digit (L.H. digit); LSD = Least significant digit (R.H. digit).
(2) Naturally, all V lines, G lines & L lines should be bussed to facilitate powering the display. If the T &/or B functions are user driven, they should be bussed also.

GENERATING PART NUMBERS

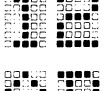
14-XPXX-X-XX

Single Ended	1	
Double Ended	2	
Multidrop, 1" & 2" (1)(3)	M1	
Multidrop, 3" & 5½" (1)(3)	M3	
Single Drop (2)	00	

A Dimension (Inches) (3)
Number of Display Plugs (4)

Notes: (1) For -M1 thru -M4 logic codes. (2) For -D1, -D2, M5 thru M8 & C1 thru C4 logic codes. (3) B = 2" for 1" & 2" displays; B = 4⅝" for 3" & 5½"displays. (4) ± Sign counts as one digit.

ALPHANUMERICS — 0.7", 2.0" & 4.0" 5 x 7 DOT MATRIX



84040 SERIES, 0.7" LED

Features an on-board, 7 bit, TTL latch, character generator & LED drive circuitry, as well as a four level brightness control & lamp test. It will display a 96 character ASCII repetoire. Power is 5 volt at 200ma max. Available in orange & green with 500ucd brightness. Micro-processor buss compatible & can interface with Dio-Rey's 820 Series ASCII Serial Receivers (up to 16 characters can be driven by one 820 receiver)*. The characters may be stacked horizontally on .7" centers. Loading data: The desired data and chip enable should be present & stable during a write pulse. No sync is necessary & character will continue to be displayed until replaced with another. Multi-character units supplied (16 character Std.).
*See SYSTEM INTERFACES on following page.

84042 SERIES, 2.0" LED & 84044 SERIES, 4.0" LED

Complete multi-character units (18 character units are Std.) can be supplied to meet a wide variety of applications. They can be supplied in NEMA or Designer enclosures. Alternately, the hardware can be supplied bare, ready for user mounting. Included in the unit: Serial ASCII current loop receiver (300 to 1200 baud); Character generator and display driver; Optional display controller which allows various modes of display including direct copy, horizontal scroll, vertical scroll, etc.; All required DC power supplies. Multiple units may be driven off a single data loop with each unit being addressable. Up to 1756 characters can be stored in the memory.— For further information or applications engineering assistance, please contact us or your area representative.

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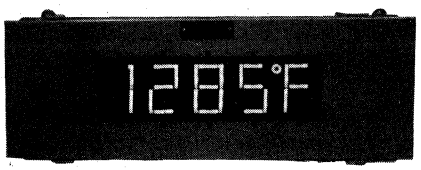
DIGITAL INSTRUMENTS AND SYSTEMS

SERIAL INTERFACE DISPLAYS, DIGITAL METERS, COUNTERS, CLOCKS & TIMERS



GENERAL:

Dio-Rey standard instruments integrate a wide range of display interfaces and power supplies. Whether it be a 6 digit, 5½" high display w/serial interface in a NEMA 12 box or a 2" 4 digit clock in a designer enclosure, Dio-Rey has the unit.

APPLICATIONS

- Analog to digital converters
- Clocks
- Bidirectional counters
- Coil winding counters
- Decade counters
- Event counters
- Pulse counters
- AC/DC ammeters
- AMP-HR meters
- Decibel indicating meters
- Fluid flow meters
- Volt meters
- Ohm meters
- Temperature meters
- Watt meters
- Timers
- Special indicators

FEATURES

- Large, easy to read LED displays for high reliability (1", 2", 3" and 5½")
- Available in rugged Industrial or attractive Designer packages
- Designed for long, trouble-free service
- Suitable for a wide variety of applications
- Serial interface EIA RS422, RS232 or current loop compatible
- Analog to digital interfaces are voltage, current, temperature, load-cell and tachometer compatible
- Counters, clocks and timers in most popular configurations are available
- Powered from 110/220V, 50/60 Hz
- All wear and calibration components easily accessible

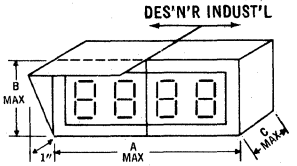
SPECIFICATIONS

- For Displays, see "Large Character Digital Display" spec. sht.
- For Interfaces, see this & next page.
- For Enclosures, see below
- Termination: barrier terminal block std.

CHOOSING A STANDARD ENCLOSURE

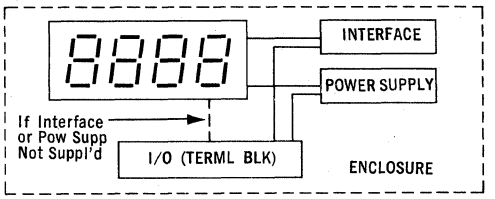
Type	Digit Ht.	No. of Digits*	Enclosure Size (in) A	B	C
Indust'l NEMA 12	1.0"	4 to 8	12	6	6
	2.1"	2 to 5	12	6	6
	3.0"	2 to 4	12	6	6
	5.6"	3 to 5	24	12	12
Des'n'r	2.0"	4 to 6	12¾	6⅛	6
	3.0"	2 to 4	12¾	6⅛	6
	3.0"	5 to 6	18¼	7	8
	5.6"	2 to 4	23	10	3

* ± sign counts as one digit



STD FINISH FOR DESIGNER ENCLOSURES IS MATTE BLACK. Std finish for INDUSTRIAL ENCLOSURE: FRONT FACE (WHICH IS A HINGED COVER) IS MATTE BLACK; BALANCE OF ENCLOSURE IS GREY.

BLOCK DIAGRAM



823 SERIES CLOCK & TIMERS

Standard Clock Interfaces are supplied in 4 or 6 digit, 12 or 24 hour formats. Calendar and decimal formats are available. Fast and Slow set inputs are standard; hold is optional.(1) As with the timers, All have BCD outputs compatible with Dio-Rey's Numeric Readouts. Timer interfaces that are available include count up, count down, both with preset options. Switch operation at a specified time optional.

(1) 50/60 Hz and crystal oscillation time bases are optional as are master/slave systems.

Part Number	Interface Code	Description
823-1	—61	4/6 Digit, 12 Hr Clock
823-2	—62	4/6 Digit, 24 Hr Clock
823-3	—63	Up Timer
823-4	—64	Down Timer

GENERATING PART NUMBERS

88X 3X — XX — XX — X

ENCLOSURE TYPE
DESIGNER 6
INDUSTRIAL 7

DIGIT HT.
1.0" 1
2.1" 2
3.0" 3
5.6" 6

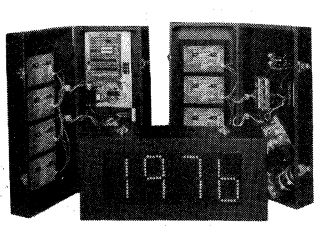
POWER
1 110V, 60 Hz
2 220V, 60 Hz
3 220V, 50 Hz

INTERFACE CODE
SEE TABLES ON THIS & NEXT PAGE

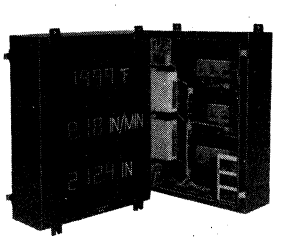
NO. OF DIGITS & FORMAT
SEE "GENERATING PART NUMBERS" IN "LARGE CHARACTER DIGITAL DISPLAY" SPEC. SHTS.

EXAMPLE: A 4 digit, 3"; designer unit w/serial RS232 receiver having 110V, 60 Hz power would have pt. no. 88633-4A-11-1.

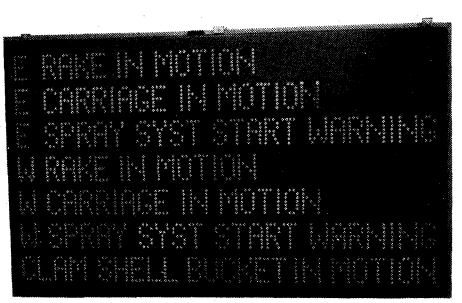
SPECIAL NUMERIC & ALPHA NUMERIC DISPLAY SYSTEMS



Laddle Wt meter (5½")



Laddle temp/cast feed/cast length digital instrument unit for metal slab casting plant (3")



If you have a special requirement for lighted displays, please call us for applications engineering assistance. — We will be happy to help you.

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DIO-REY

THE LIGHTED DISPLAY DIVISION OF
INFO-LITE CORPORATION

SYSTEM INTERFACES POWER SUPPLIES

GENERAL

DIO-REY has developed a wide variety of standard system interfaces for its numeric/alphanumeric redouts and lighted indicator/annunciators. These are the result of over 18 years experience in serving a broad spectrum of industries including instrumentation process control, communications, metals, chemicals, data processing, agriculture, security, office equipment, petroleum, auto, aerospace, textile, packaging, paper, transportation, governmental agencies and military.

These products may also be used in systems which do not require displays. In addition, custom interface electronics, designed to perform outside the specifications or capabilities of our standard units are available. Contact our sales department for technical application assistance.

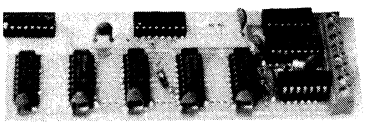
821 SERIES ANALOG TO DIGITAL CONVERTERS

The DIO-REY 821 Series are bipolar A/D's with up to 4½ digit output capacity • BCD output ranges are: ±1999, ±3999, ±19999 and ±3999.

All feature state-of-the-art technology at competitive cost • Input impedance >100 mΩ • Common mode rejection is 110 dB for DC; 90 dB for AC • Accuracy is ±0.05%, ±1 count • Auto zero and zero offset available • Ranging and zero adjustments conveniently located • 5 VDC and 110/220, 47-500 Hz input, depending on model • −10°C to +65°C; 0-90% RH non-condensing operating environment • ½" LED display available • 100 K hr MTBF.

Part Number	Interface Code	Range	Input Power 5 VDC	Input Power 110/220 VAC
821-1	—21	±1.999V	●	
821-2	—22	±199.9V	●	
821-3	—23	±20.0 mA	●	●
821-4	—24	±20.00 mA	●	●
821-5	—25	4.0-20.0 mA	●	●
821-6	—26	4.00-20.00 mA	●	●
821-7	—27	10.0-50.0 mA	●	●
821-8	—28	10.00-50.00 mA	●	●
821-9	—29	±1.999 mV		●
821-10	—30	±1999 mV		●
821-11	—31	±3.999 mV		●
821-12	—32	±3999 mV		●

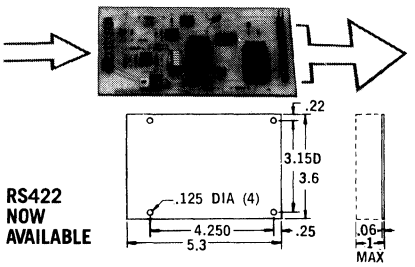
822 SERIES DECADE COUNTERS



Stds available up to 5 decades, opt'l units available up to 10 decades. This series of counters includes Up, Down, Bi-Directional and Presetable (or combinations of these) units. All have TTL BCD outputs, compatible with DIO-REY displays. — Reset, count and power (5 VDC) are brought in via a terminal block. Outputs terminate through a header.

Part Number	Interface Code	X = No. of decades Description
822-X-1	—41	X Decade, Up Counter
822-X-2	—42	X Decade, Down Counter
822-X-3	—43	X Decade, Up-Down Counter
822-X-4	—44	X Decade, Present Up Counter
822-X-5	—45	X Decade, Preset Down Counter
822-X-6	—46	X Decade, Preset Up-Down Counter

820C SERIES SERIAL ASCII INTERFACES



RS422 NOW AVAILABLE

The DIO-REY 820 Series Serial to Parallel and Parallel to Serial Converters are microprocessor based and are primarily intended for driving remote display decoders.

The input to the 820 Receiver is a Serial ASCII coded data stream at either RS232 or current loop levels. The 820 Receiver automatically adapts itself to incoming data rates over the range of 110 to 1200 baud. In addition it features a six position DIP switch which allows selective addressing of up to 64 separate receivers on one data link. The output of the receiver is six bits of data and sixteen strobe lines. The receiver, therefore, can drive either sixteen numeric or alphanumeric displays per receiver or up to 96 points in an annunciator system.

An array of sixteen, 6-bit registers may be sequentially inputed to the 820 Transmitter and converted to a serial output, for annunciator systems.

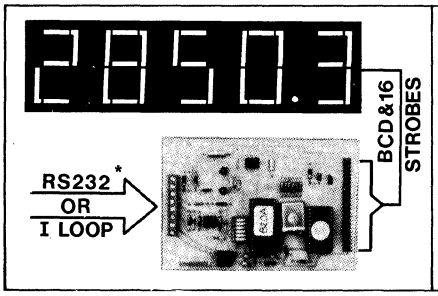
Part Number	Interface Code	Description	Transmission Mode
820-1**	—11	Serial ASCII Data Receiver	EIA RS232 110-1200 Baud
820-2	—12	Serial ASCII Data Receiver	Current Loop 110-1200 Baud
820-5/6**	—13	Serial ASCII Data Receiver	RS232 or Current Loop 1200-4800 Baud
820-9	—14	Serial ASCII Data Receiver	RS422

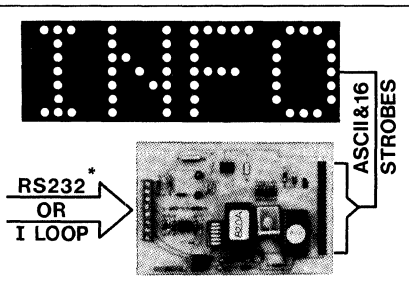
**Available w/ serial repeater circuit and voltage inverter.

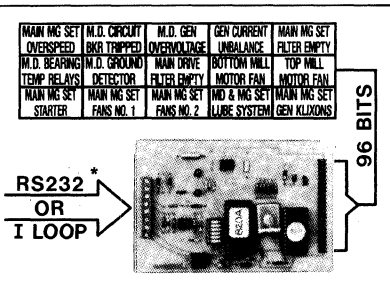
SERIAL ASCII RECEIVERS & TRANSMITTERS

FOR REMOTE DISPLAYS. CONTROLS & TELEMETRY

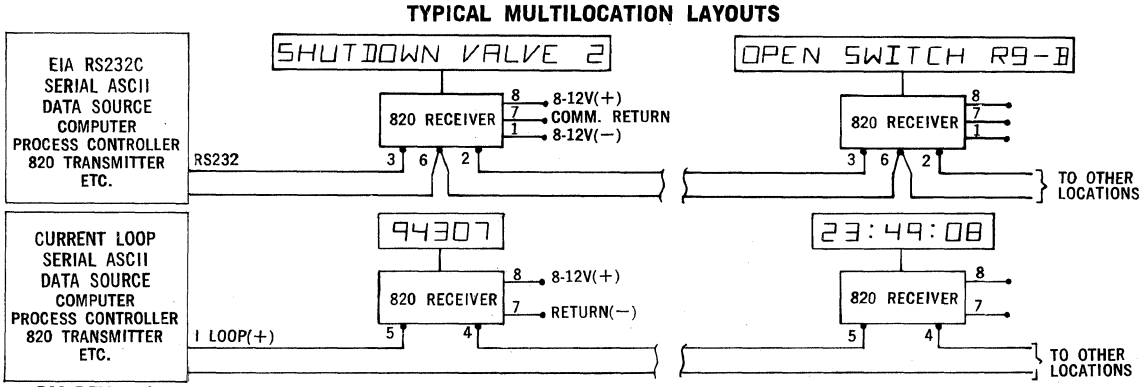
*RS422 NOW AVAILABLE







TYPICAL MULTILOCATION LAYOUTS



DIO-REY • Div. of INFO-LITE, CORP. • 422 Cliff Street • Fairview, NJ 07022 • (201) 941-4455 • FAX (201) 941-4919

"LINKS BETWEEN MAN AND MACHINE"

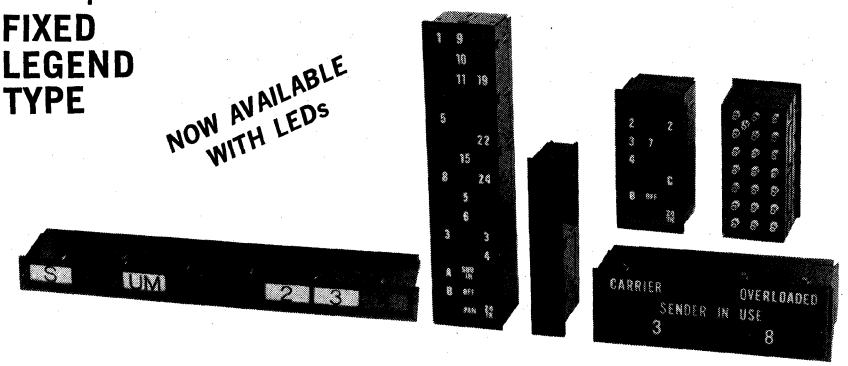
DIO-REY

THE LIGHTED DISPLAY DIVISION OF INFO-LITE CORPORATION

LIGHTED INDICATORS AND ANNUNCIATORS

FIXED LEGEND TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

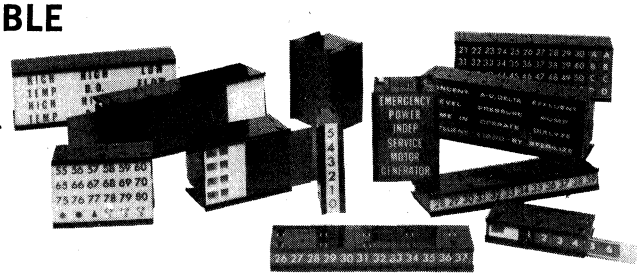
Series	Indicator Module Size	Series	Indicator Module Size
68811	3/8" x 3/8"	68822	3/4" x 3/4"
68812	3/8" x 3/4"	68823	3/4" x 1 1/8"
68813	3/8" x 1 1/8"	68824	3/4" x 1 1/2"
68814	3/8" x 1 1/2"	Special	Any size on 3/8" Grid

Any group of messages/symbols can be displayed in any combination of colors

- Construction is modular
- Front panel graphics are back lighted using LEDS — STD MFB T1 3/4 lamps also available
- Units are supplied in an attractive package with bezel and "Black-Out" front panel, ready to snap into rectangular panel cutout
- Lamp common reduces installation time
- Serviced from the front
- Lamp drivers and special logic available

RELEGENDABLE TYPE

NOW AVAILABLE WITH LEDs



U.S. PAT #3,703,720

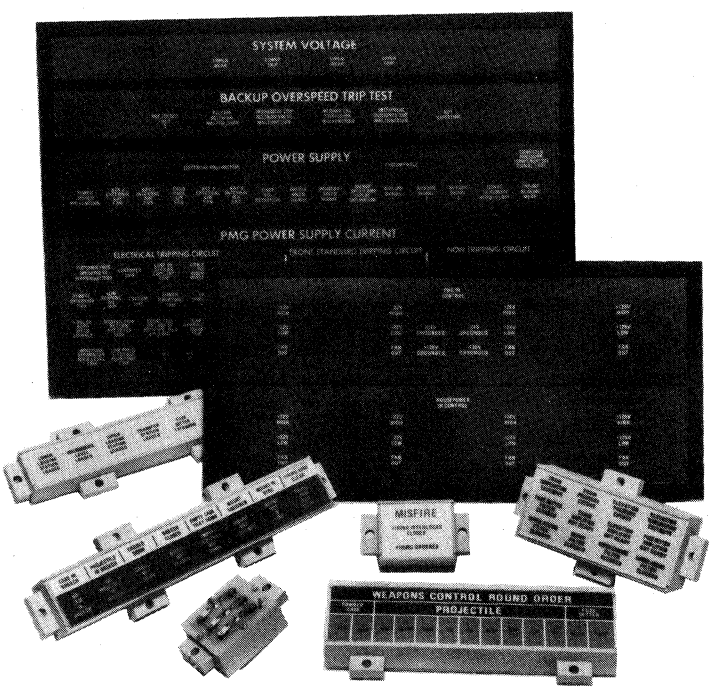
Series	68911	68912	68914
Indicator Module Size	3/8" x 3/8"	3/8" x 3/4"	3/8" x 1 1/2"

For applications where the legend or graphics must be able to be changed

- Same features as the FIXED LEGEND TYPE
- Can be supplied with photographic film legend
- Relegendable from front
- Six standard color filters
- Twenty-three standard units with from 2 to 48 indicator modules
- Special assemblies available

74000 SERIES CUSTOM UNITS

ANNUNCIATORS • STATUS DISPLAYS • BACK LIGHTED INDICATORS PANELS • MAP/FLOW DISPLAYS • DEAD FRONT PANELS



Units shown include status displays for power generating station & military fire control system. Many other configurations have been supplied for applications such as: Industrial process control, security systems, automated machine control, chemical/petroleum/textile flow indicators, steel/aluminum plant condition displays, banking system displays, medical instrument displays, communication network indicators and data processing/computer system communication.

Dio-Rey's back lighted displays are now available with either LEDs and/or incandescent light sources. They provide design flexibility and attractive appearance usually associated with expensive custom units. Dio-Rey allows you to choose the size, shape, color, legend and intensity combination that will meet your requirements. Color filters, special legends and masks are supplied to meet customer specifications. As well as having a standard line, we have supplied a wide range of hardware designed to meet special requirements. Contact us to discuss your specific needs.

FEATURES

- Available with standard LED and/or incandescent light source
- Sizes range from several square inches to square yards
- Fixed legends may be screened in one or more colors
- Can be supplied to endure severe environments (NEM4 or MIL-E-5400 and MIL-STD-202)
- Special units with any group of messages/symbols may be displayed in any combination of colors
- Units are supplied in an attractive package with bezel
- Front panel options include: "black out," clear, high efficiency red, amber or green. Lampdrivers/flashers and annunciator logic is available
- All incandescent lamps are socket mounted to ease servicing
- Termination options include: terminal block, header, connector-harness, taper pin and solder terminal

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"LINKS BETWEEN MAN AND MACHINE"

SMART FORCE™ INVERTERS

for electroluminescent lamps

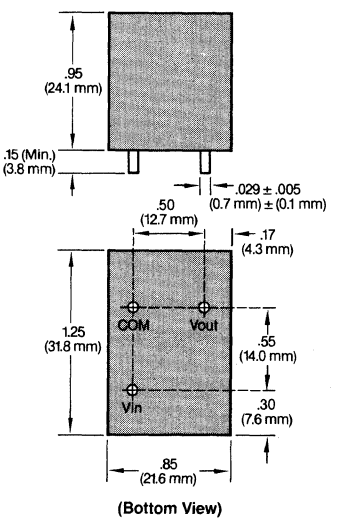
From Endicott Research Group, Inc.!

ERG Smart Force™ DC-AC Inverters compensate for the aging characteristics (brightness loss over time) of electroluminescent (EL) phosphors to improve EL lamp life! (See "Initial brightness vs. Time" graph below.) Automatically adapt their own voltage and frequency over the course of EL lamp life to deliver near constant power output.

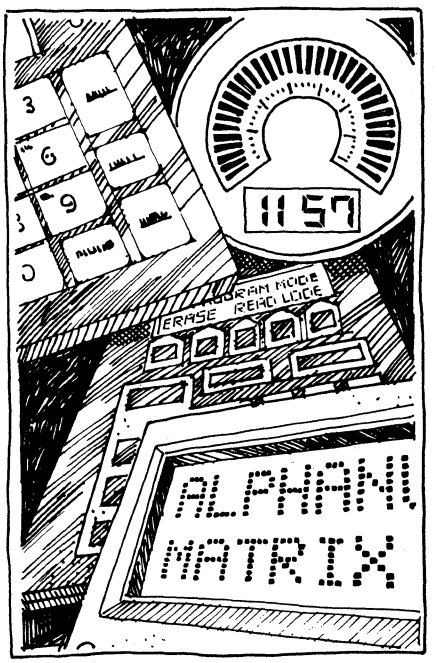
Applications:
• Backlight LCDs, membrane switches, dead front panels, legends *and* decorative trim; • Discharge latent images in copy machines; • Power emergency signage, exit signs, POP displays, novelty lighting, etc., from Low DC Voltages!

Miniaturized "P" Package Available Now!

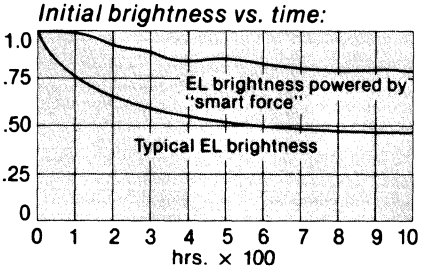
"H" Package Series Ideal for Larger EL Lamps



(Bottom View)



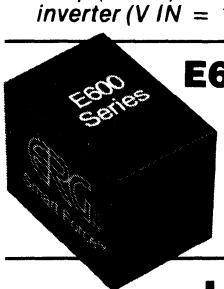
Initial brightness vs. time:



Luminescent Systems #20014-2 EL lamp (16 IN²) and ERG E613 - E0003 inverter (V IN = 12V).

General Specifications:

Input: 3, 5, 6, 9, 12, 15, 18, 24, 28 VDC (your choice)
Output: 60 - 130V RMS @ 400 - 700 Hz. nom.
Package: Nylon, epoxy filled
Mounting: PCB Mount standard
Size: 1.25" x .85" x .95" high
Temp. Range:
Operating: -25°C to +85°C
Storage: -40°C to +100°C
Weight: 30 gms. (Approx.)

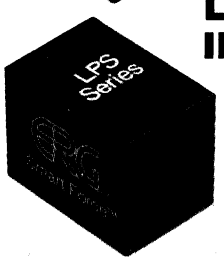


E600 SERIES

From $8.95 ea. (Qty. 1 - 9)

Our E600 Series Inverter has met the economy and reliability needs of the auto industry. Now we can tailor EL power to your needs! To help us determine what inverter suits your application, let us know: 1) input voltage; 2) lamp surface area to be excited; 3) brightness level desired (low, medium, high); 4) lamp operating life; 5) type and brand of EL phosphors; 6) number of EL segments, and 7) application.

Use our E600 Inverters to power JKL Micro-Lume mini-fluorescent lamps, including Model #BF659-01! ***Call factory for free circuit diagram and other product data!***



LPS SERIES INVERTERS

From $6.95 ea. (Qty. 1 - 9)

...TAKE THE GUESSWORK OUT OF MATCHING EL LAMPS AND DRIVERS!

Looking at EL Lamps as lossy, light-emitting capacitors (LECs), LPS Inverters are designed to power conventional foil-construction lamps of a given area to specified brightness level (low, medium, high). As a result, it is now possible for the engineer to specify and purchase a standard Smart Force Inverter for applications incorporating lamps from virtually all "foil" lamp manufacturers.

The LPS is a clearly specified DC-AC Inverter with a wide tolerance to both input voltage swings and loading. LPS units are designed to power up to approximately 60 square inches of foil-type EL lamp from a wide variety of commonly available low DC-voltage inputs.

Free Data Packet contains LPS Series specifications & EL Source List to help you source EL Lamps, LCDs, membrane switches, etc. Call today!

Also see our pages in EEM, Sec. 4000, Power Supplies DC.

To expedite smaller orders (up to $250) we welcome credit card purchases. VISA MasterCard

Specifications subject to change without notice.

Endicott Research Group, Inc.
2601 Wayne Street, P.O. Box 269, Endicott NY 13760
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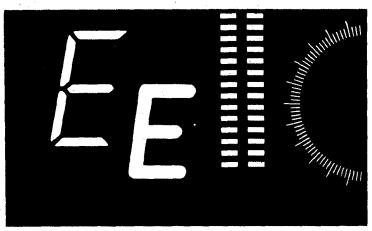
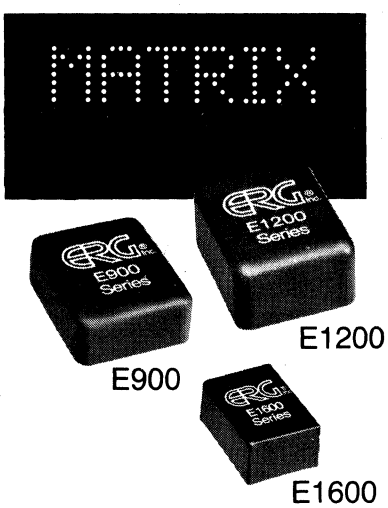
Power your displays —

DC-DC converters for Gas Discharge Displays up to 25W



Made in U.S.A.

Convert low DC line voltage to the higher voltage levels required to activate multi-segment plasma gas discharge displays (including bar graphs). ERG Converters eliminate need for 200–250V DC line.



General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700U	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) max. high	30 gms.	Plastic
E700R (Regulated)	5,9,12,15 V DC standard (to 48 available)	Up to 3W regulated (e.g. 200 V DC @ 15 ma)	1.43" (36.32 mm) × 1.5" (38.10 mm) × 1.03" (26.16 mm) max. high	40 gms.	Plastic
E500*	5,9,12,15 V DC standard (to 48 available)	Up to 3W unregulated (e.g. 200 V DC @ 15 ma)	1.00" (25.40 mm) × 1.38" (35.05 mm) × 0.70" (17.78 mm) high	20 gms.	Plastic
E1600	5,9,12,15 V DC standard (to 48 available)	Up to 6W unregulated (e.g. 250 V DC @ 24 ma)	1.30" (33.02 mm) × 1.88" (47.75 mm) × 0.82" (20.83 mm) high	44 gms.	Plastic
E900	5,12,15 V DC standard (to 48 available)	Up to 12W total, with single or dual outputs, unregulated; (e.g. Single: 250V DC @ 30 ma Dual: 250V DC @ 30 ma and −16V DC @ up to 200 ma to power the drive electronics in many applications using the Burroughs SELF-SCAN* or IEE* ARGUS displays)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum
E1200	12,15 V DC standard (others to your spec)	Up to 25W unregulated (e.g. 250V DC @ 100 ma)	2" (50.80 mm) × 2.5" (63.50 mm) × 1.19" (30.23 mm) high	185 gms.	Aluminum

*For high-volume requirements, E500 delivers same performance as E700 at significantly lower unit cost!

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 600V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0–70° C. standard. Wider ranges available. 85° C. case max. 25° C. temp. rise typical for E1200

Match our converter to your display

Use this handy chart to find the right ERG converter for your gas discharge display application. Remember, this is just a guideline. Consult the factory if your application requires a series or part number other than shown below! Ask about our expanded Cross Reference Index for gas discharge displays.

All converters below are 12V DC input; other input voltages available.

Mfr.	Mfr.'s Part #	ERG Part #	Mfr.	Mfr.'s Part #	ERG Part #
BABCOCK	SP-101	E712-215U	CHERRY	W-750-2052	E1612-1.835S
BABCOCK	HB-332	E712-215U	CHERRY	WO7-1007	E1612-1.835S
BABCOCK	DP-0216-C1	E1612-1.8540S	DALE	PD-06D040	E512-215U
BABCOCK	DP-16G101-C1	E912-1.8545S	DALE	PD-16A040	E512-215U
BABCOCK	DP-0840-C1	E1212-1.85130	DALE	PD-32A025	E512-215U
BURROUGHS	SSD1000-0030/39	E912-2.530S	DALE	APD-32A025	E1612-2.520S
BURROUGHS	SII0120A0030/39	E1212-2.5100	FUJITSU	FPN060DRUD	E1212-1.510S
BURROUGHS	SII0140A-0030/39	E1612-2.520S	FUJITSU	FPC4012NRPL	E912-1.5560S
BURROUGHS	SII-1240PD	E1212-2.5100	FUJITSU	FPN020DRUD	E1612-1.535S
BURROUGHS	BG16101-2	E712-2.512U	IEE	MAXI 32(16X2) (O)	E1612-1.535S
BURROUGHS	BAF06770	E712-215U	IEE	MAXI 128(32X4) (O)	E912-1.566S
CHERRY	W416-1051	E1612-1.835S	IEE	MINI 480(40X12)(O)	E1212-1.3185
CHERRY	W420-1052	E1612-1.835S	PCPC	RU-32-8RD10(32X8)	E1212-2.5100
CHERRY	W424-1053	E1612-1.835S	PCPC	PC1705-25664DC	E1212-1.85130
CHERRY	W416-1054	E1612-1.835S	THOMSON	TH 7606	E1212-1.00160
CHERRY	W420-1055	E1612-1.835S		NEEDS BOTH	E1212-1.00160
CHERRY	W424-1058	E1612-1.835S	THORN EMI	P157/03-MI.....	E912-2.732S

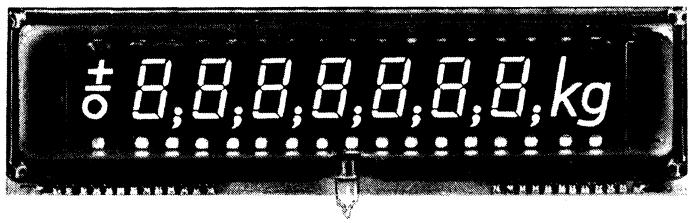
All specifications subject to change without notice.

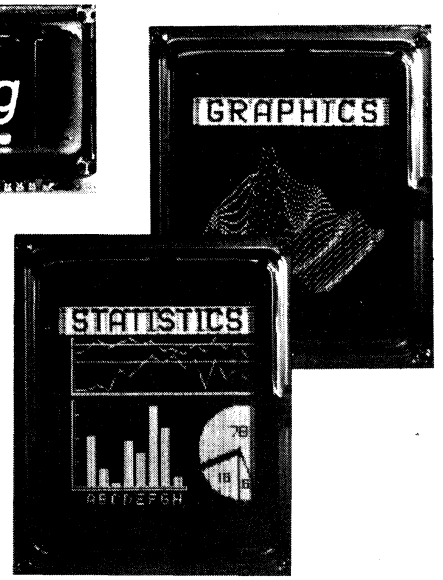
Tell us about your display power needs

- **Custom Designs**
- **Variations for multi-segment, bar graph and dot matrix gas discharge and vacuum fluorescent displays**
- **Inputs from 5V DC to 48V DC (your choice)**
- **Outputs from 5V DC to 1,500V DC (your choice)**
- **Single and dual outputs (up to 25W total)**
- **Regulated and unregulated**
- **Center tap (± voltages)**

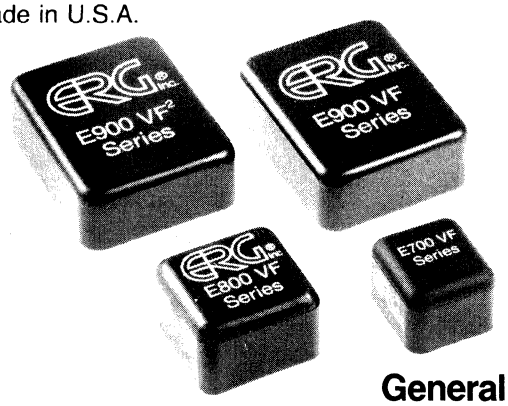
from low DC voltage

DC-DC converters for Vacuum Fluorescent Displays up to 12W





Made in U.S.A.



No need for "special" multiple output power supplies. ERG converters produce both anode and filament voltages for VF displays up to 12W. Compatible with all major VF display makes. Mount on your PC board as needed, where needed.

General Specifications

ERG Converter Series	Input	Output	Size	Weight	Package
E700 VF up to 3W	5, 12V DC (other inputs available.)	DC Anode voltage and Center tap (AC) filament voltage.	1.1" (27.94 mm) × 1.2" (30.48 mm) × .91" (23.11 mm) high	30 gms.	Plastic
E800 VF up to 6W	5, 12V DC (other inputs available.)	Up to 6W max.	1.43" (36.32 mm) × 1.50" (38.10 mm) × 1.03" (26.16 mm) high	40 gms.	Plastic
E900 VF up to 12W	5, 12V DC (other inputs available.)	Up to 12W max. (to 7.5W max. with 5V DC input)	2" (50.80 mm) × 2.5" (63.50 mm) × .98" (24.9 mm) high	122 gms.	Aluminum

Mounting: P.C. board standard
Encapsulation: All ERG converters are fully encapsulated
Isolation (in/out): 300V RMS (60 Hz. breakdown for 1 min.) standard
Temperature: 0-70° C. standard. Wider ranges available. 85° C. case max.

Match our converter to your VF display

Use this handy chart to find the right ERG converter for your VF display application. Remember, this is just a guideline. Consult the factory if your application requires a series or part number other than shown! Ask about our expanded Cross Reference Index for vacuum fluorescent displays.

All converters below are 12V DC input; other input voltages available.

Mfr.	Mfr.'s Part #	ERG Part #	Mfr.	Mfr.'s Part #	ERG Part #
FUTABA	16-SY-O3Z	E712-.24V5.8	NORITAKE	DC40125A	E912-.60100V7.6
FUTABA	5-LY-O1ZL	E712-.26V3.0	NORITAKE	DM256X64A	E912-.8060V7.2
FUTABA	16-MY-O1ZL	E712-.31V6.2	NORITAKE	DM128X128D	E912-.8060V4.0
FUTABA	32-SD-43Z	E712-.30V7.3	NORITAKE	DM64X64B	E912-.7448V4.3
FUTABA	14-LD-O1Z	E712-.31V6.5	NORITAKE	DC440066A	E912-.60V8.8
FUTABA	28-BD-O1Z	E712-.30V5.4	NORITAKE	DC440046A	E912-.60V9.2
FUTABA	16-MD-O2Z	E712-.32V6.1	NORITAKE	DC40026B2	E812-.55V9.0
FUTABA	16-LD-O1Z	E712-.47V7.5	NORITAKE	DC409A2	E712-.55V9.7
NEC	FIP32B5X	E712-.45V6.8	NORITAKE	DC209A2	E712-.35V6.5
NEC	FIP32A9X	E712-.45V6.5	NORITAKE	DC205A2	E712-.42V5.7
NEC	FIP40A5X	E712-.45V8.9	NORITAKE	DC169A2A	E712-.42V4.8
NEC	FIP80A5X	E712-.45V9.0	NORITAKE	FG206A2	E712-.35V6
NEC	FIP14A8T	E712-.135V1.7	NORITAKE	FG166A2	E712-.35V5.3
NEC	FIP16B11X	E712-.35V8.3	NORITAKE	FG326A2	E712-.45V6.8
NEC	FIP16B13R	E712-.47V7.2	NORITAKE	FG108B1	E712-.26V4.8

All specifications subject to change without notice.

Ask about our quadruple output DC-DC converters, capable of powering two dissimilar vacuum fluorescent displays!

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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
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Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
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Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
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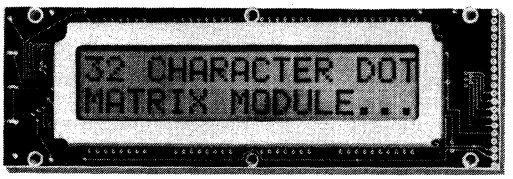
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

REFAC ELECTRONICS DISPLAYS

Intelligent LCD Modules



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0438 LCD Modules

Custom fonts up to 32 segments available in standard 0438 LCD modules. Complete with serial driver, display, PCB, connector, and bezel. Self-contained, compact LCD assemblies with backlighting and wide temperature operation including bar graphs, pictorial annunciators, and indicators.

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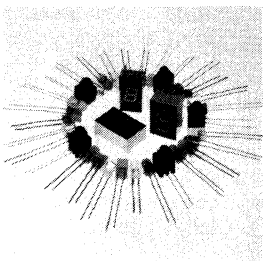

Single and bi-color lamps are 100% electrical tested and designed for more than 100,000 hours' service. Used in automotive, industrial, appliance, and military applications. Plus a broad line of single and multi, seven segment and alpha-numeric displays for automotive, industrial, appliance, and military markets.

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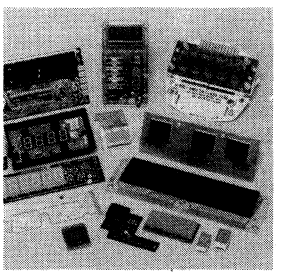
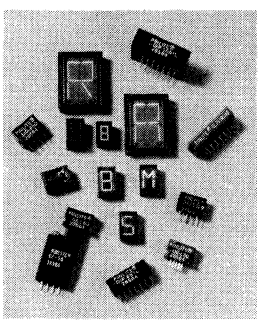
One stop shopping for custom display assemblies of all types, including incandescent, LED, or LCD digits, Display Modules, and associated electronics. For consumer, industrial, and military applications.



Pinlite® Incandescent Displays



Digital and alpha-numeric incandescent displays frequently specified for civil and military aircraft instrumentation. They offer long life, fast response, low voltage, vibration resistance, 9,000 ft./lambert minimum brightness, 120° viewing angle, patented filament arrangement, and direct compatibility with standard TTL driving networks and multiplex circuits.

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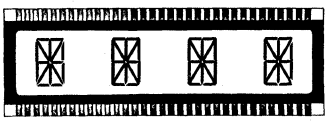
EXCEL EXCELIX LCD Technology International Corp.

Numeric Displays

Excelix LCD Model #	Digit Height (inches)	Display Format	Connector	Glass Size (inches)
3150	0.181	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
3252	0.200	3½ digits, duplex	S.I.L. Elastomer	0.808 x 0.520
6200		6 digits, duplex	D.I.L.	1.500 x 0.600
8200	0.236	8 digits, M/E, triplex	S.I.L. Elastomer	2.090 x 0.690
3250	0.255	3½ digits, direct	D.I.L.	0.808 x 0.509
3313	0.300	3 digits, 5 triangles, triplex	D.I.L.	1.200 x 1.000
8300		8 digits, triplex	D.I.L.	2.750 x 1.100
4300	0.315	4 digits, S, bell, direct	D.I.L.	1.457 x 0.709
4320	0.350	4 digits, direct	D.I.L.	2.000 x 0.900
3401	0.400	3½ digits, direct	S.I.L.	2.500 x 1.100
3450		3½ digits, duplex	S.I.L.	1.960 x 0.950
4400		4 digits, AM, PM, S, bell, direct	D.I.L.	1.960 x 0.950
4451		4½ digits, over-range, direct	D.I.L.	2.005 x 1.200
4455		4½ digits, Lobat, direct	D.I.L.	2.000 x 1.200
5400		5 digits, direct	D.I.L.	2.000 x 1.200
3451	0.433	3½ digits, direct	D.I.L.	1.960 x 0.950
3501	0.500	3½ digits, direct	S.I.L.	2.000 x 1.200
3551		3½ digits, over-range, direct	D.I.L.	2.000 x 1.200
3555		3½ digits, Lobat, direct	D.I.L.	2.000 x 1.200
3557		3½ digits, AM, PM, bell, direct	D.I.L.	2.000 x 1.200
4500		4 digits, direct	D.I.L.	2.000 x 1.200
4500 (M3)		4 digits, triplex	D.I.L.	2.000 x 1.200
6500		6 digits, direct	D.I.L.	2.750 x 1.200
8500		8 digits, direct	D.I.L.	3.695 x 1.200
3452	0.531	3½ digits, AM, PM, AL, bell, direct	D.I.L.	1.960 x 1.079
3751	0.700	3½ digits, over-range, direct	D.I.L.	2.750 x 1.500
4700		4 digits, direct	D.I.L.	2.750 x 1.500
4707		4 digits, PM, direct	S.I.L. Elastomer	3.250 x 1.250
5700		5 digits, direct	D.I.L.	3.200 x 1.500
6700		6 digits, direct	D.I.L.	3.695 x 1.500
31030	1.000	3 digits, direct	D.I.L.	3.695 x 1.800
31051		3½ digits, over-range, direct	D.I.L.	3.695 x 1.800
41000		4 digits, direct	D.I.L.	3.695 x 1.800
41051		4½ digits, over-range, direct	D.I.L.	4.000 x 1.800

Alphanumeric Displays



Excelix LCD Model #	Character Height (in.)	Display Format	Connector	Glass Size (inches)
4540	0.500	4 characters, direct	D.I.L.	3.500 x 1.150
8540		8 characters, triplex	D.I.L.	3.700 x 1.200
12540		12 characters, triplex	D.I.L.	5.750 x 1.200
16540		16 characters, triplex	D.I.L.	7.250 x 1.200
11040	1.000	1 character, direct	S.I.L. Elastomer	1.000 x 1.750

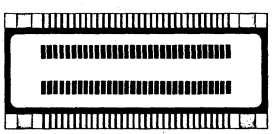
Light Valves

Excelix LCD Model #	Window Size (in.)	Display Format	Connector	Glass Size (inches)
LV001	0.375 x 0.375	1 square, direct	D.I.L.	0.500 x 0.700
LV002	1.800 x 0.700	2 triangles, direct	D.I.L.	2.000 x 1.100
LV003	1.800 x 0.700	1 rectangle, direct	D.I.L.	2.000 x 1.100

Alphanumeric Display Modules

Excelix Model #	Characters x Lines	Character Size W x H (mm.)	Display Area W x H x D (mm.)	Outside Dim. W x H x D (mm.)	Drive Method (duty)	Supply Voltage* Logic/LCD
4040	40 x 4	3.85 x 5.45	191.05 x 33.6	247 x 68 x 12	1/16	+5V +11V
1610	16 x 1	3.15 x 4.45	59.4 x 5.8	84 x 35 x 9.5	1/8	+5V +11V
1620	16 x 2	3.15 x 4.45	59.4 x 12.4	84 x 35 x 9.5	1/16	+5V +11V
4010	40 x 1	3.15 x 4.45	154.5 x 15.8	182 x 33.5 x 12	1/8	+5V +11V
4020	40 x 2	3.15 x 4.45	154.5 x 15.8	182 x 33.5 x 12	1/16	+5V +11V
2410	24 x 1	3.15 x 4.45	93.5 x 15.8	118 x 36 x 12	1/8	+5V +11V
2420	24 x 2	3.15 x 4.45	93.5 x 15.8	118 x 36 x 12	1/16	+5V +11V
4010L	40 x 1	3.15 x 7.9	154.5 x 15.8	182 x 33.5 x 12	1/11	+5V +11V
2040	20 x 4	2.95 x 4.15	76 x 25.2	98 x 60 x 12	1/16	+5V +11V

Bar Graph Displays



Excelix LCD Model #	Bar Height (inches)	Display Format	Connector	Glass Size (inches)
0520	0.156	32 bars x 2 lines, direct	Elastomer	2.750 x 1.200
0620	0.230	9 bars x 2 lines, direct	D.I.L.	1.900 x 1.100
0320	0.300	9 bars x 2 lines, direct	D.I.L.	3.100 x 1.300
01420	1.400	20 bars x 1 line, direct	S.I.L.	5.300 x 1.900

Graphic Display Modules

Excelix Model #	Number of Dots W x H (dots)	Dot Size W x H (mm.)	Display Area W x H (mm.)	Outside Dim. W x H x D (mm.)	Drive Method (duty)	Supply Voltage* Logic/LCD
G101	480 x 64	0.45 x 0.45	239.95 x 31.95	298 x 80 x 11	1/64	+5V +18V
G102	640 x 200	0.31 x 0.45	223.96 x 97.96	270 x 149 x 13	1/100	+5V +18V
G103	480 x 128	0.43 x 0.43	242 x 69	270 x 110 x 11	1/64	+5V +18V
G104	240 x 64	0.48 x 0.48	132 x 39	180 x 75 x 13	1/32	+5V +13V

* Note all LCD voltages are Maximum values.

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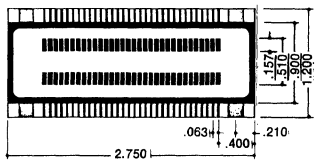
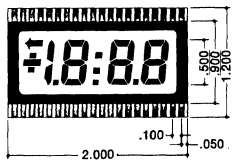
EXCEL Technology International Corp.

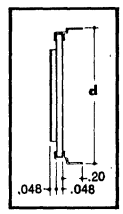
EXCELIX LCD

0520 d = N/A



3551 d = 1.25





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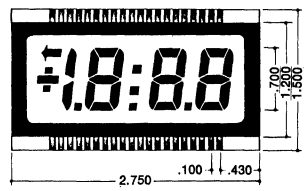
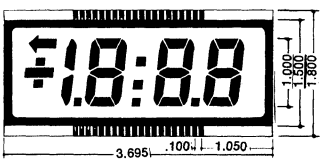
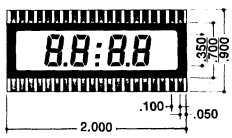


31051 d = 1.85



4320 d = .95



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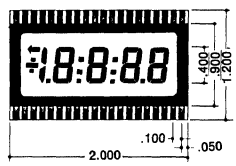

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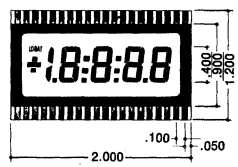

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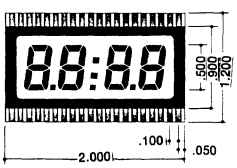

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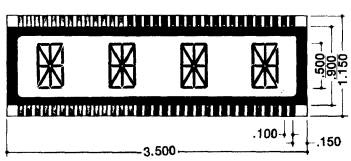

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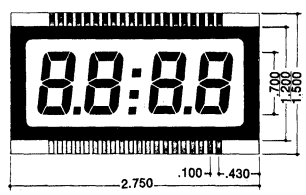

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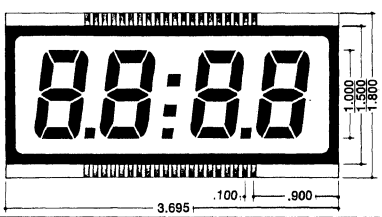
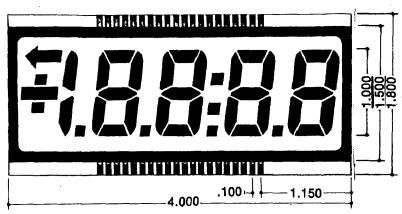


41051 d = 1.85



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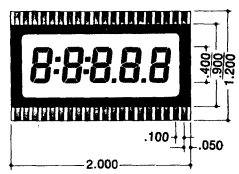

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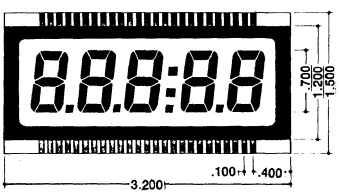

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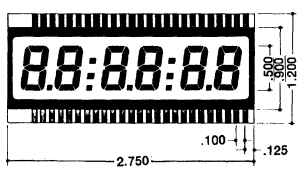

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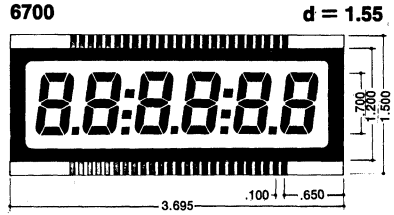

PERFORMANCE SPECIFICATIONS

PARAMETER	UNITS	MIN.	TYP.	MAX.
Operating Voltage	V	3	5	10
Operating Frequency	Hz	30	60	120
Current*	μA		3	10
Capacitance*	pf		3,000	
DC Resistance*	MΩ	20		
Allowable DC Offset	mV			50
Response Times (25°C)				
Rise to 90% ON	ms		30	50
Decay to 10% OFF	ms		50	100
Contrast Ratio			20:1	
Viewing Angle (at 5V)			±75°	
Operating Temp. Range	°C	−30		85
Storage Temp. Range	°C	−30		85
Estimated Life	hrs.		50,000	

* All Segments ON. Specifications are for 3½ digit 0.5″DH LCDs.

ORDERING INFORMATION

□□□□-□□□-□

Excelix Part Number

OPTICAL MODES:
R Reflective
T Transmissive
S Transflective
O No Polarizer

PRINTING MODES:
P Positive Printing (dark segments on light background)
N Negative Printing (light segments on dark background)
O No Polarizer

DEVIATION:
0 Standard, Epoxied Pins 0.100″ center-to-center
1 Snap on Terminal 0.100″ center-to-center
2 No Pins Conductive Pads Up
3 No Pins Conductive Pads Down

POLARIZERS:
H Standard
Q High Humidity*
O No Polarizer

* Q-type polarizer is less bright than H-type.

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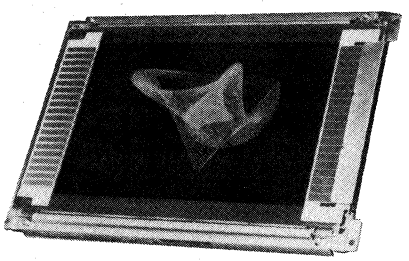
FUJITSU

PLASMA DISPLAY UNIT FPF8050HFUG

(640 x 400 DOT GRAPHIC DISPLAY)



The Fujitsu FPF8050HFUG plasma display unit consists of an AC gas discharge plasma display panel with memory function (bi-stable characteristic) and its driver circuits.

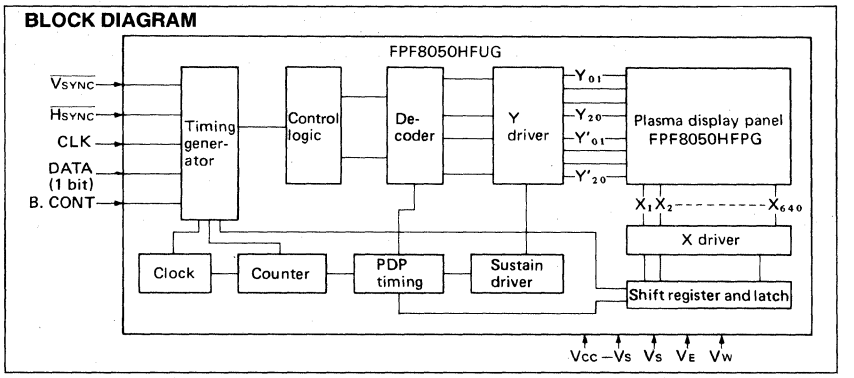
FEATURES

- **Bright, clear display**
  The black-face panel with high brightness gives a clear display even in bright places.
- **Easy-to-use CRT interface**
  This unit can be connected to all types of systems equipped with common CRT interface.
- **Compact panel**
  The higher integration of drive and logic circuits makes the display compact and thin, resulting in a total system that is more compact.
- **No flicker and warp**
  The AC memory panel gives an easy to view display, without flicker and warp.
- **High reliability**
  The unit is reliable because the panel structure employs Fujitsu's unique protective film and the drive and logic circuits are highly integrated.

UNIT SPECIFICATIONS

Display panel — FPF8050HFPG
Number of display dots — 640×400 dots (256,000 dots)
Dot pitch — 0.33mm (0.013in.)×0.33mm(0.013 in.)
Dot size — 0.2mm (0.008 in.) dia.
Effective display area — 132(V) mm (5.197 in.) ×
Dimensions — 211(H) mm (8.307 in.)
Display color — Neon orange
Brightness — 150 cd/m²
Contrast ratio — 20:1 min.
Visual angle — 120° min.
Weight — Approx. 1.5kg (with metal fittings)
Exterior dimensions — See diagram of exterior dimensions

BLOCK DIAGRAM



ABSOLUTE MAXIMUM RATINGS

Item	Symbol	Value	Unit
Sustain voltage 1	V_S	125	V
Sustain voltage 2	$-V_S$	−125	V
Write voltage	V_W	180	V
Erase voltage	V_E	40	V
Logic voltage	V_{CC}	7	V

ENVIRONMENTAL CONDITIONS

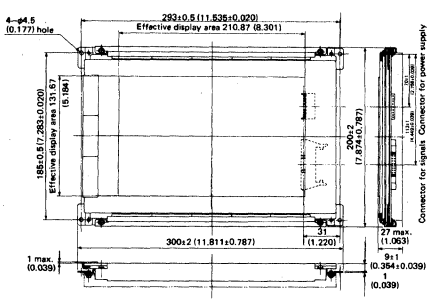
Item	Symbol	Value	Unit
Operating temperature	T_{op}	0 ~ 50	°C
Operating humidity	RH_{op}	20 ~ 80	%
Storage temperature	T_{stg}	−20 ~ 70	°C
Storage humidity	RH_{stg}	20 ~ 85	%
Vibration	V	2	G
Shock	S	40	G
Pressure (non-operating)		340 ~ 1114	mb

INTERFACE

Interface signals (TTL-compatible)

Signal	Symbol	Function
Display data signal	DATA	The serial dot data which is input synchronized with the positive going edge of the clock signal. Dots are lit at logical High and are not lit at logical Low. The diagram below shows the relation between display data and display dots.
Clock signal	CLK	The input signal which controls the input timing of the display data. Dot data is read into the shift register at the positive going edge of the signal. The number of clock signals durig the period H_{SYNC} is 640.
Line synchronous signal	$\overline{H_{SYNC}}$	The input signal which controls the scanning timing of the line-electrode. Address increment to select the next line-electrode is done at the negative going edge of each signal.
Frame synchronous signal	$\overline{V_{SYNC}}$	The input signal which controls the refresh speed of the screen. The scanning position returns to the first line-electrode (home position) at the negative going edge of the $\overline{V_{SYNC}}$
Brightness control signal	B. CONT	The input signal which controls the screen brightness. Brightness is at its maximum at logical H, and is 50% of the maximum at logical L.

EXTERIOR DIMENSIONS



CONNECTOR PIN ASSIGMENT

Connector for signal connections (FCN-605Q016-G/S)

Pin No.	Signal	Pin No.	Signal
1	N.C.	2	N.C.
3	N.C.	4	S. GND
5	DATA	6	S. GND
7	N.C.	8	S. GND
9	$\overline{H_{SYNC}}$	10	S. GND
11	$\overline{V_{SYNC}}$	12	S. GND
13	B. CONT	14	S. GND
15	CLK	16	S. GND

Connector for power supply connections (FCN-815P009-TA)

Pin No.	Signal
1	V_{CC}
2	GND (L)
3	$-V_S$
4	GND (H)
5	$+V_S$
6	V_W
7	N.C.
8	V_E
9	N.C.

Recommended connectors: FCN-813J009-A housing (attached); FCN-813J-T/Q contact for manual use (attached); FNC-813J-T/R contact for automatic use

OPERATION RATINGS (may be changed to improve characteristics)

Item	Symbol	Min.	Typ.		Max.	Unit
Supply voltage 1 for sustain	V_S	80	95	Note 1	110	V
Supply current 1 for sustain (V_S=95V)	I_S	20	75		180	mA
Supply voltage 2 for sustain	$-V_S$	−80	−95	Note 2	−110	V
Supply current 2 for sustain ($-V_S$=−95V)	$-I_S$	−20	−75		−180	mA
Supply voltage for writing	V_W	150	165	Note 3	175	V
Supply current for writing (V_W=165V)	I_W	5	10		20	mA
Supply voltage for erase	V_E	38	40		42	V
Supply current for erase (V_E=40V)	I_E	10	—		150	mA
Supply voltage for logic	V_{CC}	4.75	5.0		5.25	V
Supply current for logic (V_{CC}=5V)	I_{CC}	0.8	—		1.0	A
Signal input voltage (H-level)	V_{IH}	2.4	—		5.25	V
Signal input current (H-level) (V_{IH}=2.75V)	I_{IH}	—	—		20	μA
Signal input voltage (L-level)	V_{IL}	—	—		0.4	V
Signal input current (L-level) (V_{IL}=0.4V)	I_{IL}	—	—		−16	mA

Note 1: The power source is required to be variable from 80 to 110V DC.
Note 2: The power source is required to be variable from −80 to −110V DC.
Note 3: The power source is required to be variable from 150 to 175V DC.

INTERFACE SIGNAL CHART

		Item	Min.	Typ.	Max.	Unit
1	T_{VSYNC}	A cycle of frame synchronous signal	16.8	25		ms
2	t_{WV}	Pulse width of frame synchronous signal	2			μs
3	t_{VH}	Delay time, $\overline{V_{SYNC}}$-$\overline{H_{SYNC}}$	1			μs
4	t_{HV}	Delay time, $\overline{H_{SYNC}}$-$\overline{V_{SYNC}}$	2			μs
5	T_{HSYNC}	A cycle of line synchronous signal	40	60	80	μs
6	t_{WH}	Pulse width of line synchronous signal	2			μs
7	t_{HC}	Delay time, $\overline{H_{SYNC}}$-CLK	1			μs
8	t_{CH}	Delay time, CLK-$\overline{H_{SYNC}}$	0.5			μs
9	T_{CLK}	A cycle of clock signal	45	80	110	ns
10	$t_{WCLK_{1,2}}$	Pulse width of clock signal*	22	40		ns
11	t_{SUD}	Data set up time	20	40		ns
12	t_{HD}	Data hold time	22	40		ns

*Recommended ratio between t_{WCLK_1} and t_{WCLK_2}:1:1

LIQUID CRYSTAL DISPLAYS

HAMLIN

612 East Lake Street • Lake Mills, WI 53551
Phone 414/648-2361 • FAX 414/648-5244
TWX 910/260-3740

Hamlin built their first LCD in 1972 — and since that time has maintained the leading edge position in LCD technology and manufacturing methods. That expertise and experience provides Hamlin the unique ability to supply custom designed LCDs, in quantities from 100 to 100,000, that meet exact customer requirements.

For detailed product information send for the Hamlin LCD Catalog. The 24-page catalog provides complete information about Hamlin standard LCD's plus application and design recommendations for custom LCD's. Also included are examples of color and backlighted techniques, theory of operation, and quality assurance and test standards.

DIRECT DRIVE LCD's

MODEL 3900-365-020

MODEL 3901-365-020

MODEL 3902-365-020

MODEL 3906-365-020

MODEL 3918-365-020

MODEL 3919-365-020

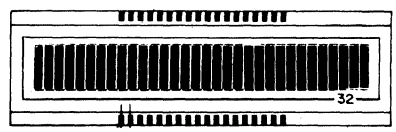
MODEL 3920-365-020

MODEL 3922-365-020

	Min.	Typ.	Max.
Operating Voltage	4	7	15
DC Drive Component Allowable		50	
Operating Frequency Range	30	60	100
Current (all segments on)*		5	20
Capacitance (all segments on)*		3000	
DC Resistance (all segments on)*		50	
Visual Threshold			
10% ON @ 25°C		2.2	
10% ON @ 0°C		2.4	
90% ON @ 25°C		3.0	
90% ON @ 0°C		3.2	
Typical Response Time*			
(T on and T off) at 25°C		Less than 45 ms total	
Segment ON (TA = 25°C)		15	20
Segment OFF (TA = 25°C)		30	60
Segment ON (TA = 0°C)		50	180
Segment OFF (TA = 0°C)		150	320
Contrast Ratio		20:1	
Operating Temperature Range	—20[1]		+85
Storage Temperature Range	—55		+85
Expected Life		100,000	
Viewing Angle — From Normal		±75° @ 7V ±60° @ 6V ±45° @ 5V	

* for a 4 digit (½ ") instrument LCD (3906)
1 Typical combined ON and OFF times of: 0.8 sec @ −20°C

MODEL 3935-365-020


MODEL 3975-365-020

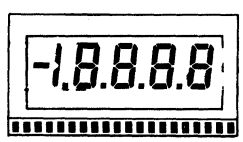
ORDERING INFORMATION

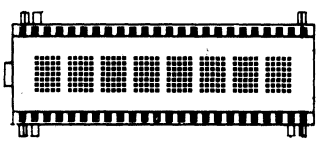
PART NUMBER	DESCRIPTION	GLASS SIZE	LIST PRICE
3900-365-020	4.0 digit (.35") 40 contacts	2.00" x 0.90", 0.70"	16.28
3901-365-020	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3902-365-020	3.5 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3906-365-020	4.0 digit (.5") 40 contacts	2.00" x 1.20", 0.90"	17.13
3918-365-020	6.0 digit (.5") 50 contacts	2.75" x 1.20", 0.90"	21.48
3919-365-020	6.0 digit (.7") 50 contacts	3.70" x 1.50", 1.20"	23.40
3920-365-020	6.0 digit (1.0") 70 contacts	5.40" x 1.80", 1.50"	48.23
3922-365-020	8.0 digit (.5") 68 contacts	3.70" x 1.20", 0.90"	24.15
3935-365-020	2.0 digit (.5") 18 contacts	1.20" x 1.20", 0.90"	15.50
3975-365-020	Single 32-Bar Graph 35 contacts	4.00" x 1.20", 0.90"	31.59

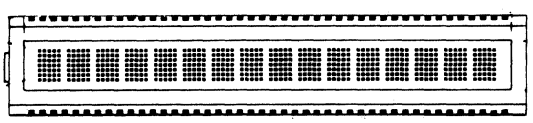
MULTIPLEX LCD's

	Min.	Typ.	Max.
DC Drive Component Allowable			100
Operating Frequency Range		30	250
Current Consumption*		3	5
Capacitance		1200	
Visual Threshold 10% ON		2.2	
dv/dt		−9	
Typical Response Time*			
T on @ 25°C		15	
T off @ 25°C		30	
T on @ 20°C		50	
T off @ 0°C		150	
Operating Temperature Range**	−20		80
Storage Temperature Range	−55		80

*Test Voltage = 6 Vrms @ 60 Hz


MODEL 4201-365-020


MODEL 4284-365-020


MODEL 4285-365-020

ORDERING INFORMATION

PART NUMBER	DESCRIPTION	GLASS SIZE	LIST PRICE
4201-365-020	4.5 digit (.4") 44 contacts	2.0" x 1.050", 0.9"	16.28
4284-365-020	8 Char., 5 x 7 dot matrix (.3") 48 contacts	2.5" x 0.8", 0.6"	18.95
4285-365-020	16 Char., 5 x 7 dot matrix (.3") 88 contacts	4.7" x 0.9", 20.7"	22.91

**Minimum operating temperature is chosen as temperature at which one update per second is possible. Temperature compensation may be required to realize satisfactory operation over entire operating temperature range.

HOMALITE DISPLAY FILTERS AND SPECIFICATIONS

LOW REFLECTANCE CONTRAST ENHANCEMENT FILTERS

Product Description

In designing instruments with LED, LCD, CRT, gas discharge, plasma or vacuum fluorescent displays, an important design consideration is the human engineering factor.

For optimum contrast and readability, Homalite™ display filters are available in colors designed to meet requirements of a wide variety of displays. Glare is reduced with a low reflectance surface cast into the material —it can't chip or peel. By increasing contrast and reducing glare, the display can be read easily and accurately under varied lighting conditions.

Because Homalite materials are thermosetting plastics, the display filters are more rigid and resistant to impact, heat, abrasion and chemical attack than other plastic filters.

All our filters can be cleaned with soap and water, acetone, chlorinated and other commercial solvents or common glass cleaning preparations.

Homalite representatives can provide technical assistance to meet your design requirements. Sample chips in various colors are available upon request.

Grades of Material

All grades shown below are available with LR (low-reflectance) surface.

	Description	Properties	UL Flammability Classification
H-100	Thermosetting polyester. Available in all colors.	General purpose applications. Excellent resistance to chemical attack. Scratch-resistant.	UL94HB
H-101	Thermosetting polyester. Available in all colors.	For high temperature applications. This self-extinguishing, fire retardant grade offers good heat distortion resistance.	UL94V-0 (thicknesses ⅛″ and over) UL94HB (thicknesses up to ⅛″)
H-911	Allyl diglycol carbonate. Available in clear and selected colors.	Highest optical qualities. Abrasion resistant—30 to 40 times more scratch-resistant than acrylics.	UL94HB

Low Reflectance Surface

Homalite filters reduce specular reflection associated with conventional face plates and filters. Unlike other filters, the low glare surface of Homalite filters is cast into the material. This surface is **not** a lamination or coating, so it cannot separate, chip, peel or rub off.

The Homalite low-reflectance surface, referred to as "LR", minimizes glare and improves readability.

Two low-reflectance surfaces are available.

LR-72—The most light diffusing surface. For mounting as close as possible to the light source, up to ½″ distance.

LR-92—For mounting from ½″ to 2″ from the light source.

INSTRUMENT DISPLAY FILTERS

Sizes and Forms

Homalite can fabricate display filters to meet your requirements. This includes cutting to size, drilling holes, milling slots, steps and beveled edges, etc. Parts can be silkscreened, mirrored or coated for RFI/EMI shielding. See standard CRT filter sizes.

Homalite materials are available in standard thicknesses of 1/16″, 3/32″, and ⅛″. Other thicknesses from 1/32″ to over 2″ are available upon request.

A protective, removable masking is available on one or both sides of fabricated parts. If masking is required, please specify when ordering.

If you choose to fabricate your own display filters, you can order Homalite materials in sheet form in two sizes: 21″ x 31″ and 33″ x 45″. Sheets will be supplied with masking on both sides. Instructions for fabrication are available upon request.

Filter Colors

Homalite filters are available in a wide range of standard colors which are designed for use with commonly available displays. Homalite can also color match and prepare filter material for specific application requirements or to duplicate the color of existing filters. Choosing the proper color will give sharp, clear characters with enhanced contrast between the information displayed and the background.

Light Emitting Displays and CRT'S

An important consideration in choosing the filter shade is the environment where the instrument will be used. For instance, if the display will be viewed in bright sunlight, you would select a darker shade than if the display were used in a room with fluorescent lighting.

Standard colors and spectral curves are as displayed. However, we would be pleased to match a specific color or work with you on a shade that meets your special application requirements.

Liquid Crystal Displays

Although LCD's do not emit light, reduction of glare from ambient light greatly improves readability. Homalite materials with the LR finish in clear or light gray (1295) are recommended for this type of display.

Spectral Transmission Data

Color	Shade	% of Transmission	Wavelength Nanometers
Gray	1245	45	N/A
	1250	22	N/A
	1265	30	N/A
	1295	60	N/A
Green	1425	25	565
	1436	36	500
	1440	40	565
	1452	50	505
Red	1600	44	655
	1670	71	655
Amber	1709	24	575
	1720	34	565
	1726	46	565
	1795	25	565
Blue	1500	55	450
	1558	80	440

CRT FILTERS

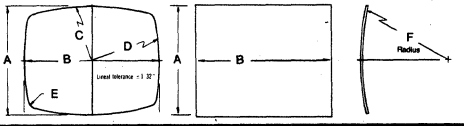
Typical filter configurations for CRT sizes 5″ to 19″ are shown below in contoured and rectangular shapes. For 5″ to 15″ filters, the standard thickness is 1/16″. For 19″ filters, we recommend 3/32″ thickness material. Other thicknesses available upon request.

When ordering filters, the letter C or R after the (Diagonal) Filter Size denotes contoured or rectangular shape. The spherical radius shown for each size applies to both contoured and rectangular shapes.

Homalite will fabricate filters to the exact size and shape requirement of specific monitors. For best results, please include measurements (width, length and spherical radius) to ensure proper fit. A mechanical assembly drawing of the monitor showing dimensions and mounting arrangements can be useful in establishing the proper configuration for your filter.

Filters can be supplied with or without adhesive tape for mounting.

Contoured Rectangular Curvature



Standard Dimensions*	Filter Size (Diagonal) 5″	9″	12″	15″	19″
A	3.62	5.87	7.88	9.50	12.87
B	4.62	7.97	10.32	11.83	15.97
C	14.19	22.00	39.00	60.00	15.00
D	13.38	22.00	18.00	49.00	32.60
E	0.44	0.68	0.75	0.81	1.50
F	14	27	25 or 24	25 or 24	47/21**

* All linear tolerances ±.030″ ** Compound Radius
Curvature radius tolerance (F) ±1″

How to Order

When placing an order for Homalite filters, please include the following information:	Example
1. Material grade	H 100
2. Type of LR surface	LR 72
3. Color number (or clear)	1265
4. Masking required (one side or both sides)	2 Sides
5. Size: For fabricated filters, indicate width x length, thickness and tolerances. Please include drawing if available (Preferred)	10″ x 8″ ±.030″ x .062″ ±.015″
For sheet material, indicate either 21″ x 31″ or 33″ x 45″ and thickness	21″ x 31″
For standard CRT applications, include diagonal size and whether filter shape is contoured (C) or rectangular (R)	12″ R

HOMALITE™

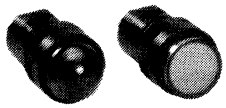
11 BROOKSIDE DRIVE
WILMINGTON, DELAWARE 19804, U.S.A.
(302) 652-3686 TELEX 510-600-0874
FAX (302) 652-4578

Send For Engineering Bulletin 126-128 for Spectral Transmission Curves and Engineering Bulletin 135 for Material Properties Chart

idec

MINIATURE LED PILOT LIGHTS & COMBINATION DISPLAY LIGHTS

AP SERIES
MINIATURE LED PILOT LIGHTS



FEATURES
- Space saving miniature style.
- A built-in current limiting resistor eliminates the need for external resistors.
- A built-in protection diode ensures a reverse withstanding voltage of 200 volts.
- AC adapter units 110/120V AC and 220V AC and DC-DC converter units 110V DC are also available.

SPECIFICATIONS
• INDICATOR LIGHTS

Input Type: Full voltage
Operational Voltage: 6, 12, 24V DC
Current Ratings: 36mA/6V DC (AP2/AP6); 18mA/24V DC (All series)
Insulation Resistance: 100MΩ min. (500V DC megger)
Reverse Withstand Voltage: 200V
Degrees of Protection: IP40

• AC ADAPTER UNIT

Operational Voltage: 110/120V AC, 220/240V AC (50/60Hz)
Power Consumption: 1.6 VA max.
Insulation Voltage: 250V AC
Insulation Resistance: 10MΩ min. (500V DC megger)
Dielectric Strength: 2,000 V AC, 1 minute

• DC CONVERTER UNIT (6V ratings only)

Operational Voltage: 110V DC (90 to 140V DC)
Power Consumption: 1W max.
Insulation Voltage: 140V DC
Insulation Resistance: 10MΩ min. (500V DC megger)
Dielectric Strength: 2,000V AC, 1 minute

TYPE LIST
• Pilot Lights

Lens Style	Operational Voltage	Part No.	
		Solder Type	Wire-Wrap Type
Dome	6V DC	AP6M266— *	AP6M266W— *
	12V DC	AP6M211— *	AP6M211W— *
	24V DC	AP6M222— *	AP6M222W— *
Flat	6V DC	AP6M166— *	AP6M166W— *
	12V DC	AP6M111— *	AP6M111W— *
	24V DC	AP6M122— *	AP6M122W— *

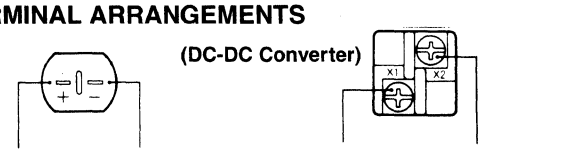
***Illumination Color (Code)**
Red (R), Green (G), Amber (A), Yellow (Y), White (W)

• AC Adapter & DC-DC Converter Unit (Option)

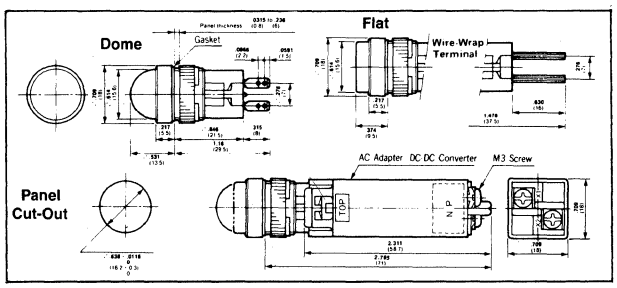
Unit	Voltage	Part No.
AC Adapter	110/120V AC 220/240V AC	AP6-016D AP6-026D
DC-DC Converter	110V DC (90 to 140V DC)	AP6-016D

Applicable Unit: AP6M266 and AP6M166 (6V DC solder terminal)

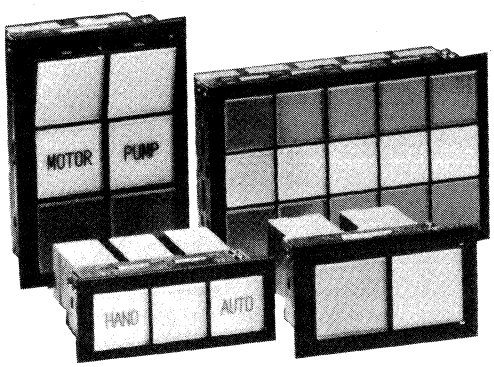
TERMINAL ARRANGEMENTS



DIMENSIONS



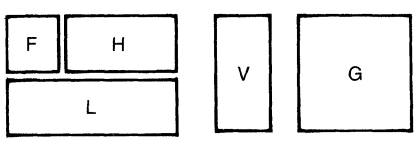
SLC 30-40 SERIES
COMBINATION DISPLAY LIGHTS



FEATURES
- Clear illumination face with non-reflective lens
- Custom built from five display face sizes
- Models available with direct voltage input; transformer and AC adapter types also available.

SPECIFICATIONS
Input Type/Primary Rated Volage: Direct, 30V AC/DC max.
Insulation Resistance: 10MΩ or more
Dielectric Strength: 2,000V AC, 1 minute
Lens Colors: Red, Green, Amber, Yellow, White, Blue
Lamp Ratings: 5 to 6V: 6.3V/1W
12 to 18V: 18V/1W
18 to 24V: 24V/1W
24 to 30V: 30V/1W

DISPLAY FACE DIMENSIONS



• SLC 30 Series
*F = 1.181 × 1.181 (30 × 30)
H = 1.181 × 2.362 (30 × 60)
L = 1.181 × 3.543 (30 × 90)
V = 2.362 × 1.181 (60 × 30)
G = 2.362 × 2.362 (60 × 60)

• SLC 40 Series
*F = 1.575 × 1.575 (40 × 40)
H = 1.575 × 3.150 (40 × 80)
L = 1.575 × 4.724 (40 × 120)
V = 3.150 × 1.575 (80 × 40)

Note: *Basic display size.

Dimensions in inches (mm).

Industrial Products Division

Intelligent Displays, and Much More
IEE's Industrial Products Division offers as standard products a broad range of intelligent display modules, incorporating a variety of display technologies. Nearly all include on-board intelligent controllers to handle display control, refresh, and character generation. Most modules have on-board power converters. These features greatly simplify the customer's design tasks.

We also offer a wide assortment of accessories, including power supplies, contrast-enhancement filters, cables/connectors, and serial data converters. This comprehensive range of products, combined with the total customer support offered by our technical staff, helps make IEE the "one-stop" source for all your display needs.

Vacuum Fluorescent Family
The unbeatable combination of outstanding appearance, ease of use, and a broad choice of formats, have helped our FLIP™ intelligent VF display modules find wide use in applications such as industrial, medical and test equipment.

Display fields range from 10 to 240 bright, easy-to-read characters. The display color is a pleasant blue-green which may be filtered to any of a range of colors.

The FLIP product family includes 14-segment and "No-Frills" budget lines, the "Industrial Strength" FLIP line, several ruggedized models, and a group of extended operating-temperature range models. Our newest models take advantage of surface-mount technology, for the ultimate in compact packaging.

Liquid Crystal Family
IEE's newest display technology is embodied in the DAYSTAR NOVA™ line of high-performance, ASCII-input LCD modules. Engineered for high reliability, they feature extra-large characters and an extra-wide operating-temperature range (−30 to +85°C).

These low-power, compact modules are ideal for battery-operated portable equipment, especially when sunlight readability is a must. Optional electroluminescent back-lighting makes night-time viewing easy.

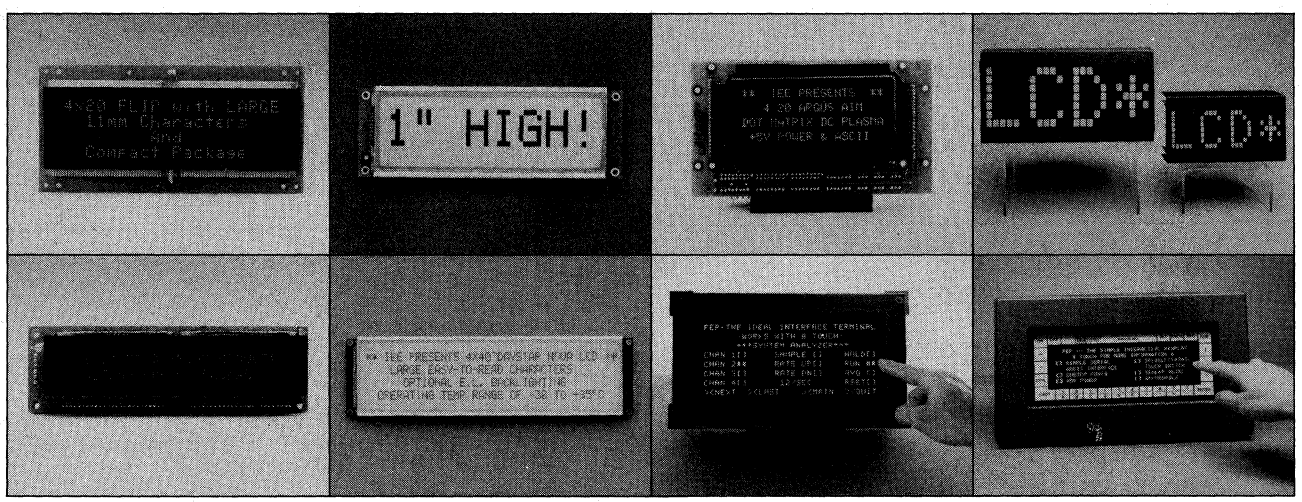
The SUPERNOVA™ family uses advanced LCD technology in the transmissive mode to create extra-large (4 to 6") characters for signs, message centers, and factory-floor annunciators. Many eye-catching colorful effects are possible using fluorescent backlighting.

DC Plasma Family
Especially well-suited to high-information-content applications, ARGUS™ DC plasma display modules use neon-orange or green 5×7 dot matrix panels to produce bright, easy-to-read, alphanumeric characters. Careful attention to package design has resulted in very compact modules.

New ARGUS AIM™ modules require only low-voltage (+5 and +11 to 29VDC) power supplies. High-voltage IC drivers ensure maximum reliability and power efficiency.

Interactive Touch-Entry Display Modules
The PEP™ family of interactive touch-entry display modules includes models based on ARGUS and FLIP displays. These innovative operator interface modules helped establish the current trend towards touch-interactive displays.

The newest PEP model is based on a 6×40 VF display, and features a sealed bezel and fixed-legend switch areas. On the drawing boards now are several "full-dot" graphic-type PEP modules using advanced display technologies.



Large Character 4×20 VF Display	**Large Character 1×8 LCD Display**	**Low Power DC Plasma Display**	**4" to 6" LCD Modules**
Low Cost 2×24 VF Display	**4×40 LCD Module**	**Interactive Touch DC Plasma Display**	**Interactive Touch VF Display Modules**

IEE® THE DISPLAY MAKERS™

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Van Nuys, California 91409-9234
Tel.: (818) 787-0311 • Telex: 4720693 IEE IPD
FAX: (818) 901-9046 (G2/G3)

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

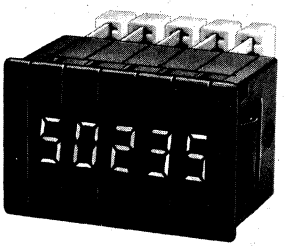
LED Displays

Product Group S

Modular LED Displays

D 005
D 006
D 016
D 020

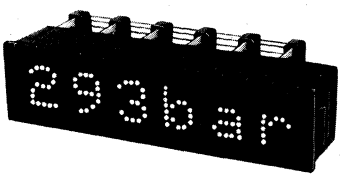
7-segment LED, Hi-efficiency red or green
Character height 9, 11, or 20 mm
Module width 8, 10, 16, or 20 mm
Decimal, hexadecimal, or +/– display
Optional latch/decoder for TTL, CMOS, or 24 VDC, or direct drive
Continuous filter lens for multiple digit assemblies
Mounting compatibility with C 005, C 006 switches and accessories



Modular Alphanumeric Display DA 20

DA 020

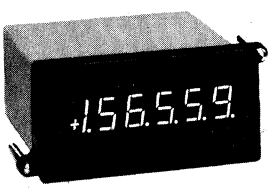
Hi-efficiency red or green LED 5x7 dot matrix
17,3 mm character height for 30 foot viewing distance
5 or 24 VDC operation
Built-in latch/decoder with 7-bit data bus
Full 96-character ASCII format
4-level digital brightness control
Lamp test input
Display enable input for multiplexing
Continuous filter lens for multiple character assemblies



Large figure LED remote Displays

D 155

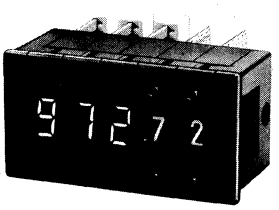
7-segment Hi-efficiency red LED, 3 1/2 or 5 1/2 digits
14,5 mm figure height for 23 foot viewing distance
Fully multiplexed 4-bit data input, CMOS logic
Decimal or hexadecimal display
Operating voltage 10-24 VDC
Panel-mount housing with clamp
Standard 25-pin "D" connector



Pushwheel switch/Display combinations

D 005/C 005
D 006/C 006

Series C 005 and C 006 pushwheel switches
Series D 005, D 006, D 016, D 020 and DA 20 displays
Accessories from Series C 005 and C 006
Complete switch/display/cable assemblies to customer specifications



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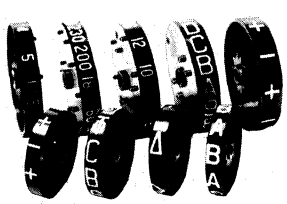

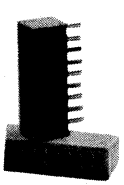

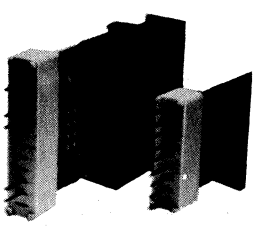

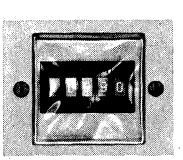

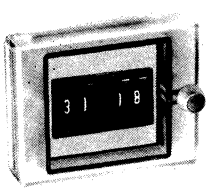

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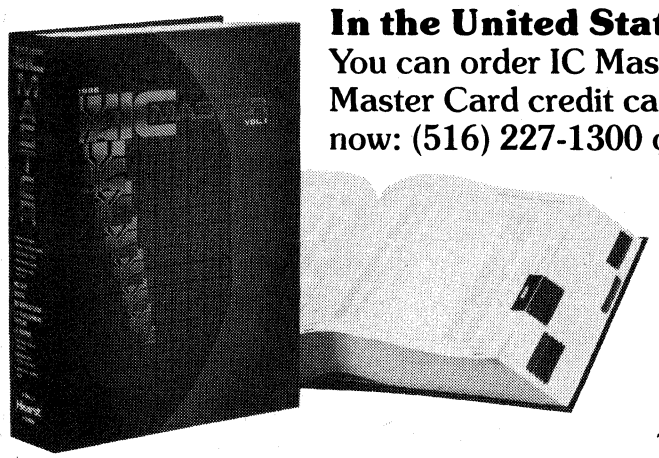

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LED PANEL INDICATORS DISCRETE LED LAMPS

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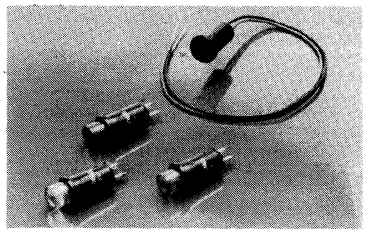
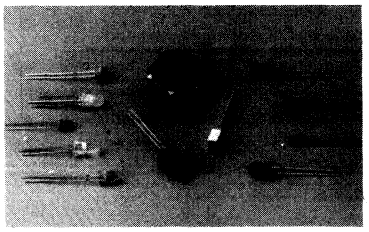


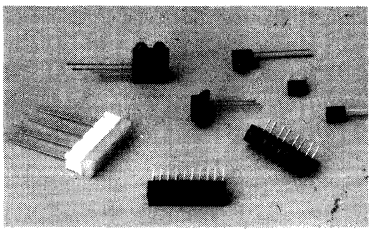
Snap-In—0.156", 0.250", 0.312", 0.500"
Push-On Nut—0.187", 0.312"
Threaded Body—0.187", 0.312"
LED Type—7-LED, 6-LED, Cluster LEDs, Multichip 8, 6-Chip, Durachip, Ultras, 3000mcd Ultras, Hi-Efficiency, Bicolors
Lens Style—Fluted Dome, Low Profile Flat Cylindrical, Small Dome, etc.
Second Sources—Dialight (558, 559). Leecraft, IDI, Data Display, Lumex, Solico, GI, etc.

STD AND SPECIAL SHAPE LEDs



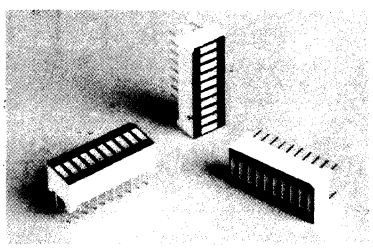
Std. LEDs—T1 (3mm), T1¾ (5mm), T3 Diffused, Clear, Narrow Beam Ultra, 3000mcd Ultra, Hi-Efficiency, Bicolors, Resistor 5V, 12V, Blinking
Rectangular—.07" x .15", .08" x .20", .10" x .20", .10" x .30", .04" x .20", etc.
Square—0.20" x 0.20", 0.11" x 0.11"
Specials—Multichip, 6/8-Chip, Dualchip, 6-Chip Big Lamp, Fluted Flat, Bi-Polars
Second Sources—Hewlett-Packard, General Instrument, Siemens, Rohm, Panasonic, Dialight, Toshiba, etc.

PC BOARDS LEDs & PC BOARD LED ARRAYS



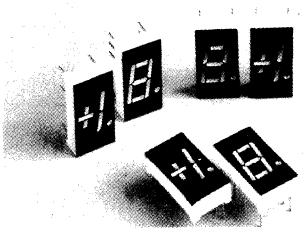
Styles—Right Angle or Vertical
Size—T¾ (2mm), T1 (3mm), T1¾ (5mm)
LED Types—Std. Reds, Hi-Efficiency, Ultra, 300mcd Ultra, Bicolors, Blinking, Resistor 5V/12V, Infrareds, Bi-Polars, etc.
Lens—Diffused, Clear, Waterclear
Specials—Multichip, 6-Chip, Dualchip Flat-Top Cylindrical, Rectangular PCB LEDs, Square LED PCB, etc.
Second Sources—Dialight, HP, IDI, Leecraft, Tec, Data Display, etc.

LED LIGHTBARS AND BARGRAPHS



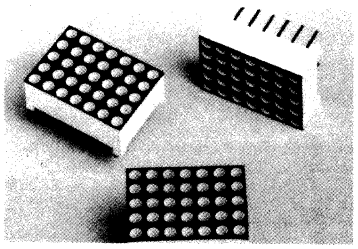
Lightbars—.25" x .15", .50" x .25", .35" x .15", .15" x .75", .35" x .35", etc.
Bargraphs—10-Element Array, 7-LED Linear Arrays, Custom Arrays
Colors—Std. Red, Hi-Effeciency Red, Yellow, Green
Second Sources—Hewlett-Packard, General Instrument (GI/CM), Siemens/Litronix, Panasonic, Rohm
Custom—LED Arrays with Various Rectangular and Square LEDs in 1-8 LEDs with mix/Match Colors

LED 7 AND 16 SEGMENT DISPLAYS



Sizes—0.3", 0.4", 0.43", 0.52", 0.56", 0.6", 0.8", 1.02"
Types—Single and Dual Digits, ±1 Overflow, RHDP, LHDP
Colors—Std. Red, GoP Red, Hi-Efficiency Red, Ultra Red, Yellow, Green
Second Sources—Hewlett-Packard, General Instrument, Siemens, Litronix, Panasonic, Telefunken, Toshiba, Rohm, etc.

5 x 7 LED DOT MATRIX DISPLAYS



Sizes—0.3", 0.7", 1.2", 2.0"
Colors—Std. Red, Hi-Efficiency Red, Orange, Yellow, Green
Second Sources—Hewlett-Packard, General Instrument, Siemens, Litronix, Panasoic, Telefunken, Toshiba, Rohm, etc.

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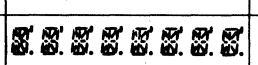
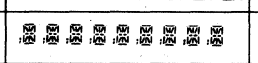
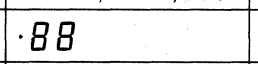
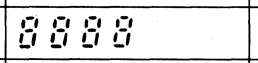
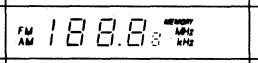
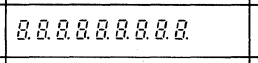
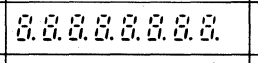
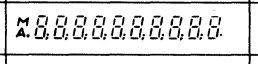
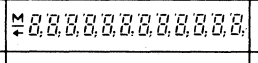
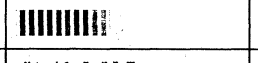
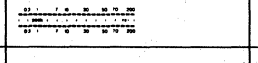
OPTOELECTRONIC PRODUCTS—FLUORESCENT INDICATOR PANEL DISPLAYS

Vacuum Fluorescent Indicator Panels are more effective and reliable than other display systems. An exceptionally wide variety of sizes, styles and configurations are available from NEC. The table below provides a brief glimpse at a few selected standard types. Hundreds of others are available.

The principal advantages of FIPs is their inherent brilliance and sharpness. They can be driven directly from MOS ICs and operate at voltages as low as 10V.

The normal color of an FIP is blue-green. This is filterable to red, orange or yellow with very little visual loss. The basic blue-green color is far less fatiguing to the human eye than colors in the red-orange end of the spectrum.

For complete details on NEC FIPs, ask for the FIP Selector Guide.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions				
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)	L.P. (mm)	L.L. (mm)
FIP16X1EA	16	5×7	3.95	2.3	$26.0^{+0.8}_{-0.3}$	$82.0^{+0.8}_{-0.3}$	7.4 MAX.	2.54	14.0
FIP16XM1DA/FIP16D11X	16	5×7, DP, COMMA, CURSOR (▽)	11.3	7.25	43.2 MAX.	$208.0^{+0.8}_{-0.3}$	9.9 MAX.	2.54	14.0
FIP20X1KA	20	5×12	15.85	6.4	42.4±1.0	208.0±1.0	9.5±0.7	2.54	14.0
FIP16XM2AA/FIP32A11X	32 16×2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	208.0±1.0	13.0 MAX.	2.54	14.0
FIP20X2CA	40 20 × 2 line	5×7, DP, COMMA, 2 line	11.3	7.25	60.0±1.0	252.0±1.0	12.0 MAX.	2.54	16.0
FIP40X1DA/FIP40E5X	40	5×7	5.05	3.55	$34.0^{+1.0}_{-0.5}$	220.0±0.7	10.0 MAX.	2.54	8.76
FIP20X3AA/FIP60A5X	60 20 × 3 line	5×7, 3 line	5.05	3.55	49.0±1.0	138.0±1.0	11.0 MAX.	2.0	10.2
FIP20X4AA	80 20×4 line	5×7, 4 line	11.3	7.25	90.0±1.0	240.0±1.0	13.3±0.7	2.54	10.0
FIP80X2AA/FIP160A4X	160 80×2 line	5×7, CURSOR, 2 line	3.55	2.05	$44.0^{+0.8}_{-0.3}$	$298.0^{+0.8}_{-0.3}$	10.0±0.7	2.54	7.0
FIP40X6AA	240 40×6 line	5×7, CURSOR, 6 line	5.0	3.5	90.0 MAX.	250.0±1.0	14.0 MAX.	2.0	20.0
FIP48GX7AA/FIP48A8XT	—	48×7, GRAPHIC	7.9	57.1	34.0±1.0	93.0±1.0	9.5 MAX.	2.54	7.4
FIP180GX48BA	—	180×48, GRAPHIC	29.54	111.38	60.0±1.0	156.0±1.0	11.0 MAX.	1.27	20.0
FIP280GX60AA/ FIP240A4XT	—	280×60, GRAPHIC	38.75	181.75	70.0±1.0	265.0±1.0	12.0 MAX.	1.27	20.0
FIP8A5R FIP8A5AR	8		5.0	3.0	$24.5^{+0.5}_{-0.3}$	65.5 MAX.	7.3 MAX.	2.54	14.0 7.0
FIP9A5AR	9		5.0	3.0	$23.0^{+0.5}_{-0.3}$	71.5 MAX.	7.5 MAX.	2.54	7.0
FIP80B5R	80 40×2 line	14 segment CURSOR, COMMA, 2 line	5.0	3.0	39.0±1.0	250±1.0	9.7±0.7	2.54	10.0
FIP2A13	2		12.5	6.6	$28.0^{+1.5}_{-0.5}$	50.0±1.0	7.5±1.0	2.54	10.0
FIP4H5	4		5.0	2.5	14.5±1.0	41.0±1.0	6.5±0.7	2.54	8.0
FIP7P8 Series	7		8.0	4.6	24.5±1.0	76.0±1.0	6.1±0.7	2.54	15.0~3.2
LD8225/FIP8A5	8		4.5	2.3	17.0±1.0	58.0±1.0	6.5 MAX.	2.54	6.2
FIP9B6 FIP9B6A	9		5.5	2.65	20±1.0	70±1.0	6.5±0.5	2.54	3.5 9.0
FIP11B8A	11		8.0	3.6	$25.5^{+1.5}_{-1.0}$	$93.0^{+1.5}_{-0.5}$	9.5 MAX	2.54	14.0
FIP13F7	13		6.5	2.9	$25.0^{+0.5}_{-0.3}$	94.5 MAX.	9.5 MAX.	2.54	34.0
FIP10CW19Y	10		18.5	70.0	33.0±1.0	98.0±1.0	8.0±0.7	2.54	9.5
FIP24A15YS	24		15.0	71.7	33.0±1.0	98.0±1.0	8.5 MAX.	2.54	7.0
FIP101B8AY	101		7.6	127.5	24.5±1.0	158.8±1.5	10.0 MAX.	5.08	12.5

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

OPTOELECTRONIC PRODUCTS,—FLUORESCENT INDICATOR PANEL DISPLAYS

World's first Chip-In-Glass FIP Modules give you beauty that lasts.

NEC has removed something that used to stand between you and truly reliable fluorescent displays. We took the anode and grid driver ICs out of their packages. Then mounted the bare chips directly on the display substrate. Result: a trimmed-down, cost-efficient display that solves a host of reliability problems.

Now, for the first time, the display drivers are on-board —in a vacuum-sealed glass envelope that provides the ideal protective environment. On-board ICs permit a drastic reduction in the number of lead terminals. By reducing leads, we further increase dependability. Create a more compact design. And lower costs to you.

MINI-MODULES: UP TO 50% SMALLER AND 33% LIGHTER.

We use surface-mount technology to trim our modules even more. Board height is up to 50% less than conventional modules and weight is reduced by up to 33%.

Chip-In-Glass FIPs come in four models: 20 characters x 1 line; 20 x 2; 40 x 1; or 40 x 2. All models offer a 5 x 7 dot character format. The display is brilliant and easy to read from virtually any angle.

FIPs run on a 5V power source. Interface readily with your system bus. Execute numerous commands. Fonts include: ASCII-7, ECMA-7 (General European, German, Scandinavian, Spanish) and JIS.

If you want beauty that lasts through the years, get the bare facts on NEC's Chip-In-Glass FIP modules.

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FC20X1JA-AB	20	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	194	24
FC20X1NA-AB	20	5 x 7 DOT MATRIX	9	6.3	30	259	24
FC20X2FA-AB	40	5 x 7 DOT MATRIX	5.05	3.55	34	194	24
FC40X1KA-AB	40	5 x 7 DOT MATRIX, CURSOR	5.05	3.55	29	280	24
FC40X2DA-AB	80	5 x 7 DOT MATRIX, CURSOR	5.35	3.55	40	270	28

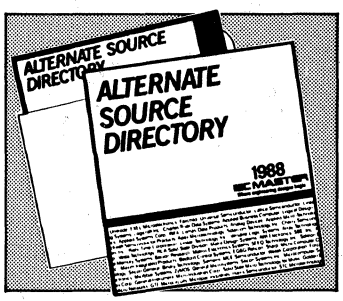
LARGE MODULES AND GRAPHICS

Type No.	No. of Digits	Character Format, Symbol	Character Dimensions		Outline Dimensions		
			C.H. (mm)	C.W. (mm)	P.H. (mm)	P.L. (mm)	P.T. (mm)
FM40X6AA-A	240	5 x 7 DOT MATRIX, CURSOR	5.0	3.5	110	264	45
FM80X2AA-A	160	5 x 7 DOT MATRIX, CURSOR	3.5	2.05	66	388	43
FM180GX48BA-A	GRAPHIC	180 x 48 DOT MATRIX	—	—	90	200	45
FM256GX64AA-AA	GRAPHIC	256 x 64 DOT MATRIX	—	—	93	230	45
FM256GX128AA-AA	GRAPHIC	256 x 128 DOT MATRIX	—	—			45

HEARST ENGINEERING SOFTWARE

ICMASD...IC Alternate Source Directory

If you've used the IC MASTER, you know what the Alternate Source Directory is. Engineers tell us that it's one of the most valuable sections of the Master. The Alternate Source Directory...ASD...is now available in floppy disk form.



The electronic ASD is FAST! Just ask a question and the answer pops up in a split second.

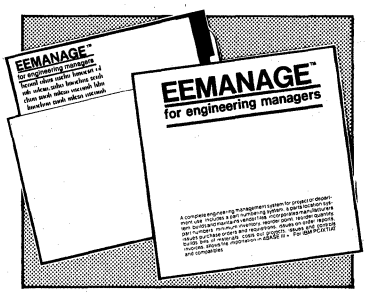
The electronic ASD is FLEXIBLE! You can add ICs and you can add comments.

You can add part numbers, prices, technical notes or anything else you like. You can customize the ASD to fit your needs and the needs of your company.

Order the 1988 Alternate Source Directory for your AT, XT or compatible. We'll send you two floppies and a very simple piece of printed documentation. Download the floppies and you're in business. All you need is a hard disk.

EEMANGE...for engineering managers

Developed by the publishers of EEM/ Electronic Engineers Master, EEMANAGE is a software program designed to make life easier for engineers and engineering managers.



EEMANAGE does many things: 1. Develops Bills of Materials 2. Assigns Part Numbers logically 3. Manages Engineering Inventories 4. Issues Purchase Requisitions 5. Relieves Engineering Inventories 6. Manages a Parts Storage System 7. Issues Engineering Change Notices 8. Interfaces with dBaseIII+ Programs.

EEMANAGE is completely menu driven. It is simple to understand and operate. Any competent secretary can be up and running on EEMANAGE in minutes.

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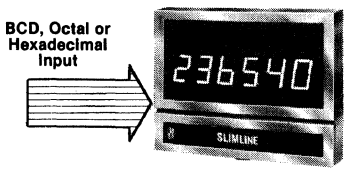
LOCAL & DISTANT

LOCAL DISPLAY



Accepts BCD, octal or hexadecimal code and displays up to 6 digits in either an LCD or LED display. Meter will accept full parallel or data bus input. Large, bright displays are highly readable even in high ambient light conditions. Easy panel drilling, mounting and wiring.

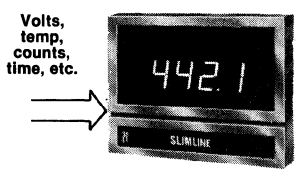
- ★ 2, 3, 4, 5 or 6 digit models
- ★ Non-glare faceplate
- ★ Polarity, decimal pt., colons available
- ★ Accepts 5 to 24 V input
- ★ Front panel mounting
- ★ LED or LCD displays
- ★ Price: $140 - $200

DISTANT DISPLAY

Units accept 2-wire serial ASCII input for numerical and most alpha character display. There are also ASCII controlled output capabilities to provide alarm or control functions. There is individual character control (dimming, flashing and blanking).

- ★ Accepts RS232, 422, 485 or 20/60 mA
- ★ 110 - 9600 baud
- ★ Limited alpha capability
- ★ Large, bright display, easily read
- ★ Flexible addressing capability
- ★ ASCII command switch outputs
- ★ Price: $325 - $450

SIGNAL READOUT



Display a wide range of volts, amps, watts, resistance, counts, temperature, etc. with these units. Meters include full input conditioning and built-in A-to-D signal conversion. Unit can be field scaled to read out directly in any desired engineering unit.

- ★ 2, 3, 4, 5 or 6 digit models
- ★ Rugged industrial design
- ★ Preset units
- ★ Data outputs available
- ★ Front panel mounting
- ★ Microprocessor-based units
- ★ Price: $140 - $350

LARGE DISPLAY

Meters feature 3 or 5-inch, 7 segment, incandescent displays. Many different colors are available. Meter will accept inputs from:

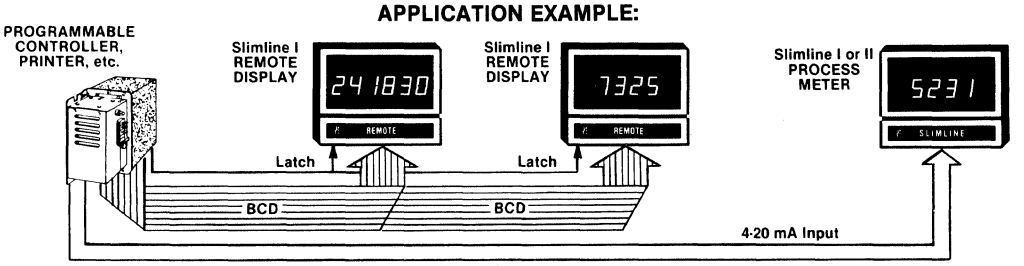
1) Parallel data (BCD, octal, hexadecimal)
2) Serial ASCII (RS232, 422, 20/60 mA)
3) Wide metering range (volts, amps, temperature, counts, time, etc.)

- ★ 4 - 6 digits available
- ★ Self-contained displays
- ★ Decimal point or colons available
- ★ Rugged Nema-12 industrial enclosure
- ★ Great for distances up to 250'
- ★ Latching and blanking capabilities
- ★ Price: $650 - $750

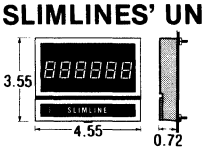
ADVANTAGES:

- ★ Individual digit strobe permits single or group digit control
- ★ Display may be selected by individual strobes (standard technique) or addressed by BCD (saves cost of I/O and wiring)
- ★ Interfaces with TTL, CMOS, 24 V and 48 V I/O modules
- ★ The BCD data and control lines may be negative or positive (0 or 1) true
- ★ Optional Stainless Steel Bezel – fully gasketed and sealed; built to NEMA 1, 2, 3, 3R, 4, 4X, 5, 6, 6P, 11, 12, 13; easy access to controls

APPLICATION EXAMPLE:



SLIMLINES' UNIQUE FEATURES



Size: 4.55" x 3.55" x 0.72". Panel surface mounting means easy & fast installation. Also fast wiring – no soldering needed.

High Quality: Less downtime, long useful life. Much better investment; socketed parts and highest quality components. Conservative design; works well in harsh factory environments, not like other meters that are made to only work in a laboratory.

Backed by 3-year warranty!

Who Uses: With over 2 million meters shipped, NES is recognized as the leader in high quality industrial meters. Some users are: the Space Shuttle, Air Force 1, most of the Fortune 500's and many more.

About NES: We design & manufacture over 3,000 different products from Broadcast Automation Computers to the broadest range of panel meters available. NES has been a leader in innovative panel meter technology with ASCII communication for nearly 20 years.

Please call us. It is easy to talk to one of our expert Application Engineers. They care about your problem and will do all they can to assure your success.

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Polaroid

Polaroid Linear and Circular Polarizers to eliminate glare and enhance contrast

POLAROID Quality and Service...

Polaroid *invented* the sheet polarizer...and, with more than 40 years pioneering experience in the field, Polaroid offers the knowledge, expertise, and facilities to provide the polarizer that's exactly right for your application. And of course, Polaroid polarizers are manufactured, tested, and inspected to meet today's highest technical standards and specifications.

CIRCULAR POLARIZERS

Polaroid Circular Polarizers — for a variety of display applications. For example, if you need to increase the legibility of a particular display unit operating under specific ambient level use the following chart to match your display with the appropriate light level to select the optimum Polaroid circular polarizer.

Display Type	Ambient Light Level		
	Low	Medium	High
Planar Gas Discharge	HNCP37	HNCP37 HACP HRCP	HNCP10 HNCP22 HRCP
Red LED	HNCP37	HRCP	HNCP22
Green LED	HNCP37	HGCP	HGCP
Yellow LED	HNCP37	HACP	HACP
High Efficiency Red LED	HNCP37 HRCP (High T)	HACP HRCP (High T)	HNCP10 HNCP22
Vacuum Fluorescent	HNCP37	HBCP	HNCP10
Incandescent Filament	HNCP37	HNCP37	HNCP10 HNCP22
Standard B/W CRT	HNCP37	HNCP37	HNCP22
P-31 Green CRT	HNCP37	HGCP	HNCP22
P-43 Green CRT	HNCP37	HGCP (P43)	HGCP (P43)

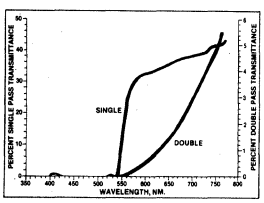
N = Neutral A = Amber B = Green R = Red

Displays are just one of the many applications of Polaroid polarizers.

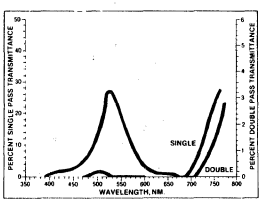
POLAROID offers features like these...

- the widest selection available of off-the-shelf contrast enhancement filters
- facilities to precisely manufacture custom designed filters
- choice of product formats, including rolls, reels, sheets, and die-cut parts ready for use with automatic machinery
- choice of circular polarizers in standard laminations and colors
- choice of glass or plastic filters with standard or non-glare surfaces
- choice of optical densities and thicknesses
- choice of custom coatings: anti-reflective, reflective, RFI or abrasion-resistant

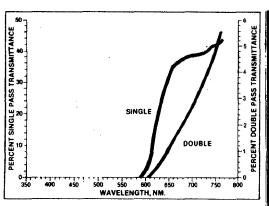
All panels are rugged, reliable, and resist heat, impact, and abrasion. They can be easily cut, punched, drilled, or overprinted.



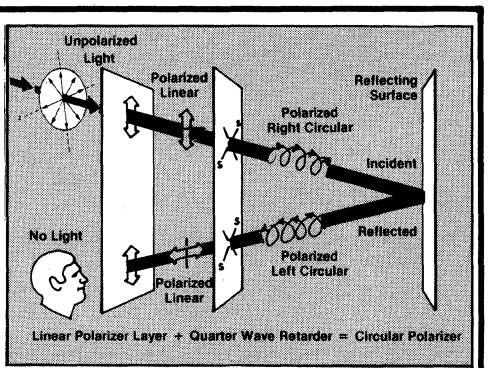
Polarizer: HACP
Type: Amber hue circular polarizer
Features: Excellent reflection suppression for instruments and displays.
Typical Applications: Yellow LEDs, planar gas discharge displays, Nixie tubes, CRTs, high efficiency red LEDs, orange LEDs.



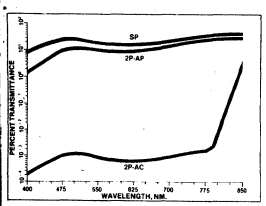
Polarizer: HGCP
Type: Green hue circular polarizer
Features: Excellent reflection suppression for instruments and displays.
Typical Applications: Green LEDs, CRTs (P-31 phosphor), planar gas discharge displays.



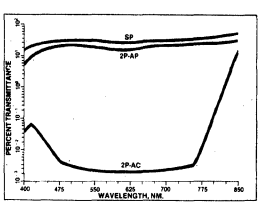
Polarizer: HRCP
Type: Red hue circular polarizer
Features: Excellent reflection suppression for instruments and displays.
Typical Applications: Standard red LEDs, planar gas discharge displays, red CRTs.



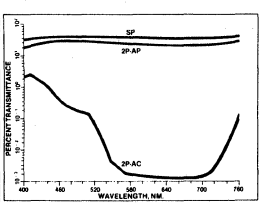
LINEAR POLARIZERS



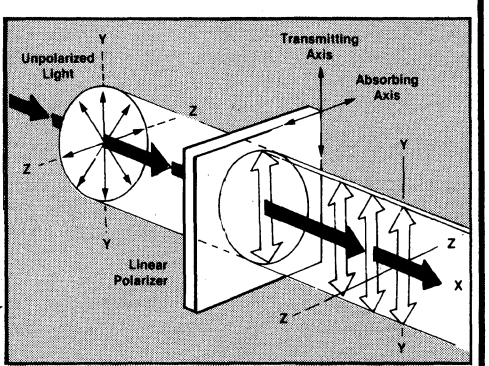
Polarizer: HN22
Type: Grey-green linear polarizer
Features: For the visible spectrum and also for a portion of the near infrared region. It offers a very high extinction value of approximately 0.0009%.
Typical Applications: Microscopes, sextants and optical instruments where extreme extinction density is required.



Polarizer: HN32
Type: Neutral linear polarizer
Features: Represents the best balance between transmission and extinction for general use. Extinction transmission is about 0.005%.
Typical Applications: Variable density filter systems, photoelastic stress analysis and other applications where light modulation is necessary.



Polarizer: HN38
Type: Neutral linear polarizer
Features: Exceptionally free from color distortion.
Typical Applications: Camera filters, studio light filters, variable color filter systems, other applications where high transmission is required along with a medium extinction density.



Polaroid Polarizer Division
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Norwood, MA 02062
Tel. # 800-225-2770
FAX # 617-446-4600
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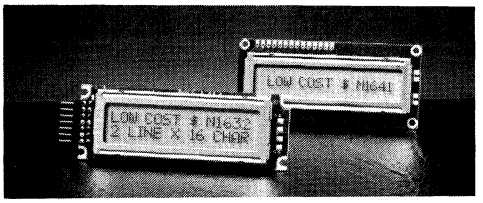
Seiko Instruments

LIQUID CRYSTAL DISPLAYS

DOT MATRIX MODULES



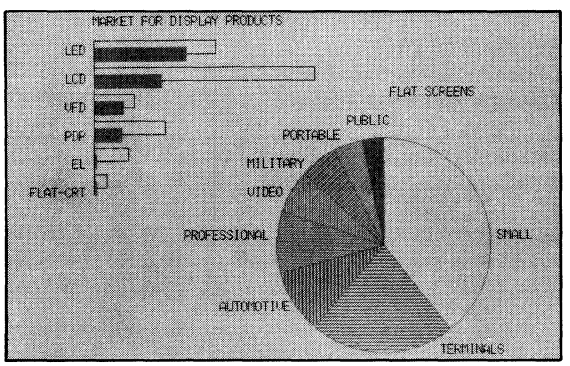
Seiko Instruments Dot Matrix Character Modules were designed with your application in mind. The expanded range offers a wide variety of sizes, all using industry standard controllers and drivers. They are now available with our grey-mode Supertwist option for enhanced contrast and viewing angle. The compact modules are also available with an electroluminescent (EL) backlight panel for use in dark environments. Positive or negative character image options combined with bottom viewing (6:00 o'clock) or top viewing (12:00 o'clock) directions allow you to "customize" your product's display.

- ☐ 5 x 7 Dot Matrix plus cursor
- ☐ Character Generator and Data RAM on board
- ☐ Compact, lightweight, and low cost
- ☐ Single 5 volt input
- ☐ 4 or 8 bit Parallel Interface

Model	Outside Dim.	No. Characters x No. Lines	Character Size	Dot Size
M1641	80 x 36 x 11.3	16 x 1 line	3.07 x 5.73	0.55 x 0.75
M1632	85 x 30 x 10.1	16 x 2 lines	2.78 x 4.27	0.50 x 0.55
L2012	116 x 37 x 11.3	20 x 2 lines	3.20 x 4.85	0.60 x 0.65
*M24111	126 x 36 x 11.3	24 x 1 line	3.15 x 7.90	0.55 x 0.70
L2432	118 x 36 x 11.3	24 x 2 lines	3.20 x 4.85	0.60 x 0.65
*L4041	182 x 33.5 x 11.3	40 x 1 line	3.15 x 7.90	0.55 x 0.70
L4042	182 x 33.5 x 11.3	40 x 2 lines	3.20 x 4.85	0.60 x 0.65
M4032	182 x 33.5 x 11.3	40 x 2 lines	3.20 x 4.85	0.60 x 0.65
M4024	190 x 54 x 10.1	40 x 4 lines	2.78 x 4.27	0.50 x 0.55

*5 x 10 Dot Matrix plus cursor

GRAPHIC MODULES



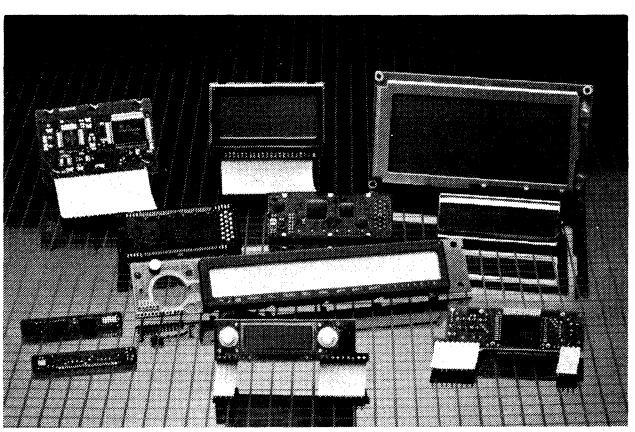
The Seiko Twist technology featured in the following graphic modules solves many of the problems associated with large size, high resolution LCDs. Improved contrast and viewing angle combined with a variety of options make the Seiko Twist modules compatible with your display requirements.

- ☐ Options
- ☐ Reflective or transflective polarizers
- ☐ Positive or negative character image
- ☐ Electroluminescent backlighting
- ☐ Grey or yellow background

Unit: mm

Model	Outside Dim. (W x H x D)	Dot Format (Row x Column)	Display Area (W x H)	Dot Size (W x H)
F2426	180 x 75 x 12	64 x 240	127.2 x 33.9	0.49 x 0.49
F645D	270 x 150 x 12	220 x 640	224.0 x 98.0	0.32 x 0.46
F642F	270 x 198 x 12	400 x 640	230.3 x 143.9	0.33 x 0.33

CUSTOM DISPLAYS



With over 15 years of custom LCD experience, Seiko Instruments can meet your needs for custom LCDs or custom Liquid Crystal Display Modules (LCM). Special type styles or graphic patterns are possible in glass sizes from ¼″ x ½″ up to 10″ x 7″. Static drive up to 1/200 duty cycle, colored polarizers, and a variety of backlighting methods round out Seiko's custom capabilities. Complete design and applications assistance is only a phone call away. Contact Seiko Instruments when your design calls for custom LCDs or LCMs, you will like the results.

Seiko Instruments USA, Inc., Electronic Components Division, 2990 W. Lomita Blvd., Torrance, CA 90505 (213) 517-7770 FAX: (213) 517-7792

SHARP

EL Display Units

Sharp's EL Display Units Pave the Way for a New Generation of Displays

Sharp's Electro-Luminescent (EL) displays—thin, solid-state, light-emitting panels—stand at the leading edge of display technology. Through innovative technology, Sharp has developed EL display units which combine the high contrast and brightness of CRTs with the light weight and thinness of LCDs. Sharp gives you the display of your dreams.

Easy-to-Read and Easy on the Eyes

Sharp's EL display units feature the yellow-orange "amber" color generally acknowledged as being easiest on the eyes. Based on innovative technological breakthroughs, Sharp has succeeded in creating high-definition El display units with a resolution of 3 lines per millimeter and dot density providing the same detail as 640 x 400-dot CRTs. Moreover, these display units feature a flickerless, easy-to-read, flat screen. Users need not suffer from eye fatigue when using computers for long periods of time.

Wide Viewing Angle

Sharp's all solid-state EL technology provides a bright, light-emitting display unmatched by conventional LCDs. The operation of these units does not depend on ambient light for illumination, allowing users to view information presented on the screen even in low-light situations. These units also offer a maximum 140°-wide viewing angle, enabling users to view undistorted character text and graphics from a wide range of positions.

High-Speed Display Capability

EL display units can display information as rapidly as conventional CRTs. By using the same simple input signals as those used by CRTs and developing simplified interface circuitry, Sharp has achieved a high-speed display that can respond far more rapidly than LCDs and virtually as quickly as high-speed response CRTs. Users can display high volumes of data or rapidly changing information on the screen in real time.

Low Power Consumption

Sharp is currently producing energy-saving display units made possible through two important developments based on original Sharp technology: high-voltage MOS driver ICs and high-efficiency thin film panel structure. Lower power consumption has also resulted from adopting new EL panel driver circuitry, optimized for maximum efficiency. Highly compact, lightweight designs are now feasible for a wide variety of information processing systems and equipment.

Lightweight, Thin, Compact, and Durable

Sharp's EL display units are constructed from durable solid-state components which have a high degree of resistance to damage caused by vibration and impact. Devices equipped with EL display units can be used under severe environmental conditions, such as outdoors in the field or in automobiles. Sharp's EL display units are the result of innovative thin-film deposition technology and high-density mounting technology. This makes them ideally suited for displays in all kinds of portable equipment.

Applicable Options for EL Display Units

Options	Model Number Number of Matrix Electrodes (Dot Pitch Ratio)	LJ320U21 320×240 (1:1)	LJ320U26 320×256 (1:1)	LJ512U21 512×128 (1:1)	LJ512U05/25 512×256 (1:1)	LJ640U21 640×200 (1:1)	LJ640U23 640×200 (1:1.4)	LJ640U24 640×200 (1:2)	LJ640U30 640×200 (1:1.6)	LJ640U26 640×400 (1:1)	Notes
Interface Circuit Boards	LJ064F01	●		●							For coded/full-graphic display
	LJ064F02				●	●	●	●	●		For coded/full-graphic display
	LJ064F03									●	For coded/full-graphic display
	LJ064F04		●								For coded/full-graphic display
	LJ232F01				●	●	●	●	●	●	For coded/full-graphic display
Power Supply Units	LJ515V01	●	●	●							Input: 110VAC Output: +5V/0.65A, +15V/0.80A
	LJ515V02	●	●	●							Input: 220VAC Output: +5V/0.65A, +15V/0.80A
	LJ515V03	●	●	●	●	●	●	●	●		Input: 110VAC Output: +5V/0.80A, +15V/0.80A
	LJ515V04	●	●	●	●	●	●	●	●		Input: 220VAC Output: +5V/0.80A, +15V/0.80A
	LJ525V01									●	Input: 110VAC Output: +5V/0.95A, +15V/0.6A, +25V/0.55A
	LJ525V02									●	Input: 220VAC Output: +5V/0.95A, +15V/0.6A, +25V/0.55A
Acrylic Filters	LJ320Z01	●									
	LJ512Z01			●							
	LJ512Z02				●				●		
	LJ640Z01					●					
	LJ640Z02							●		●	
	LJ640Z03						●				

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SHARP

EL Display Units

Sharp's EL Display Units Line-up—— Meeting a Broad Range of User Needs

Specifications

Parameter	LJ320U21	LJ320U26	LJ512U21	LJ512U05
Effective Display Area*	119.9(W) × 89.9(H)	95.9(W) × 76.7(H)	179.1(W) × 44.7(H)	191.9(W) × 95.9(H)
No. of Matrix Electrodes	320(W) × 240(H)	320(W) × 256(H)	512(W) × 128(H)	512(W) × 256(H)
Number of Dots	76,800 (320 × 240)	81,920 (320 × 256)	65,536 (512 × 128)	131,072 (512 × 256)
Dot Size (mm)	0.275(W) × 0.225(H)	0.22(W) × 0.22(H)	0.25(W) × 0.20(H)	0.275(W) × 0.225(H)
Dot Pitch (mm)	0.375(W) × 0.375(H)	0.30(W) × 0.30(H)	0.35(W) × 0.35(H)	0.375(W) × 0.375(H)
Display Color	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)
Luminance (fL)	20 (Min.)	20 (Min.)	20 (Min.)	20 (Min.)
Display Method	Line at a time scanning	Line at a time scanning	Line at a time scanning	Line at a time scanning
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	70 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Operating Temp. (°C)	0 ~ +55	0 ~ +55	0 ~ +55	0 ~ +55
Storage Temp. (°C)	−25 ~ +70	−25 ~ +70	−25 ~ +70	−25 ~ +70
Outline Dimensions (mm)	178.5(W) × 148.5(H) × 34.0(D)	130.0(W) × 110.0(H) × 33.0(D)	228.5(W) × 108.5(H) × 34.0(D)	228.5(W) × 148.5(H) × 35.0(D)
Weight (g)	Approx. 600	Approx. 600	Approx. 600	Approx. 600

Parameter	LJ512U25	LJ640U21	LJ640U23	LJ640U24
Effective Display Area*	191.9(W) × 95.9(H)	191.9(W) × 59.9(H)	191.9(W) × 83.9(H)	191.9(W) × 119.7(H)
No. of Matrix Electrodes	512(W) × 256(H)	640(W) × 200(H)	640(W) × 200(H)	640(W) × 200(H)
Number of Dots	131,072 (512 × 256)	128,000 (640 × 200)	128,000 (640 × 200)	128,000 (640 × 200)
Dot Size (mm)	0.275(W) × 0.225(H)	0.23(W) × 0.20(H)	0.185(W) × 0.28(H)	0.18(W) × 0.30(H)
Dot Pitch (mm)	0.375(W) × 0.375(H)	0.30(W) × 0.30(H)	0.30(W) × 0.42(H)	0.30(W) × 0.60(H)
Display Color	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)
Luminance (L)	20 (Min.)	20 (Min.)	20 (Min.)	20 (Min.)
Display Method	Line at a time scanning	Line at a time scanning	Line at a time scanning	Line at a time scanning
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level	LS TTL Level	LS TTL Level
Operating Temp. (°C)	0 ~ +55	0 ~ +55	0 ~ +55	0 ~ +55
Storage Temp. (°C)	−25 ~ +70	−25 ~ +70	−25 ~ +70	−25 ~ +70
Outline Dimensions (mm)	228.5(W) × 148.5(H) × 35.0(D)	228.5(W) × 108.5(H) × 34.0(D)	228.5(W) × 148.5(H) × 35.0(D)	228.5(W) × 158.5(H) × 35.0(D)
Weight (g)	Approx. 650	Approx. 650	Approx. 650	Approx. 750

Parameter	LJ640U30	LJ640U26
Effective Display Area*	191.9(W) × 95.8(H)	191.9(W) × 119.9(H)
No. of Matrix Electrodes	640(W) × 200(H)	640(W) × 400(H)
Number of Dots	128,000 (640 × 200)	256,000 (640 × 400)
Dot Size (mm)	0.185(W) × 0.28(H)	0.22(W) × 0.22(H)
Dot Pitch (mm)	0.30(W) × 0.48(H)	0.30(W) × 0.30(H)
Display Color	Orange-yellow (peak wavelength 5850Å)	Orange-yellow (peak wavelength 5850Å)
Luminance (L)	20 (Min.)	20 (Min.)
Display Method	Line at a time scanning	Line at a time scanning
Frame Frequency (Hz)	60 (Typ.)	60 (Typ.)
Input Signal Level	LS TTL Level	LS TTL Level
Operating Temp. (°C)	0 ~ +55	0 ~ +55
Storage Temp. (°C)	−25 ~ +70	−25 ~ +70
Outline Dimensions (mm)	228.5(W) × 148.5(H) × 35.0(D)	228.5(W) × 158.5(H) × 35.0(D)
Weight (g)	Approx. 650	Approx. 800

Note 1)
These units should not be operated under environmental conditions where the humidity exceeds the dew point.

Note 2)
EL display units with wider operating temperatures (−20°C ~ +65°C) are also available. Model No.: LJ512U10 (512 × 256 dots). LJ640U11 (640 × 200 dots)

*Effective Display Area (mm)

■ Specifications are subject to change without notice.

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SHARP

LCD Units

Sharp, unchallenged leader in the field of LCD units, is about to revolutionize the field.

Sharp's capacity for technological development is creating new worlds for LCD applications.

Since 1973, when Sharp introduced the use of the LCD in electronic calculators for the first time in the world, new fields of application have been rapidly opened up thanks to a series of constant technological improvements. This commitment to improvement has led to LCD units with superior readability over a wide range of adverse conditions.

As demand for large-size and high-resolution LCD units increased, Sharp responded by adding quality features, including high contrast, wide viewing angle and wide temperature range displays, all of which drew attention in various fields. Sharp's innovative approach to LCD design has led to LCD units which are lightweight, thin and power-saving for better cost performance with high reliability. Sharp's search for new possibilities in the application of the LCD has no limits.

Paper white mode Double Super Twisted LCD unit—synthesis of Sharp's LCD technology.

A large portion of the information we regularly read is in the form of black letters printed on white paper. This same format has long been deisred for the LCD, as well.

Sharp has taken the lead in developing and mass-producing a paper white mode Double Super Twisted (DST) LCD unit capable of reproducing an image close to the printed page to which we are accustomed. This advanced display, almost equivalent to a CRT, is about to change the current image of the LCD entirely.

With nearly 3 times higher contrast and a wider viewing angle compared with our conventional Super Twisted High Contrast (STHC) LCD units, this new product, with built-in CCFT backlight, is our answer to the call for brighter and clearer displays. Paper white mode DST LCD units are ideal for OA equipment, from personal computers to word processors.

Table of Graphic Display Type LCD Units

Display format (Dot)	Model No.	Type*1 I	II	III	IV	Unit outline dimensions WxHxD (mm)*2	Effective viewing area WxH (mm)	Dot size WxH (mm)
240 x 64	LM24008W	R	—	P	S	180x75x10.5	132.6x39	0.48x0.48
	LM24008M	M	E	P	S	180x75x10.5	132.6x39	0.48x0.48
240 x 128	LM24009W	R	—	P	S	176x96x12	134x76	0.49x0.49
	LM24010J	T	C	P	S	176x96x19	134x76	0.49x0.49
480 x 128	LM48011W	R	—	P	S	261x96x12	238x70	0.43x0.43
640 x 200	LM64012C	T	C	P	S	274x130x21	232x106	0.31x0.45
	LM64014C	T	C	P	S	274x130x21	232x106	0.31x0.45
	LM64032W	R	—	P	S	256x128x12	232x106	0.32x0.46
	LM64032M	M	E	P	S	256x128x12	232x106	0.32x0.46
	LM64032X	T	E	P	S	256x128x12	232x106	0.32x0.46
	LM64050W	R	—	P	S	256x164x13	230x138	0.285x0.61
	LM64050M	M	E	P	S	256x164x16	230x138	0.285x0.61
	LM64025J/R	T	—	P	S	303.2x289x7.6	230x138	0.285x0.61
640 x 400	LM64015T	T	C	N	S	300x174x30	237x151	0.33x0.33
	LM64023W	R	—	P	S	266x174x14.5	237x151	0.33x0.33
	LM64035W	R	—	P	S	266x174x14	237x151	0.33x0.33
	LM64035M	M	E	P	S	266x174x16	237x151	0.33x0.33
	LM64035X	T	E	P	S	266x174x16	237x151	0.33x0.33
	LM64035J/R	T	—	P	S	337.7x262.4x7	237x151	0.33x0.33
	LM64135Z	T	C	N	D	300x166x26	218x139	0.30x0.30
640 x 480	LM64048Z	T	C	N	D	310x240x25	237x180	0.33x0.33
	LM64148Z	T	C	N	D	(280x180x25.5)	(205x155)	(0.28x0.28)
	LM64048E	T	—	N	D	(310x240x20)	(237x180)	(0.33x0.33)
	LM64148E	T	—	N	D	269.6x216x11.5	205x156	0.28x0.28
720 x 400	LM72060Z	T	C	N	D	320.4x170.4x34	260x147	0.32x0.32

*1 Type I: Transmissive: T / Transflective: M / Reflective: R
Type II: CCFT backlight is built in.: C / EL backlight can be installed.: E
Type III: Positive: P / Negative: N
Type IV: STHC LCD: S / DST LCD: D

*2 Excluding mounting tabs. D (Depth): max. value *3 Ta = 25°C

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SHARP LCD Units

Sharp LCD units are the result of a fully integrated process, from initial development to final inspection.

Sharp offers a diverse line of LCD units, small, medium and large. And with the addition of the Double Super Twisted LCD unit to the large-size graphic display line and the Super Twisted High Contrast LCD unit to the character display line, even wider range of choices can now be offered.

Sharp's high quality LCD units guarantee high reliability for a wide variety of applications. This attractive product line is the ultimate response to customers' needs, from large-size displays for computers to displays for precision machinery.

Please feel free to consult us about custom-designed units to match your specific applications.

DST LCD Unit

Demand for even higher display quality is increasing with a trend toward larger, higher-resolution LCD units. Sharp has succeeded in developing and mass producing paper white mode DST LCD units with image quality approaching that of the printed page.

Features

- Advanced start-to-finish production system to maximize the product quality.
- A broad range of products, from 240x64 to 720x400 dot display formats.
- Thin, lightweight and compact in design.
- Low drive voltage and low power consumption.
- A bright, high contrast, Double Super Twisted (DST) LCD with a wide viewing angle, adopted for the large-size LCD unit.
- Backlit models are also available offering the optimum readability under diverse lighting conditions.

Table of Graphic Display Type LCD Units

Duty	Supply voltage (V)*3		Power consumption (mW)*3	Operating temperature (°C)	Storage temperature (°C)	Weight (g) (Approx.)	Applicable controller	Model No.
	V_{DD}-V_{SS}	V_{EE}-V_{SS}						
1/64	5.0	-11.0	48	0~45	-25~60	120	LR3692	LM24008W
1/64	5.0	-11.0	48	0~45	-25~60	120	LR3692	LM24008M
1/128	5.0	-17.5	343	0~45	-25~60	200	LR3692	LM24009W
1/128	5.0	-21.0 (Min.)	395	5~45	-20~60	365	LR3692	LM24020J
1/64	5.0	-11.0	213	0~45	-20~60	320	LR3691A	LM48011W
1/200	5.0	-21.1	526	0~45	-25~60	790	V6366	LM64012C
1/100	5.0	-16.0	318	0~45	-25~60	790	V6366	LM64014C
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032W
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032M
1/200	5.0	-21.1	534	0~45	-25~60	320	V6366	LM64032X
1/200	5.0	-19.8	407	0~45	-20~60	570	V6366	LM64050W
1/200	5.0	-21.1	526	0~45	-25~60	650	V6366	LM64050M
1/100	5.0	-17.0	387	0~45	-25~60	350	V6366	LM64025J/R
1/200	5.0	-21.1	495	0~45	-25~60	1200	V6366	LM64015T
1/200	5.0	-19.8	712	0~45	-20~60	690	Built-in controller	LM64023W
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035W
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035M
1/200	5.0	-16.0	495	0~45	-25~60	480	V6366	LM64035X
1/200	5.0	-16.0	495	0~45	-25~60	280	V6366	LM64035J/R
1/200	5.0	-15.7	430	0~45	-25~60	950	V6366	LM64135Z
1/240	5.0	-16.5	460	0~45	-25~60	1200	V6366	LM64048Z
(1/240)	(5.0)	TBD	TBD	(0~45)	(-25~60)	TBD	(V6366)	LM64148Z
(1/240)	(5.0)	(-16.5)	(460)	(0~45)	(-25~60)	TBD	(V6366)	LM64048E
1/240	5.0	-16.5	498	0~45	-25~60	650	V6366	LM64148E
1/200	5.0	-15.0	485	0~45	-25~60	1450	V6366	LM72060Z

Note 1) Above models may be discontinued without notice due to switching to new products or other reasons.
Note 2) ( ): Tentative

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SHARP

LCD Units

Sharp character type LCD Unit operates under the control of a 4 or 8-bit microcomputer

Features

- Interface with either 4-bit or 8-bit microprocessor.
- Display data RAM
  80 x 8 bits (80 characters).
- Character generator ROM
  160 different 5 x 7 dot-matrix character patterns.
- Character generator RAM
  8 different user programmed 5 x 7 dot-matrix patterns.
- Display data RAM and character generator RAM may be accessed by the microprocessor.
- Numerous instructions
  Clear Display, Cursor Home, Display ON/OFF, Cursor ON/OFF, Blink Character, Cursor Shift, Display shift.
- Built-in reset circuit is triggered at power ON.
- Built-in oscillator.

TN-FEM LCD UNITS

Number of characters	Model No.	Type*1				Unit outline dimensions W x H x D (mm)*2	Effective viewing area W x H (mm)	Character size W x H (mm)
		I	II	III	IV			
16 x 1	LM16152A	R	—	P	6	115 x 35 x 12	99 x 13	4.9 x 7.95
	LM16152D/E/H	M	L	P	6	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM165159D/E/H	M	L	P	12	115 x 39.5 x 16	99 x 13	4.9 x 7.95
	LM16155	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155K	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155M	M	E	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155N	M	E	P	12	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
	LM16155S	R	—	P	6	80 x 36 x 11	64.5 x 13.8	3.07 x 5.73
16 x 2	LM16255	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255K	R	—	P	12	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255M	M	E	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16255S	R	—	P	6	84 x 44 x 11	61 x 15.8	2.96 x 4.86
	LM16257	R	—	P	6	85 x 32.6 x 11	61 x 15.8	2.96 x 4.86
	LM162A01	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B01	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162A02	T	L	P	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
	LM162B02	T	L	N	6	84 x 44 x 16	61 x 15.8	2.96 x 4.86
20 x 2	LM20255	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255M	M	E	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20255S	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM20256	R	—	P	6	115 x 36 x 11	83 x 18.6	3.2 x 4.85
	LM202A02	T	L	P	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
	LM202B02	T	L	N	6	115 x 36 x 16	83 x 18.6	3.2 x 4.85
24 x 2	LM24255	R	—	P	6	115 x 36 x 11	83 x 18.6	2.7 x 4.85
40 x 2	LM40255	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255K	R	—	P	12	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255M	M	E	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40255S	R	—	P	6	183 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM402A01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402B01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402X01	T	L	P	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85
	LM402Y01	T	L	N	6	182 x 33.5 x 16	154.4 x 15.8	3.2 x 4.85

STHC LCD UNITS

16 x 2	LM16A21	R	—	P	—	84 x 44 x 11	61 x 15.8	2.96 x 4.86
40 x 2	LM40A21	R	—	P	—	182 x 33.5 x 11	154.4 x 15.8	3.2 x 4.85
	LM40X21A	T	L	P	—	(182 x 33.5 x 16)	(154.4 x 15.8)	(3.2 x 4.85)
	LM40X21B	T	L	N	—	(182 x 33.5 x 16)	(154.4 x 15.8)	(3.2 x 4.85)

*1 Type I: Transmissive: T / Transflective: M / Reflective: R
Type II: LED backlight is built in.: L / EL backlight can be installed.: E
Type III: Positive: P / Negative: N
Type IV: 6 o'clock viewing direction: 6 / 12 o'clock viewing direction: 12

*2 D (Depth): max. value
*3 Ta = 25°C

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP

LCD Units

Sharp provides a solid line-up including 5 series with various display formats

Overview

The Sharp character type LCD unit, with built-in control LSI, operates under the control of a 4-bit or 8-bit microcomputer to display alphanumeric characters, symbols and others. It provides a solid line-up including 5 series (38 models) with various display formats, ranging from 16 characters × 1 line to 40 characters × 2 lines.

You can select models best suited to your application from the series.

In addition to the basic reflective type, backlit types (transmissive and transflective types) capable of service in low ambient light conditions are also available. We also offer a wide temperature range type which can be used in special environments (a wide temperature range).

New models added to the conventional line-up of TN-FEM (twisted nematic) type LCD units are the STHC (Super Twisted High Contrast) type designed to meet the needs of customers who require even more sophisticated display quality (still higher contrast and wider viewing angle range).

TN-FEM LCD UNITS

Dot size W × H (mm)	Duty	Supply voltage (V)*3	Power consumption (mW)*3	Operating temperature (°C)	Storage temperature (°C)	Weight (g) (Approx.)	Model No.
0.9 × 1.05	1/8	+5	25.0	0 ~ 50	−25 ~ 55	38	LM16152A
0.9 × 1.05	1/8	+5	383	0 ~ 50	−25 ~ 70	60	LM16152D/E/H
0.9 × 1.05	1/8	+5	383	0 ~ 50	−25 ~ 70	60	LM16159D/E/H
0.55 × 0.75	1/16	+5	7.5	0 ~ 50	−25 ~ 70	25	LM16155
0.55 × 0.75	1/16	+5	7.5	0 ~ 50	−25 ~ 70	25	LM16155K
0.55 × 0.75	1/16	+5	7.5	0 ~ 50	−25 ~ 70	25	LM16155M
0.55 × 0.75	1/16	+5	7.5	0 ~ 50	−25 ~ 70	25	LM16155N
0.55 × 0.75	1/16	+5, −5	11.7	−10 ~ 70	−40 ~ 80	25	LM16155S
0.56 × 0.66	1/16	+5	8.0	0 ~ 50	−25 ~ 70	28	LM16255
0.56 × 0.66	1/16	+5	8.0	0 ~ 50	−25 ~ 70	28	LM16255K
0.56 × 0.66	1/16	+5	8.0	0 ~ 50	−25 ~ 70	28	LM16255M
0.56 × 0.66	1/16	+5, −5	12.7	−10 ~ 70	−40 ~ 80	28	LM16255S
0.56 × 0.66	1/16	+5	8.0	0 ~ 50	−25 ~ 70	25	LM16257
0.56 × 0.66	1/16	+5, +12	608	0 ~ 50	−25 ~ 70	40	LM162A01
0.56 × 0.66	1/16	+5, +12	488	0 ~ 50	−25 ~ 70	40	LM162B01
0.56 × 0.66	1/16	+5	608	0 ~ 50	−25 ~ 70	40	LM162A02
0.56 × 0.66	1/16	+5	408	0 ~ 50	−25 ~ 70	40	LM162B02
0.6 × 0.65	1/16	+5	9.0	0 ~ 50	−25 ~ 70	40	LM20255
0.6 × 0.65	1/16	+5	9.0	0 ~ 50	−25 ~ 70	40	LM20255M
0.6 × 0.65	1/16	+5, −5	13.2	−10 ~ 70	−40 ~ 80	40	LM20255S
0.6 × 0.65	1/16	+5	9.0	0 ~ 50	−25 ~ 70	40	LM20256
0.6 × 0.65	1/16	+5	1109	0 ~ 50	−25 ~ 70	50	LM202A02
0.6 × 0.65	1/16	+5	1109	0 ~ 50	−25 ~ 70	50	LM202B02
0.6 × 0.65	1/16	+5	9.0	0 ~ 50	−25 ~ 70	40	LM24255
0.6 × 0.65	1/16	+5	12.0	0 ~ 50	−25 ~ 70	70	LM40255
0.6 × 0.65	1/16	+5	12.0	0 ~ 50	−25 ~ 70	70	LM40255K
0.6 × 0.65	1/16	+5	12.0	0 ~ 50	−25 ~ 70	70	LM40255M
0.6 × 0.65	1/16	+5, −5	22.4	−10 ~ 70	−40 ~ 80	70	LM40255S
0.6 × 0.65	1/16	+5, +12	1452	0 ~ 50	−25 ~ 70	90	LM402A01
0.6 × 0.65	1/16	+5, +12	972	0 ~ 50	−25 ~ 70	90	LM402B01
0.6 × 0.65	1/16	+5, +12	1452	0 ~ 50	−25 ~ 70	90	LM402X01
0.6 × 0.65	1/16	+5, +12	972	0 ~ 50	−25 ~ 70	90	LM402Y01

STHC LCD UNITS

0.56 × 0.66	1/16	+5	8.0	0 ~ 50	−25 ~ 70	28	LM16A21
0.6 × 0.65	1/16	+5	12.0	0 ~ 50	−25 ~ 70	70	LM40A21
(0.6 × 0.65)	(1/16)	(+5)	TBD	(0 ~ 50)	(−25 ~ 70)	(90)	LM40X21A
(0.6 × 0.65)	(1/16)	(+5)	TBD	(0 ~ 50)	(−25 ~ 70)	(90)	LM40X21B

Note 1) Above models may be discontinued without notice due to switching to new products or other reasons.
Note 2) ( ): Tentative

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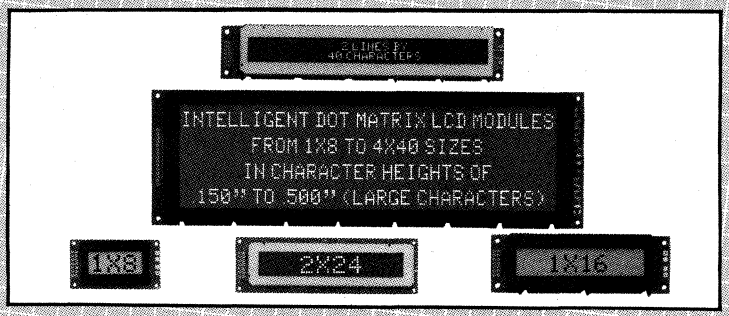
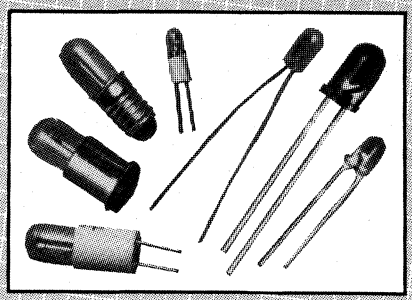
Optoelectronics from Shelly!

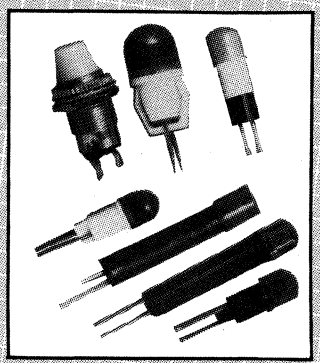


DOT MATRIX LCD MODULES

■ 1x8 to 4x80 sizes ■ .15 to .5" character heights ■ EL, LED and fluorescent backlighting ■ commercial wide temperature and Supertwist fluids

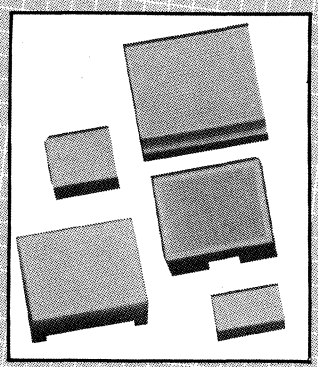


INCANDESCENT, NEON AND LED LAMPS



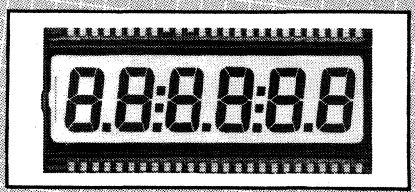
INDICATORS

■ based lamp ■ front relampable ■ incandescent ■ LED ■ neon



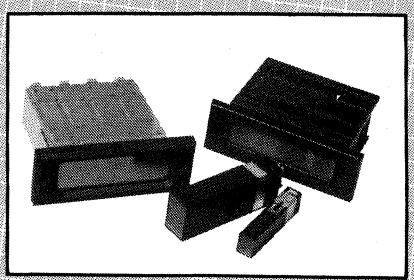
LED LIGHT BARS

■ large area indicators

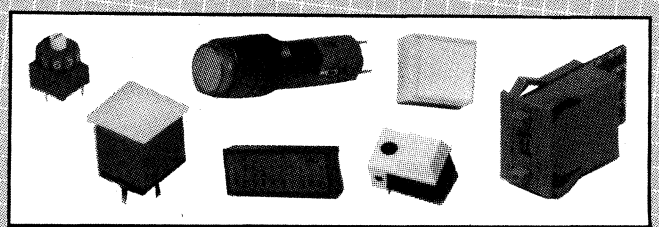


MULTI-DIGIT 7- SEGMENT LCDs

■ commercial & industrial temperature range fluids



MULTI-MESSAGE DISPLAYS



SWITCHES

■ lighted and unlighted switches

14281 Chambers Road . Tustin, California 92680
(714) 669-9850 . TLX: 85-2263 . FAX: 714-669-1081

SHELLY associates

SIGNALEX®

HIGH VISIBILITY DISPLAYS

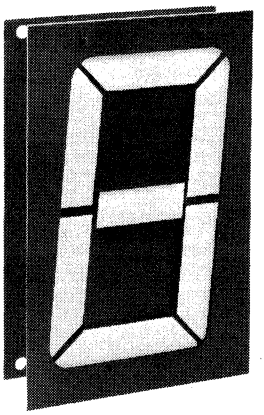
ENERGY-SAVING: Electromagnetically-operated Signalex displays require no power to maintain continuous indication. Inherently bi-stable, Signalex displays draw power only at the instant of change.

INHERENT MEMORY: Indication is maintained even with loss of power.

DIRECT ACCESS: Signalex displays can change from one number to any other—without a run-through of numbers. The unit immediately displays the transmitted number.

LOW MAINTENANCE: The rugged Signalex design assures long life and dependability. With no bulbs to replace, they are virtually maintenance-free.

HIGH-VISIBILITY: Signalex displays can be used indoors and out, in temperatures ranging from -40°C to +75°C. Their light-reflecting segments give high visibility in bright ambient light.



402L

7 SEGMENT MODELS

DISPLAY SIZES	1½"	4"	6"	9"	12"	18"	24"
SIGNALEX MODEL	152L	402L	602L	900L	1200L	1810L	2410L
Character Size H x W	1-9/16" x 15/16" (40 x 24 mm)	4-1/16" x 2-5/16" (103 x 59 mm)	6-1/16" x 3-9/16" (154 x 91 mm)	9" x 6" (228 x 152 mm)	12" x 8" (305 x 204 mm)	18" x 12" (46 x 30 cm)	24" x 16" (61 x 41 cm)
Vane Width	5/32" (4 mm)	7/16" (11 mm)	11/16" (17 mm)	1-1/8" (29 mm)	1-1/2" (38 mm)	2-1/4" (5.7 cm)	3" (7.6 cm)
Frame Size H x W	1-7/8" x 1-5/16" (49 x 33 mm)	5" x 3-1/4" (127 x 83 mm)	7-1/4" x 5-1/8" (184 x 130 mm)	11" x 8-1/4" (279 x 210 mm)	14" x 11" (356 x 279 mm)	21" x 16½" (533 x 419 mm)	28" x 22" (711 x 559 mm)
Pulse Length, min.	30 ms	50 ms	90 ms	150 ms	200 ms	300 ms	400 ms
Pulse Power, Each Vane	0.35 W	0.93 W	1.4 W	3.6 W	3.6 W	9.0 W	9.0 W
Viewing Dist., max.	50 Feet (15 Meters)	160 Feet (50 Meters)	240 Feet (75 Meters)	360 Feet (110 Meters)	480 Feet (150 Meters)	720 Feet (220 Meters)	960 Feet (300 Meters)
Weight	2-1/4 oz. 65 gm.	8-1/2 oz. 240 gm.	12-2/3 oz. 360 gm.	1-1/2 lbs. 680 gm.	2-1/4 lbs. 1020 gm.	4-1/2 lbs. 2. kg	6 lbs. 2.7 kg

U.S. Patent Nos. 3,886,545; 4,117,478; U.S. Design Patent 249,985 and Patents Pending

Operation: Individually controlled segments, pulse-operated through a bi-stable magnetic circuit.

Voltage: 12.V. DC ±10% standard. Other voltages available.

Coils: Standard is bifilar wound with 3 leads per segment. Model 152L has terminal pins for direct PCB mounting.

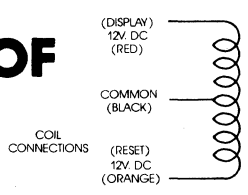
Temperature: -40°C to +75°C.

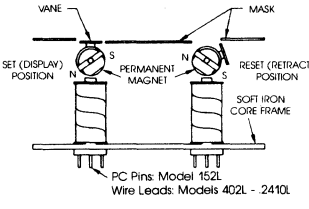
Relative Humidity: Up to 95% R.H. at any temperature in the range, provided no consideration present.

Power to Maintain Display: NONE

Vane Colors: White, Saturn-Yellow, Orange-Red Fluorescents. Black background standard. Other high-visibility colors available.

PRINCIPLE OF OPERATION





Signalex® displays operate on a well-proven electromagnetic principle. A short pulse in a coil produces a magnetic field that acts upon a permanent magnet located in a rotor, part of which is the vane itself.

The magnet is either attracted or repelled, turning the rotor and vane with it. In either display or reset position the magnetic circuit is stable so that the vane can remain in either position with no power in the coil. The permanent magnet pole is attracted to the soft iron core which will hold the vane in position until a reverse pulse is passed.

The rotor and magnet assemblies are the only moving parts in the display. Their light weight and low inertia give fast response time. High lubricity plastic bearings are used.

THE STAVER COMPANY INCORPORATED

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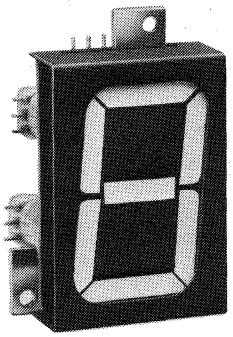
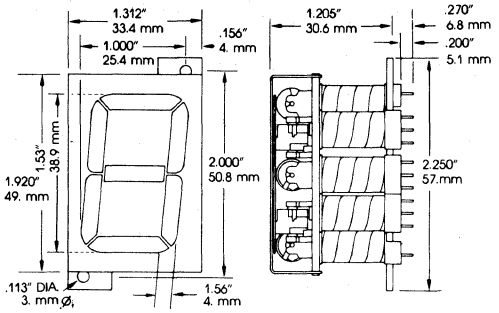
SIGNALEX

SIGNALEX®

HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODEL 152L

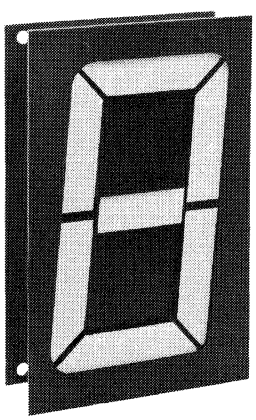


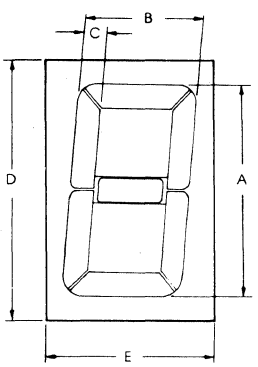


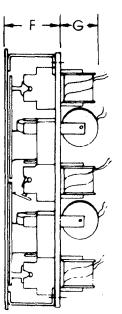
The Signalex 152L is used world-wide in readout applications for toll booths, clocks, gas pumps, arcade games, oil rig instrumentation, currency exchange panels, and industrial controls. Since Signalex readouts draw no power while maintaining position, they are ideal for battery-powered systems as well as AC.

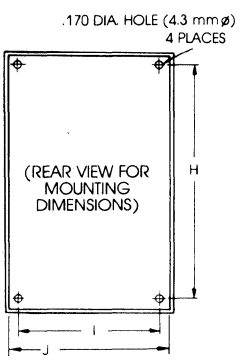
Connections: 3 per coil
(1 to display, 1 to reset, 1 common)
Pulse Power: 31ma at 12.V.
Pulse Length: 30ms min., display or reset
Character Slope: 5°
Visibility: Up to 70° either side of perpendicular to the front face.
Temperature Range: -40°C to + 75°C
Materials: Front Mask: Steel, Bearings: Polyester.
Hazardous Areas: Recognized by Underwriters Laboratories, Inc.,
No. MH10471. BASEEFA Class 2 No. 4054 J.

MODELS 402L & 602L

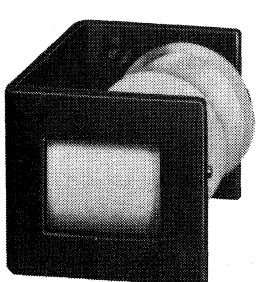








(in.) Dim.	A	B	C	D	E	F	G	H	I	J
Model 402L	4-1/16	2-5/16	7/16	5	3-1/4	1-1/16	3/4	4-1/2	2-5/8	3-1/8
Model 602L	6-1/16	3-9/16	11/16	7-1/4	5-1/8	1-5/16	3/4	6-1/2	4-1/2	5



SIGNALEX® TYPE A

The Type A Indicator is a bi-stable electromagnetic annunciator showing alternate display faces in its window. It may be mounted for operation in any position. It is driven in either direction by 1.1 watt pulses as short as 30 ms and remains in its last position without power input until pulsed to the opposite position.

Signalex Type A indicators are used in hospital, apartment house, and commercial call boards, as well as in circuit indicators, alarm systems, and a variety of other applications.

SIGNALEX®

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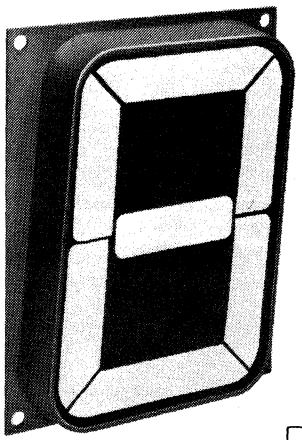
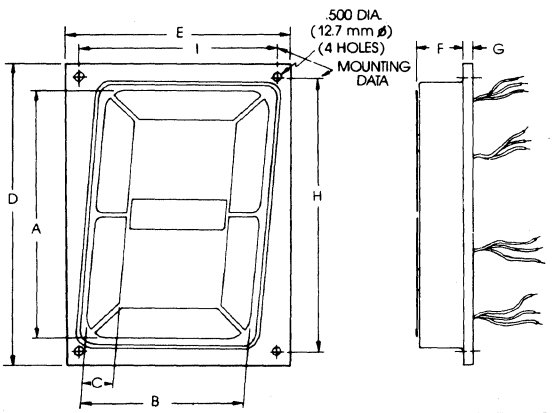
SIGNALEX®

HIGH VISIBILITY 7-SEGMENT DISPLAYS

MODELS 900L & 1200L

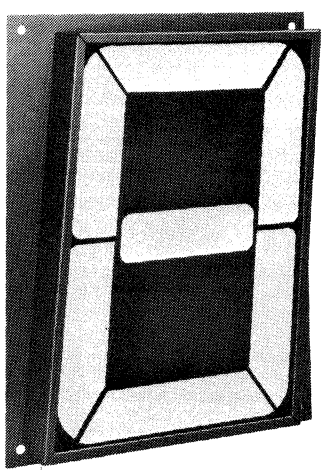


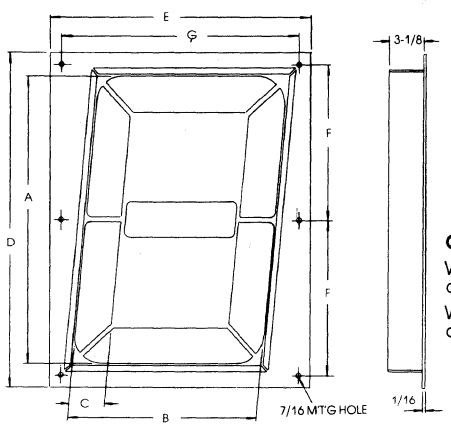


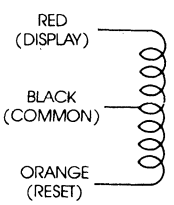
Length of Leads: 7" Min. for 402L & 602L.
30" Min. for 900L & 1200L
Bearings: High lubricity polyester, replaceable.
Vanes: Individually replaceable.
Visibility: 402L & 602L Series—To 60° either side.
900L & 1200L Series—To 75° either side.

(in.) Dim.	A	B	C	D	E	F	G	H	I
Model 900L	9	6	1-1/8	11	8-1/4	2-1/32	3/16	10*	7-1/4*
Model 1200L	12	8	1-1/2	14	11	2-1/16	3/16	13	10

MODELS 1810L & 2410L







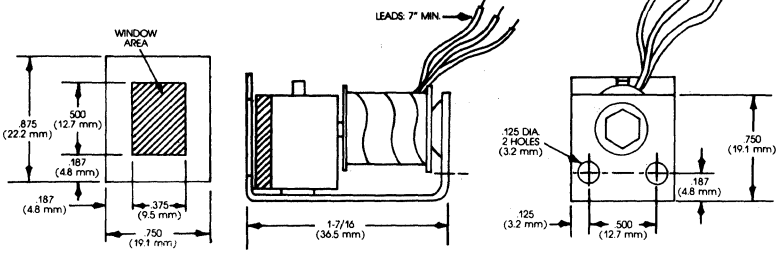
Coil Connection (402L & larger) (7 coils per digit)
With black lead connected to (-), (+) on red lead displays white. (+) on orange lead resets to black.
With black lead connected to (+), (-) on orange lead displays white. (-) on red lead resets to black.

(in.) Dim.	A	B	C	D	E	F	G
TYPE 1810L	18"	12	2 1/4	21	16 1/2	19 1/2*	15
TYPE 2410L	24"	16	3	28	22	13	20

*20" From Top to Bottom MT'G Hole. No Center Holes.

ANNUNCIATOR

Window Size: 3/8" H x 1/2" W (9.5 mm x 12.7 mm)
Displays per Window: 2
Operating Temp. Range: -40°C to +75°C
Operating Mode: Bi-stable, pulsed
Min. Pulse Length: 30ms. either display
Power/Pulse: 1.1W
Coil Resistance: 125. Ω ± 10%
Standard Voltage: 12 V. DC*
Standard Colors: Black & White, Yellow, Red.*
Leads: 7" Min.:
*Others Available.



U.S. Patent No. 3,936,818

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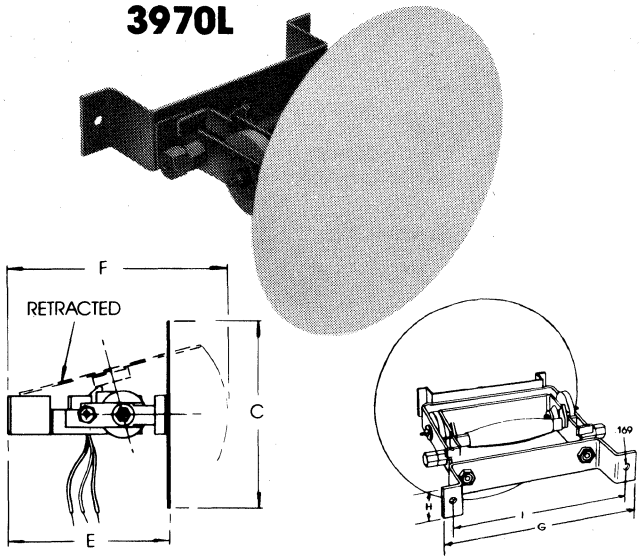
SIGNALEX®

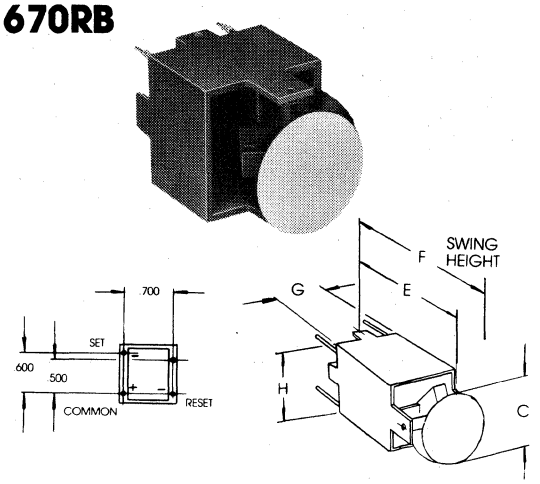
SIGNALEX®

HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

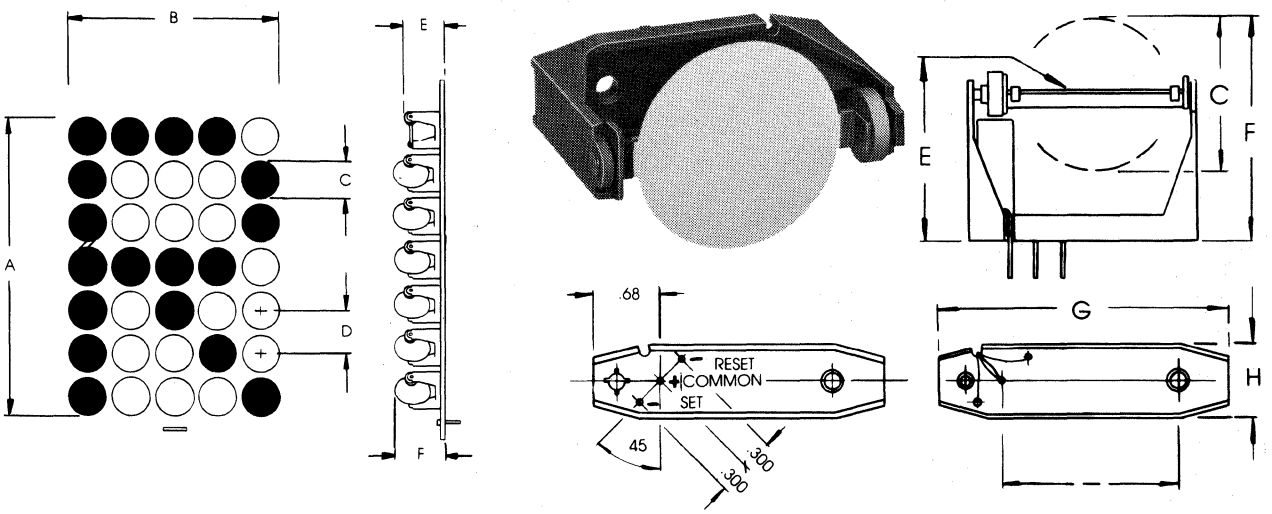
3970L



670RB



972R - 1872R



Model Number	Dim. A Char. Hgt. in.	mm.	Dim. B Char. Width in.	mm.	Dim. C Dot Dia. in.	mm.	Dim. D Dot Pitch in.	mm.	Dim. E Display Hgt. in.	mm.	Dim. F Swing Hght. in.	mm.	Dim. G Length in.	mm.	Dim. H Width in.	mm.	Dim. I Mounting in.	mm.
670R	6.00	152	4.25	108	.75	19.0	.875	22.2	1.33	33.8	1.57	39.7	.84	21.3	.84	21.3	—	—
972R	9.00	230	6.37	162	1.12	28.0	1.31	33.3	1.45	36.8	2.10	53.3	1.81	46.0	.75	19.0	.596	15.1
1272R	12.00	300	8.50	216	1.50	38.0	1.75	44.5	1.45	36.8	2.29	58.2	2.24	56.9	.75	19.0	1.026	26.1
1672R	16.00	406	11.37	289	2.00	51.0	2.34	59.5	1.45	36.8	2.54	64.5	2.74	69.6	.75	19.0	1.526	38.8
1872R	18.00	457	12.75	324	2.25	57.0	2.62	66.7	1.45	36.8	2.66	67.6	2.99	76.0	.75	19.0	1.776	45.1
3970L	39.50	1000	28.00	711	5.00	127.0	5.75	146.0	4.30	109.2	5.87	149.1	4.50	114	1.0	25.4	4.000	102.0

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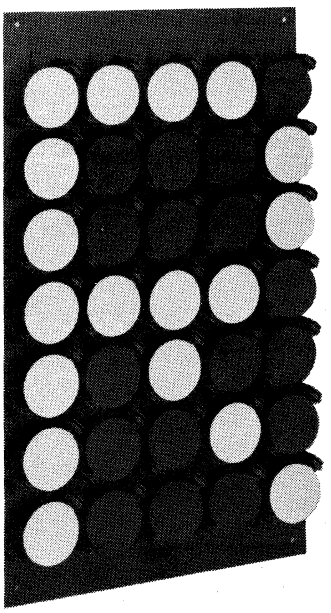
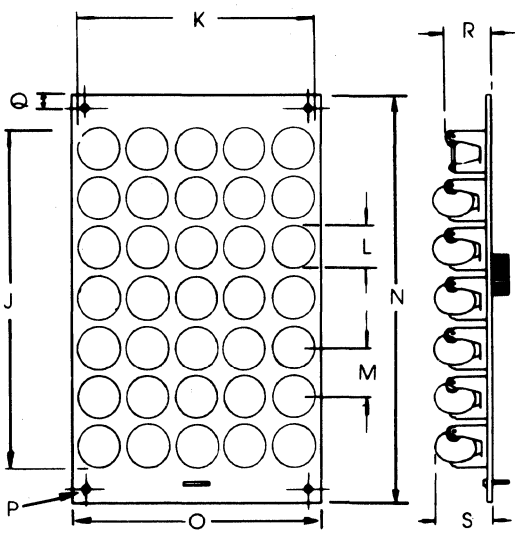
SIGNALEX®

HIGH VISIBILITY ALPHANUMERIC DISPLAYS AND INDIVIDUAL GRAPHIC ELEMENTS

Signalex Individual Alphanumerics are bi-stable electromagnetic displays which require only a very short pulse to change position. Inherent latching memory requires no power except during the moment of change. The magnetic design permits operation of most models using 12vdc with a 2 msec. pulse and, at higher voltages, at 1 msec. or less.

The standard 7 by 5 matrix of 35 dots gives full alphanumeric capability, and is available in sizes which can create characters 4", 6", 9", 12", 16", 18" and 39" high. The flexibility of Signalex individual alphanumerics permits the creation of custom displays. In addition to the standard (7 x 5) format, the 28-dot (7 x 4) numeric format, a 23-dot (7-Bar) format, or other desired shapes may be used.





670R-1872R-35BC

SPECIFICATIONS—ALL MODELS

	670R-35BC	972R-1872R-35BC
Pulse Length, Min. @ 12V	2ms	2ms
Pulse Length, Min. @ 18V	1ms	1ms
Maximum Duty Cycle @ 12V	5%	5%
Current Each Dot @ 12V	680ma	580ma
Coil Res. Center to Each Side	17.5 ohms	20.5 ohms
Coil Winding	Center Tapped Coil	
Coil Addressing	All Models	X-Y Matrix
Ground Polarity	Negative	Negative
Diodes	1N4004	1N4004
PCB Material	FR-4 or Equivalent	
Operating Temperature Range	All Models: -40 C to +75 C	
Operating Rel. Humidity	All Models: Up to 95% @ +75 C*	
Standard Colors	All Models: White, Yellow, Red	

*Provided No Condensation Present

35 DOT 7 BY 5 ALPHANUMERIC MATRICES

	Dim. J Char. Hgt		Dim. K Char. Width		Dim. L Dot Dia.		Dim. M Dot Pitch		Dim. N Matrix Hgt		Dim. O Matrix Width		Dim. P Mtg. Hole		Dim. Q Hole Offset		Dim. R Thickness		Dim. S Swing Hgt.	
	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.	in.	mm.
670R-35BC	6	152	4.25	108	.75	19	.875	22.2	7.75	197	4.25	114	.178	4	.25	6	1.35	34	1.57	39.7
972R-35BC	9	230	6.37	162	1.12	28	1.31	33.3	11.87	301	6.53	166	.195	5	.25	6	1.80	43	2.07	52.6
1272R-35BC	12	300	8.50	216	1.50	38	1.75	44.5	15.00	386	8.72	224	.195	5	.50	13	1.80	43	2.25	57.2
1672R-35BC	16	406	11.37	289	2.00	51	2.34	59.4	19.50	502	11.69	301	.195	5	.50	13	1.80	43	2.54	64.5
1872R-35BC	18	457	12.75	324	2.25	57	2.62	66.7	21.63	557	13.09	337	.195	5	.50	13	1.80	43	2.66	67.6

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SIGNALEX®

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

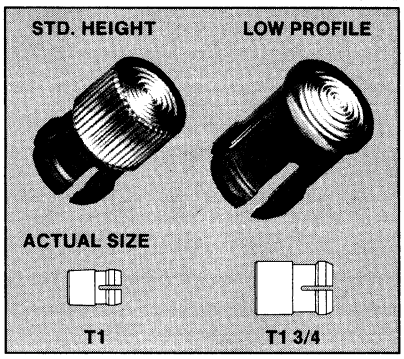
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

CLIPLITE® LENS/MOUNTS FOR T1 & T1 3/4 LEDs

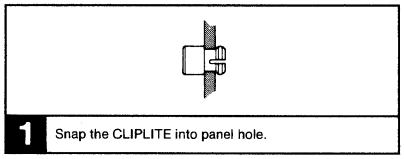


U.S. & For. Pat. Issued & Pend.

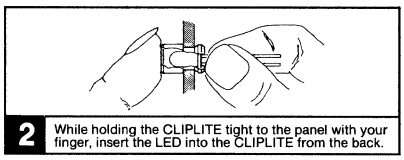
FEATURES

- Installs with finger pressure — no tools required — takes only six seconds
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Protects LED from being pushed back through panel — LED blackout
- Moisture seals easily to panel with the application of common sealants
- Intensifies apparent brightness up to 125% by the use of striated lines and fresnel rings
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

SIMPLE TWO-STEP INSTALLATION

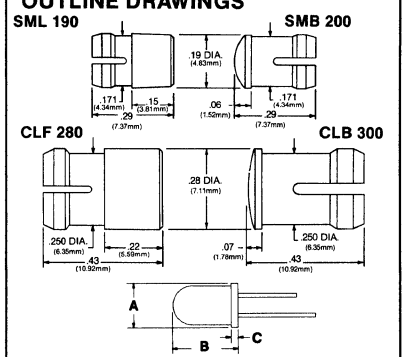


1 Snap the CLIPLITE into panel hole.



2 While holding the CLIPLITE tight to the panel with your finger, insert the LED into the CLIPLITE from the back.

OUTLINE DRAWINGS



RECOMMENDED LEDs

	A	B	C
T1	.150	.200	.02 MIN to .04 MAX
T1 3/4	.230	.340	.02 MIN to .05 MAX

SPECIFICATIONS

MATERIAL Lens — Polycarbonate; Spacer — Nylon, (U.L. Listed plastics).

DESIGN Standard and low profile lens using fresnel rings and striated lines.

MOUNTING Mounts thru front of panel. Mounting holes should be deburred but not chamfered.
T1 size (SML 190, SMB 200) mounts in a .171+/-.002 (4.34mm) hole on 1/4" centers. Panel thickness for SML 190, 1/32" to 1/16"; SMB 200, 1/16" to 1/8".
T1 3/4 size (CLF 280, CLB 300) mounts in a .250+/-.002 (6.35mm) hole on 3/8" centers. Panel thickness for CLF 280, 1/16" to 1/8"; CLB 300, 1/32" to 1/4"; (panels less than 3/16", SPC 125 spacer available).
Standard metal or plastic washers can be used to increase panel thickness if necessary.

ORDERING CODES

CLF 280 RTP

MODEL
SML 190 (T1 Size) Std. Hgt.
SMB 200 (T1 Size) L/Profile
CLF 280 (T1 3/4 Size) Std. Hgt.
CLB 300 (T1 3/4 Size) L/Profile
SPC 125 (Spacer for CLB 300)

COLOR

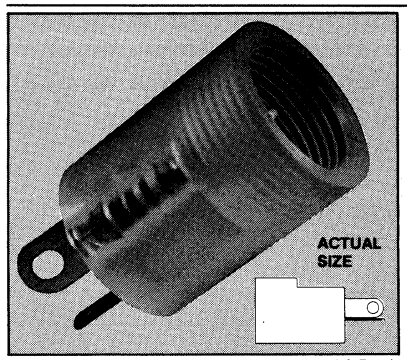
RTP Red Transparent	BTP Blue Transparent
ATP Amber Transparent	YTP Yellow Transparent
GTP Green Transparent	CTP Clear Transparent

OEM PRICES

QUANTITY	100	500	1000
SML 190	17.00/C	14.00/C	11.00/C
SMB 200	17.00/C	14.00/C	11.00/C
CLF 280	18.00/C	15.00/C	12.00/C
CLB 300	18.00/C	15.00/C	12.00/C
SPC 125	2.40/C	2.10/C	1.70/C

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

CONXRITE® SOLDERLESS LED CONNECTOR

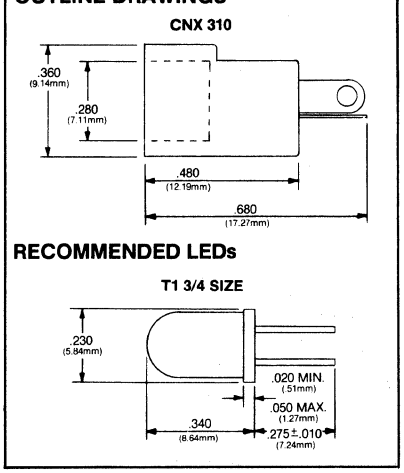


U.S. & For. Pat. Issued & Pend.

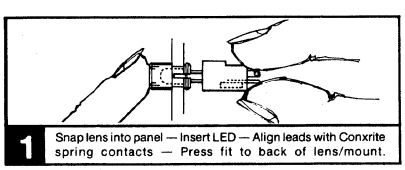
FEATURES

- Internal resistor for 3V to 28V circuits - when external resistor is required or desired Conxrite is available without built-in resistor
- Requires no tools — provides a simple fast press-fit connection to either Cliplite or clip mount
- Stress relieved connection controls the problem of broken LED leads
- When preassembled to the wiring harness final assembly of the panel mounted LED is greatly simplified
- Various colored Cliplite lenses are available for use with the Conxrite.
- Makes field replacement of defective LEDs practical and cost-effective

OUTLINE DRAWINGS

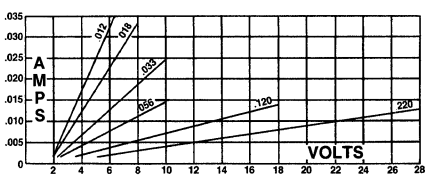


EASY INSTALLATION



1 Snap lens into panel — Insert LED — Align leads with Conxrite spring contacts — Press fit to back of lens/mount.

RESISTOR SELECTION GUIDE



SPECIFICATIONS

MATERIAL
HOUSING — Polypropylene (natural).

TERMINALS — Phosphor bronze, tin plated
Compatible with AMP FASTON Terminals.

RESISTOR — Melf 1/4 watt resistor provides current limiting to 28 volts.

PANEL MOUNTS — Cliplite Series - Polycarbonate (see specs above). Clip mount polypropylene (Hewlett Packard P/N 5082-4707 or equal)

NOTE: Trim LED lead length to .275± .010 (7.24 .254mm)

ORDERING CODES

CNX 310 012

MODEL
RESISTOR CODE

CODE	VALUE	CODE	VALUE
000	NO RESISTOR	056	560 OHMS
012	120 OHMS	120	1200 OHMS
018	180 OHMS	220	2200 OHMS
033	330 OHMS		

OEM PRICES

QUANTITY	100	500	1000
CNX 310 (NO RESISTOR)	.50	.43	.36
CNX 310 (RESISTOR)	.64	.55	.46

All units and values can be combined for price advantage. For higher quantity pricing contact VCC. Prices subject to change without notice.

MINIATURE INDICATORS

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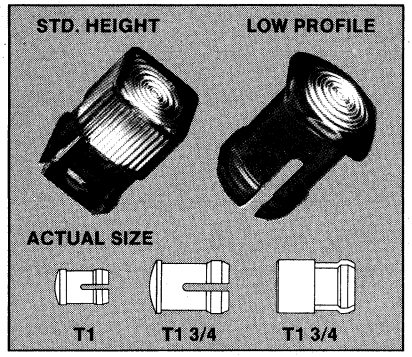
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

CUBELITE® SQUARE LENS/MOUNTS FOR LEDs



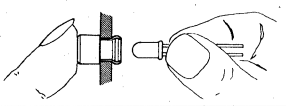
U.S. & For. Pat. Issued & Pend.

FEATURES

- Enhances aesthetics, square design in both standard and low profile configurations
- Mounts either as a single square lens or stacks in bar configuration
- Increases viewing angle up to 180 degrees using either diffused or point source LEDs
- Intensifies apparent brightness up to 140% by the use of striated lines and fresnel rings
- Installs with finger pressure — no tools required — takes only six seconds
- Guards against IC damage from electrostatic discharge transmitted thru exposed LED

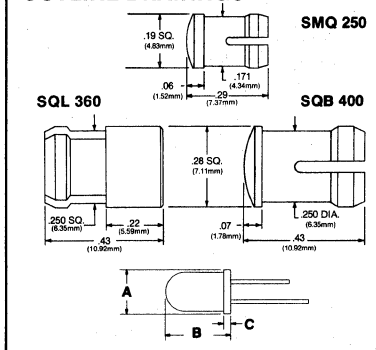
EASY TWO-STEP INSTALLATION

1 Snap CUBELITE in a .250 inch panel hole.



2 Holding CUBELITE firmly to panel, insert LED into CUBELITE from the back. Installs in just 6 seconds.

OUTLINE DRAWINGS



RECOMMENDED LEDs

	A	B	C
T1	.150	.200	.02 MIN to .04 MAX
T1 3/4	.230	.340	.02 MIN to .05 MAX

SPECIFICATIONS

MATERIAL Lens — Polycarbonate; Spacer — Nylon, (U.L. Listed plastics).

DESIGN Square lens, standard and low profile, fresnel rings and striated lines.

MOUNTING Mounts thru front of panel. Mounting holes should be deburred but not chamfered.
T1 size (SMQ 250) mounts in a .171+/-.002 (4.34mm) hole on 1/4" centers. Panel thickness from 1/16" to 1/8".
T1 3/4 size (SQL 360) mounts in a .250+/-.002 (6.35mm) square punched hole on 3/8" centers. Panel thickness from 1/16" to 1/8".
T1 3/4 size (SQB 400) mounts in .250+/-.002 (6.35mm) round hole on 3/8" centers. Panel thickness from 1/32" to 1/4"; (for panels less than 3/16", optional spacer SPC 125 is available).
Standard metal or plastic washers can be used to increase panel thickness if necessary.

PUNCH SOURCES Porter Precision, Cincinnati, OH; Strippet, Houdaille Ind., Akron, NY; Unipunch Products, Buffalo, NY; Wiederman Co., King of Prussia, PA

ORDERING CODES

SQL 360 RTP

MODEL
SMQ 250 (T1 Size) L/Profile
SQB 400 (T1 3/4 Size) L/Profile
SQL 360 (T1 3/4 Size) Std. Hgt.
SPC 125 (Spacer for SQB 400)

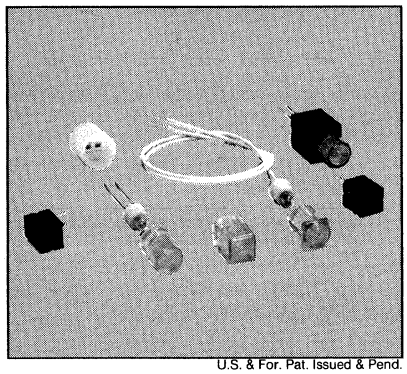
COLOR
RTP Red Transparent
ATP Amber Transparent
GTP Green Transparent
BTP Blue Transparent
YTP Yellow Transparent
CTP Clear Transparent

OEM PRICES

QUANTITY	100	500	1000
SMQ 250	17.00/C	14.00/C	11.00/C
SQL 360	20.00/C	17.00/C	14.00/C
SQB 400	18.00/C	15.00/C	12.00/C
SPC 125	2.40/C	2.10/C	1.70/C

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

CLIPLITE® ROUND CUBELITE® SQUARE / INCANDESCENT INDICATORS



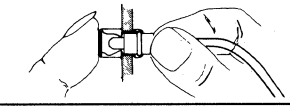
U.S. & For. Pat. Issued & Pend.

FEATURES

- Installs with finger pressure — no tools — takes only 6 seconds
- Provides 180 degrees of visibility using transparent lenses
- Bi-Pin or wire lead lamps easily installed or replaced
- Produces a brighter display than LEDs — provides extremely long life

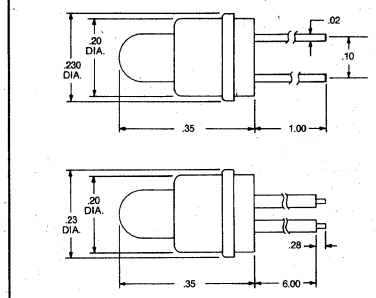
SIMPLE TWO-STEP INSTALLATION

1 Snap lens into panel hole.



2 Holding lens firmly to panel, insert lamp into lens mount from the back. Installs in just 6 seconds.

OUTLINE DRAWINGS



USE WITH

CLB 300	CNX 310 000
CLF 280	PCR 740
SQB 400	PCH 330
SQL 360	PCV 340

SPECIFICATIONS

LAMPS Aged and selected, Bi-Pin base or 6" insulated wire leads. Voltages 5v, 14v and 28v. IC compatible lamp also available.

MOUNTING Lamps have special base for use with VCC's lenses, connectors and PCB mounts.

LENSES CLIPLITE (round), CUBELITE (square), standard and low profile, mount in .250 hole, panels from 1/32" to 1/4" thickness.

CONNECTORS CONXRITE, provides a fast press-fit connection to lamps mounted in CLIPLITE & CUBELITE lenses.

PCB MOUNTS/SOCKETS P-C-LITE, methods of attaching lamps vertically and horizontally to PCBs. See CLIPLITE, CUBELITE, CONXRITE and P-C-LITE data.

ORDERING CODES

05 020 PIN

LAMP VALUES

VOLTS	AMPS	MSCP	LIFE HRS.
05	020	.02	25,000
05	060	.05	100,000
14	040	.14	16,000
28	024	.15	16,000

LAMP BASE
W6 (6" WIRE LEADS)
PIN (BI-PIN)

OEM PRICES

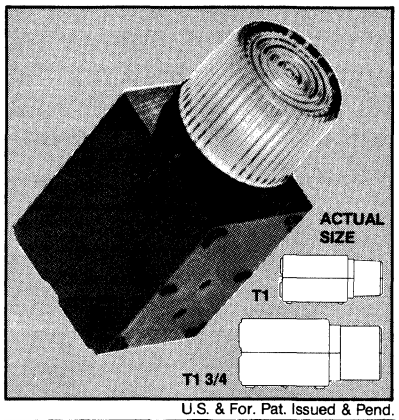
QUANTITY	1	50	100	500	1000
05 020	1.14	1.03	.92	.80	.69
05 060	1.07	.96	.86	.75	.65
14 040	1.37	1.23	1.10	.96	.83
28 024	2.24	2.02	1.80	1.57	1.35

For higher quantity pricing contact VCC. Prices subject to change without notice.

MINIATURE INDICATORS

VISUAL COMMUNICATIONS COMPANY, INC.
7920-G Arjons Drive San Diego, CA 92126 U.S.A. IN CA (619) 549-6900
FAX (619) 549-3520 Toll Free (800) 522-5546

P-C-LITE® PCB MOUNTS FOR T1 & T1 3/4 LEDs

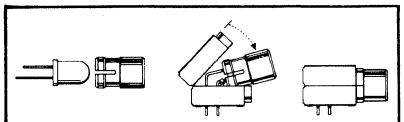


U.S. & For. Pat. Issued & Pend.

FEATURES:

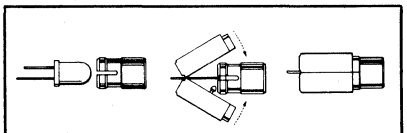
- Wave solders horizontally or vertically without special jigs or fixtures
- Stabilizes LED during packaging and physically protects after assembly
- Mounts flush, recessed or fully extended thru display panel without attachments
- Height compatible with switches and other circuit board mounted components
- Increases LED apparent brightness and viewing angle up to 180 degrees
- Guards against IC damage by electrostatic discharge transmitted thru exposed LED

HORIZONTAL MOUNT



Snap LED into lens — insert LED leads through holes in mount base — close mount, bending leads into position.

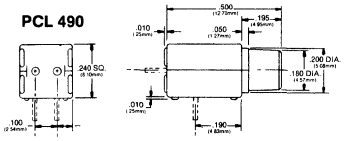
VERTICAL MOUNT



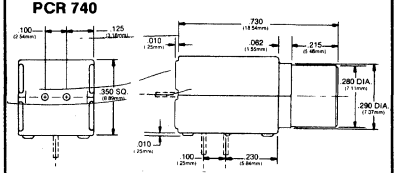
Snap LED into lens — insert LED leads through holes in mount — close mount.

OUTLINE DRAWINGS

PCL 490



PCR 740



RECOMMENDED LEDs

See Cliplite Lens Data Page.

SPECIFICATIONS

BODY — General purpose nylon (black).

LENS — Plycarbonate. Flat top design using fresnel rings and striated lines.

MOUNTING — P C Board horizontally or vertically on .100 inch hole centers.

(PCL 490) Panel thickness from 1/64" to 3/16" thru a 7/32" clearance hole.

(PCR 740) Panel thickness from 1/32" to 9/32" thru a 5/16" clearance hole.

Permits full projection to flush mounting of the lens portion thru the panel.

LED Standard LEDs. See Cliplite Lens Data Page for dimensional infomation. No attempt should be made to bend a lead with a stepped thickness.

ORDERING CODES

PCL 490 RTP

MODEL
PCL 490 (T1 SIZE)
PCR 740 (T1 3/4 SIZE)

COLOR

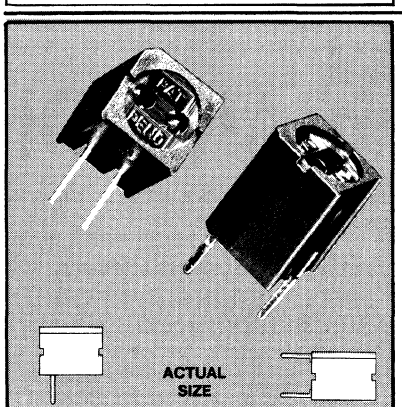
RTP Red Transparent	YTP Yellow Transparent
ATP AmberTransparent	CTP Clear Clear Transparent
GTP Green Transparent	BTP Blue Transparent

OEM PRICES

QUANTITY	100	500	1000
PCL 490	34.00/C	28.00/C	22.00/C
PCR 740	36.00/C	30.00/C	24.00/C

All colors can be combined for price advantage per line item. For higher quantity pricing contact VCC. Prices subject to change without notice.

P-C-LITE® CIRCUIT BOARD SOCKET FOR LEDs

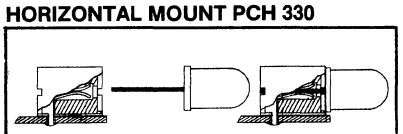


U.S. & For. Pat. Pend.

FEATURES

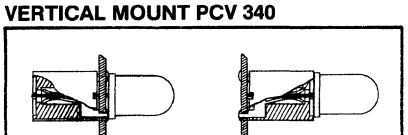
- Relampable — no direct soldering of LEDs
- Used to mount round, square, triangular, odd sizes and various shapes of LEDs
- Easy installation, replacement of phototransistors, IR emitters, incandescent bi-pin lamps
- Mounting of PCB status, logic, fault indictor lights
- Mounts horizontally or vertically — LEDs can be inserted from either end of socket
- Designed for lock type security of LEDs used in high shock and vibration environments

HORIZONTAL MOUNT PCH 330



Insert LED - trim LED or bend LED leads for security.

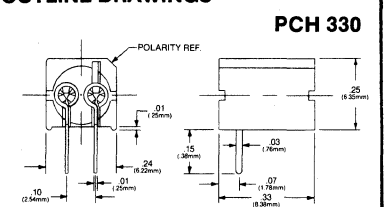
VERTICAL MOUNT PCV 340



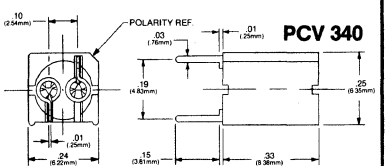
Opposite Side Mounting | Same Side Mounting

OUTLINE DRAWINGS

PCH 330

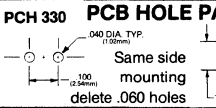


PCV 340

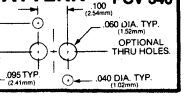


PCB HOLE PATTERN

PCH 330



PCV 340



SPECIFICATIONS

MATERIAL

HOUSING — General purpose nylon (black)
CONTACTS — Phosphor bronze, tin plated

MOUNTING

PCH 330 — .040 (1.02mm) holes on .100 (2.54mm) centers (see pattern)
PCV 340 — .040 (1.02mm) holes with optional .060 (1.52mm) holes for opposite side mounting. Same side mounting, delete the .060 holes (see pattern).
SPACER OPTION — Bivar, Series 908 nylon spacer or equal

LED LEAD DIMENSIONS

MINIMUM — .017 (.43mm) round or square shape
MAXIMUM — .030 (.76mm) thickness — .040 (1.02 mm) width

ORDERING CODES

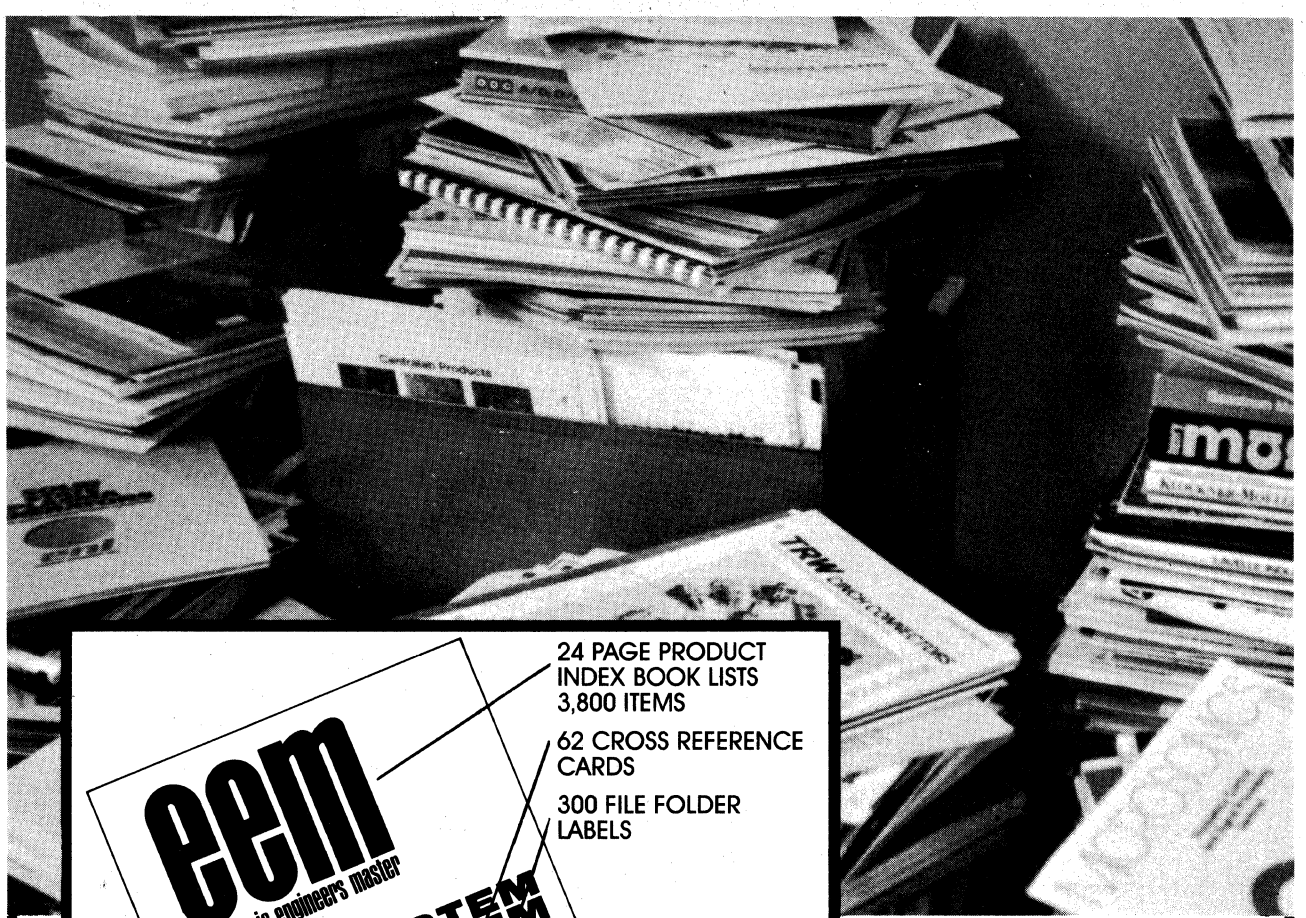
PCH 330

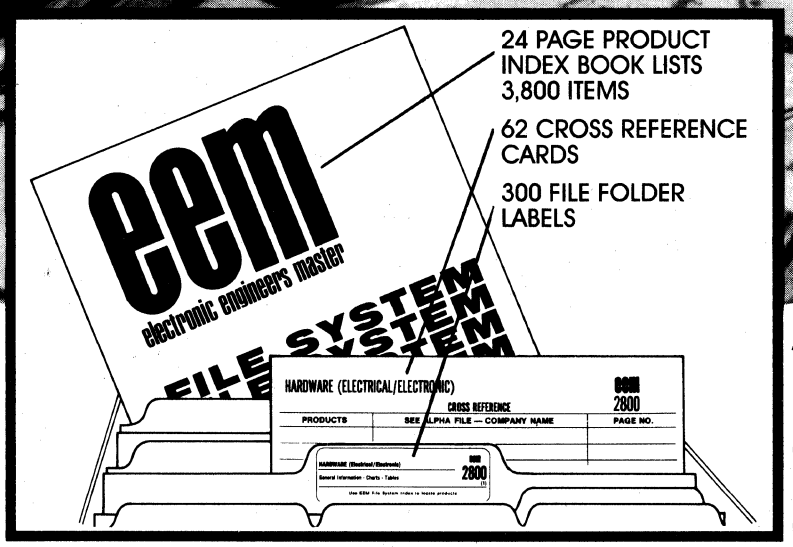
MODEL
PCH 330 (HORIZONTAL MOUNT)
PCV 340 (VERTICAL MOUNT)

OEM PRICES

QUANTITY	100	500	1000
PCH 330	45.00/C	40.00/C	35.00/C
PCV 340	45.00/C	40.00/C	35.00/C

Units can be combined for price advantage. For higher quantity pricing contact VCC. Prices subject to change without notice.





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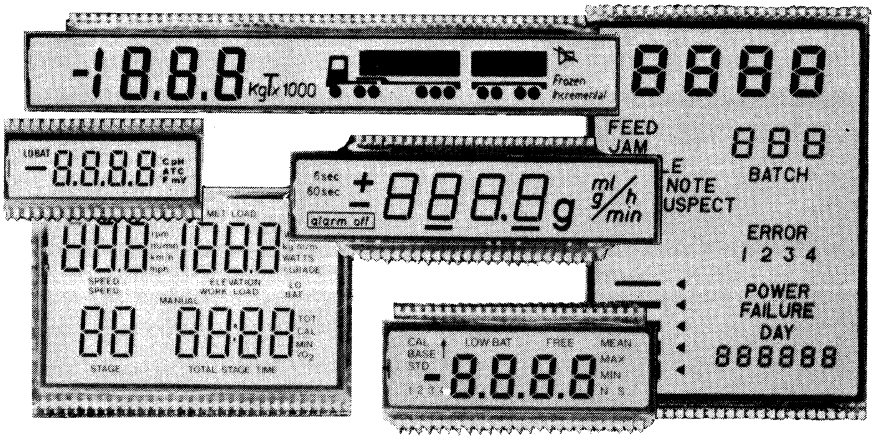
custom designs

LIQUID CRYSTAL DISPLAYS



FEATURES

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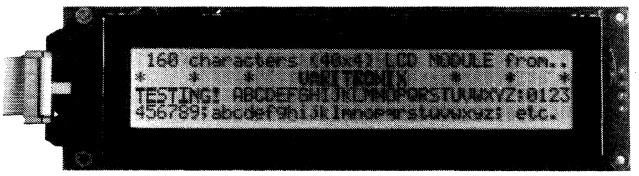


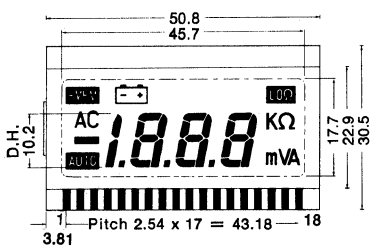
- High contrast
- Wide viewing angle
- Industry standard controller
- Int. ROM with 96 ASCII char.
- Options available:
  - EL & LED backlighting
  - negative image
  - wide temperature
  - color polarizer
  - supertwist

alpha-numeric modules

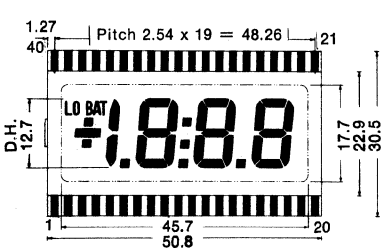
Model Number	Characters x Lines	Character Format	Digit Size	Module Size (WxHxD)
MDL-15701	1x1	5x7	59.9	96x57x12
MDL-81820	8x1	5x7	20.8	172x52x12
MDL-16166R	16x1	5x8	6.3	80x36x12
MDL-16188	16x1	5x8	9.2	122x33x11
MDL-16265	16x2	5x8	5.6	84x44x12
MDL-201612	20x1	5x8	12.7	180x48x11
MDL-20188	20x1	5x8	9.2	146x33x11
MDL-202612	20x2	5x8	12.7	182x60x11
MDL-20265	20x2	5x8	5.6	116x37x12
MDL-20268	20x2	5x8	9.2	146x43x11
MDL-204612	20x4	5x8	12.7	182x90x11
MDL-20464	20x4	5x8	4.8	98x60x12
MDL-20468	20x4	5x8	9.2	146x63x11
MDL-24166	24x1	5x8	6.3	126x36x12
MDL-24265	24x2	5x8	5.2	118x36x11
MDL-40166	40x1	5x8	6.3	192x56x12
MDL-40266	40x2	5x8	5.5	182x34x12
MDL-40466	40x4	5x8	5.5	196x56x12

standard LCD'S for general applications

VIM-309



VI-302 NEW

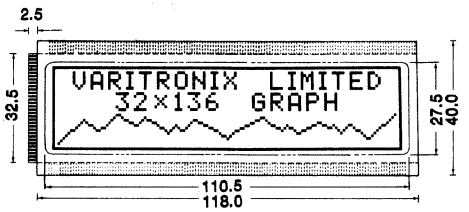


partial list

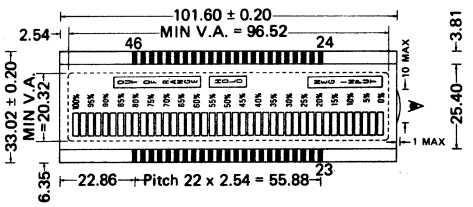
Model	Char. Ht.	Digits
VI-102	76.0	1
VI-201	12.7	2
VI-351	6.4	3½
VIM-309	10.2	3½
VI-302	12.7	3½
VI-320	25.4	3½
VI-402	12.7	4
VI-50402	50.0	4
VI-509	10.2	4½
VI-510	20.5	4½
VI-505	17.8	5
VIM-806	9.0	8
VG-080	32x 80	Graphic
VG-136	32x136	Graphic

All dimensions in mm

VG 136-32



VBG-413



INDICATOR LIGHTS

Manufacturer	Starting EEM Page No.	Incandescent	LED	Neon	Fluorescent	Accessories/Hardware: Sockets/ Holders/ Clips	Accessories/Hardware: Caps & Lenses	Features: Panel Mount	Features: Relampable PC Mount	Features: Assemblies	Features: Rectangular	Features: Waterproof
AEG Telefunken	B•1105		¤									
Altair	B•1106	¤	¤									
AND	B•1107		¤						¤			
Arcoelectric	B•1108	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	
Cord Electronics	B•1114	¤		¤	¤							
Dialight	B•1115	¤	¤	¤		¤	¤	¤		¤		
Dio-Rey	B•1056		¤					¤		¤		
ERA/Refac	B•1067		¤									
Gilway	B•1126	¤	¤	¤	¤	¤				¤		
IDEC	B•1073		¤			¤	¤	¤		¤		
Industrial Devices	B•1130	¤	¤	¤		¤	¤	¤		¤	¤	¤
Inter-Market	B•1153	¤	¤	¤			¤	¤		¤	¤	
JKL Components	B•1135	¤	¤	¤	¤	¤	¤					
Lamptronix	B•1136	¤		¤		¤			¤	¤		
Ledtronics	B•1125 B•1079	¤	¤	¤				¤	¤	¤	¤	¤
Littelfuse Electronic	B•1137	¤	¤	¤		¤		¤		¤	¤	
Marktech Int'l	B•1138		¤									
Minelco/Talley	B•1140	¤	¤					¤				
NEI/Ferranti	B•1143							¤		¤		
Oshino	B•1146	¤						¤	¤			
Oxley	B•1142		¤	¤		¤	¤	¤				¤
Sharp Opto	B•1148		¤								¤	
Shelly Assoc.	B•1092	¤	¤	¤				¤	¤	¤		
Shogyo	B•1154	¤		¤	¤	¤	¤	¤	¤	¤		
Sloan	B•1155	¤	¤	¤		¤	¤	¤	¤	¤		¤
Sorenson	B•1161	¤	¤	¤				¤			¤	
Sylvania/GTE	B•1163	¤		¤		¤	¤	¤	¤	¤	¤	
Visual Comm.	B•1099					¤	¤	¤	¤	¤	¤	¤

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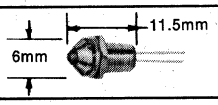
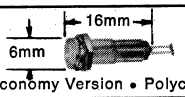
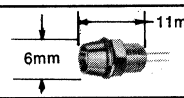
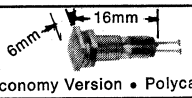
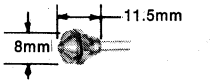
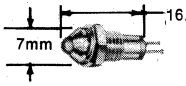
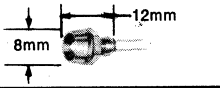
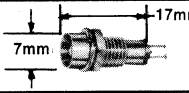
LED Type

Voltages may be specified through 24 Volts where indicated. Except where noted, metal chrome bodies are supplied. Black anodized bodies are available — specify colors, lead length and Voltages. Available Colors — Red, Green, Yellow.

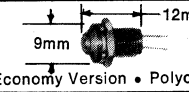
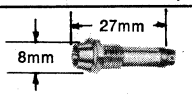
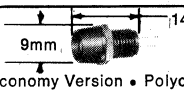
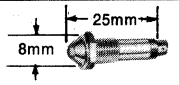
5mm HOLE SIZE

BD 0502 2 VOLT 	**BD 0503** 2 VOLT  Economy Version • Polycarbonate
BD 0501 2 VOLT 	**BD 0504** 2 VOLT  Economy Version • Polycarbonate

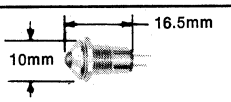
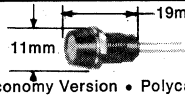
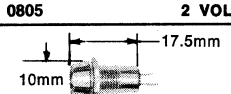
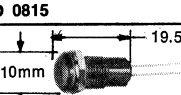
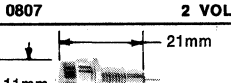
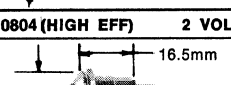
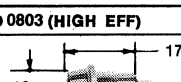
6mm HOLE SIZE

BD 0603 2 VOLT 	**BD 0605** 2 VOLT 
BD 0601 2 VOLT 	**BD 0604** 2 VOLT 

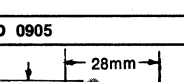
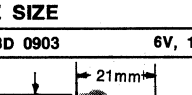
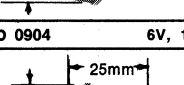
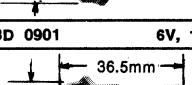
7mm HOLE SIZE

BD 0714 2 VOLT  Economy Version • Polycarbonate	**BD 0701** 6V, 12V, 24V 
BD 0713 2 VOLT  Economy Version • Polycarbonate	**BD 0702** 6V, 12V, 24V 

8mm HOLE SIZE

BD 0806 2 VOLT 	**BD 0813** 2 VOLT  Economy Version • Polycarbonate
BD 0805 2 VOLT 	**BD 0815** 2 VOLT  Economy Version • Polycarbonate
BD 0807 2 VOLT 	**BD 0816** 2 VOLT
BD 0804 (HIGH EFF) 2 VOLT 	**BD 0803 (HIGH EFF)** 2 VOLT 

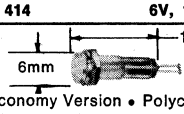
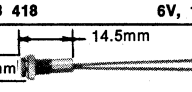
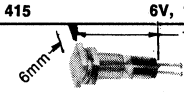
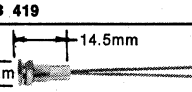
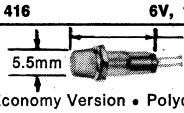
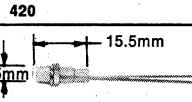
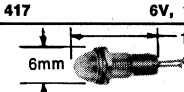
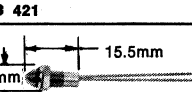
9mm HOLE SIZE

BD 0905 2 VOLT 	**BD 0903** 6V, 12V, 24V 
BD 0904 6V, 12V, 24V 	**BD 0901** 6V, 12V, 24V 

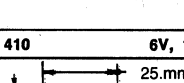
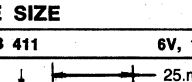
INCANDESCENT Type

Standard Voltages include 5V, 6V, 8V, 12V & 24V. Specific Voltage and currents are available. Please Specify. Leaded units come standard with 6″ stripped. Specify other lengths. Available Colors — Blue, Green, Orange, Red & Clear.

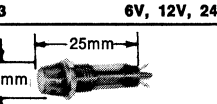
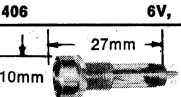
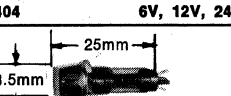
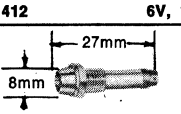
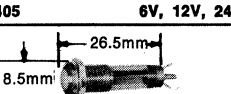
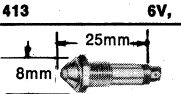
5mm HOLE SIZE

B 414 6V, 12V, 24V  Economy Version • Polycarbonate	**B 418** 6V, 12V, 24V  Economy Version • Polycarbonate
B 415 6V, 12V, 24V  Economy Version • Polycarbonate	**B 419** 
B 416 6V, 12V, 24V  Economy Version • Polycarbonate	**B 420** 
B 417 6V, 12V, 24V  Economy Version • Polycarbonate	**B 421** 

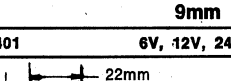
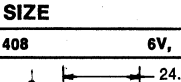
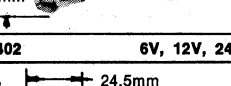
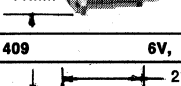
8mm HOLE SIZE

B 410 6V, 12V, 24V 	**B 411** 6V, 12V, 24V 

7mm HOLE SIZE

B 403 6V, 12V, 24V 	**B 406** 6V, 12V, 24V 
B 404 6V, 12V, 24V 	**B 412** 6V, 12V, 24V 
B 405 6V, 12V, 24V 	**B 413** 6V, 12V, 24V 

9mm HOLE SIZE

B 401 6V, 12V, 24V 	**B 408** 6V, 12V, 24V 
B 402 6V, 12V, 24V 	**B 409** 6V, 12V, 24V 

AND
ONE OF THE PURDY GROUP OF COMPANIES

Light Emitting Diodes
Discrete Lamps and Display

770 AIRPORT BLVD., BURLINGAME, CA 94010 • TEL (415) 347-9916 • FAX (415) 340-1670 • MCI/TLX 677-1439 (PURDY UW)

LED Lamps
*NEW GaAlAs

*Kilo Bright (up to 3000 mcd)

Color	ϕ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Colorless Clear	AND150AR	1000
	AND150BR	2000
θ = ±4°	AND150CR	3000
Red Colorless Clear	AND120AR	300
	AND120BR	600
θ = ±20°	AND120CR	900

Special Shapes

Color	3 × 4 × 4 mm	ϕ2 mm	Mini ϕ2 mm	1 × 5 mm	2 × 4 mm	2 × 5 mm	2.5 × 2.0 mm
Red Diffused	AND207R	AND206R	AND226R	AND205R	AND211R	AND208R	AND221S
Green Diffused	AND207G	AND206G	AND226G	AND205G	AND211G	AND208G	AND221G
Yellow Diffused	AND207Y	AND206Y	AND226Y	AND205Y	AND211Y	AND208Y	AND221Y

Dual Color

Color	ϕ4 mm	ϕ5 mm (T1¾)	1 × 5 mm	2 × 5 mm	ϕ5 mm (T1¾)	T1	2.2 × 3.2 mm
Red/Grn	AND101RG	AND116SG	AND205SG	AND208SG	AND2451RGL	AND126SG	AND222SG
Yel/Grn		AND116YG	AND205YG	AND208YG			
Orge/Grn		AND116OG	AND205OG	AND208OG			

Standard Bright (up to 10 mcd)

Color	ϕ3.1 mm (T1)	Luminous Intensity mcd (I_f = 20 mA)	ϕ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Clear	AND123R	2.5	AND113R	3.5
Red Diffused	AND124R	1.5	AND114R	1.5
Green Clear	AND123G	6	AND113G	1.7
Green Diffused	AND124G	4	AND114G	5
Yellow Clear	AND123Y	4	AND113Y	9
Yellow Diffused	AND124Y	2.5	AND114Y	5
Orange Clear	AND123O	3.5	AND113O	8
Orange Diffused	AND124O	2	AND114O	4

*Ultra Bright (up to 220 mcd)

Color	ϕ3.1 mm (T1)	Luminous Intensity mcd (I_f = 20 mA)	ϕ5 mm (T1¾)	Luminous Intensity mcd (I_f = 20 mA)
Red Clear	AND163UR	40	AND153UR	200
Red Diffused	AND164UR	20	AND154UR	100
Green Clear	AND163UG	40	AND153UG	120
Green Diffused	AND164UG	20	AND154UG	60
Yellow Clear	AND163UY	40	AND153UY	120
Yellow Diffused	AND164UY	20	AND154UY	60

LED Displays *New GaAlAs — X-tra Bright Displays

Character Height		0.3 Inch		.43 Inch		.56 Inch	
7 Segments Display Font	Common	Cathode	Anode	Cathode	Anode	Cathode	Anode
	Standard Bright	AND332	AND333	AND342	AND343	AND362	AND353
	Super Bright (Red)	AND332S	AND333S	AND342S	AND343S	AND362S	AND363S
	Ultra Bright (Red)	*AND332UR	*AND333UR	*AND342UR	*AND343UR	*AND362UR	*AND363UR
	Low Current (Red)	AND332TR	AND333TR	AND342TR	AND343TR	AND362TR	AND363TR
	Standard Bright	AND334		AND344		AND364	AND365
	Super Bright (Red)	AND334S		AND344S		AND364S	AND365S
	Ultra Bright (Red)	*AND334UR		*AND344UR		*AND364UR	*AND365UR
	Low Current (Red)	AND334TR		AND344TR		AND364TR	AND365TR

AlphaNumeric

Digit Height	Common Cathode	Common Anode
.5 inch	AND370R	AND371R
.8 inch	AND8010SCLB	AND8010SALB
2.3 inch	AND2316SCLB	AND2316SALB

Large Size

.8 inch	AND8010SCL	AND8010SAL
1.8 inch	AND380R	—
2.3 inch	AND2307SCL	AND2307SAL
4.0 inch	AND4107SCL	AND4107SAL

Bar Graphs

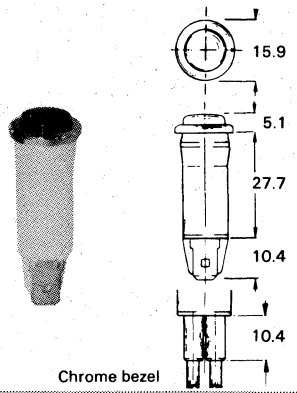
Display Font	Color	Type No.
1″ × .4″ 10 Segment	RED GREEN	AND10KRL AND10KGL
	RED GREEN	AND8101R AND8101G
GREEN — RED	RED GREEN	AND8101M
GREEN — RED	RED GREEN	AND8102M

INDICATOR LIGHTS, NEON & INCANDESCENT

BASIC CATALOG NO. IN LEFT-HAND CORNER OF RESPECTIVE INDICATOR LIGHT

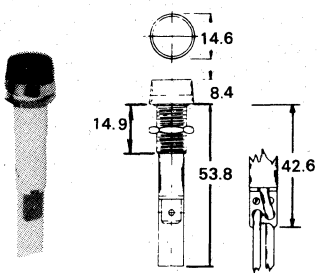
All dimensions in millimeters.

67



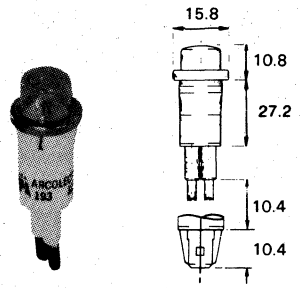
Chrome bezel

177



Chrome bezel

193



Chrome bezel

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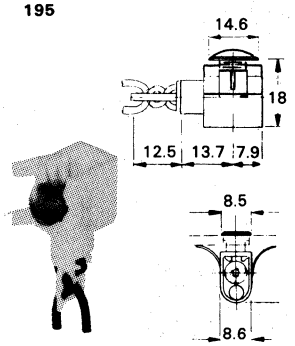

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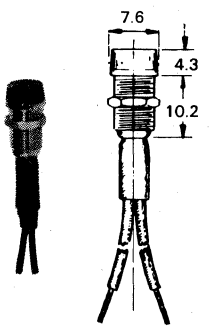
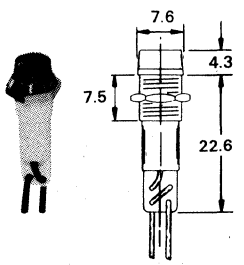


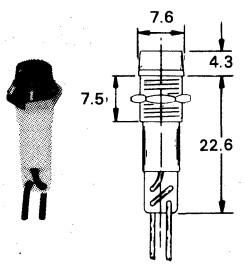
Metal body

244C *



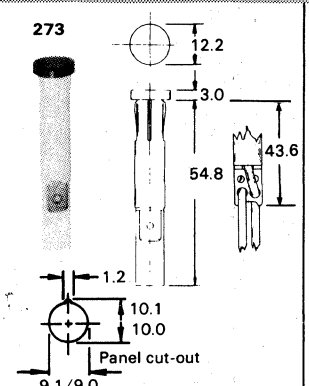
Chrome bezel

245C

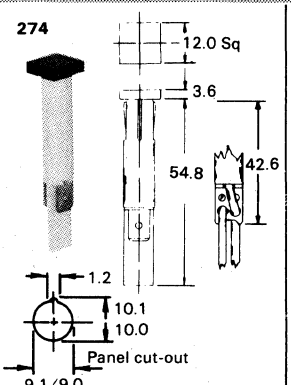


Chrome bezel

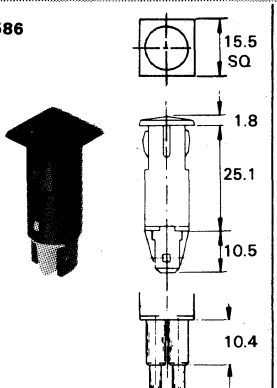
273



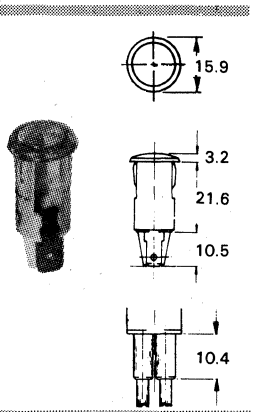
274



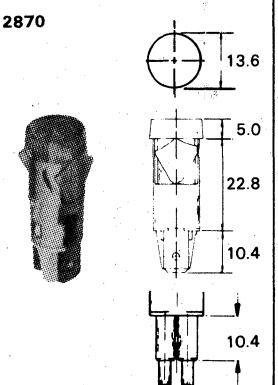
586



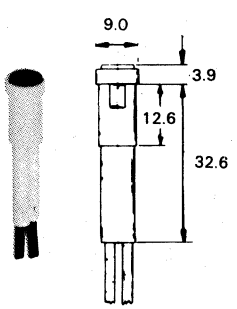
589



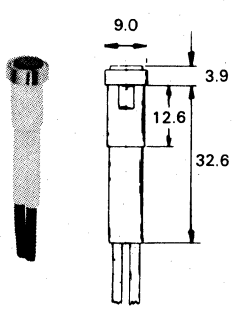
2870



2950

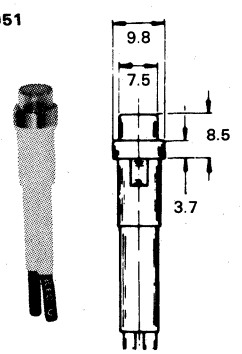


2950C



Chrome bezel

2951



Chrome bezel

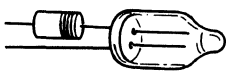
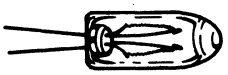
* Incandescent only

See opposite page for ordering information. Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

INDICATOR LIGHTS, NEON & INCANDESCENT

LAMP INFORMATION

NEON LAMPS	VOLTS	RESISTOR	LIFE HOURS A. C.*
	125 250 Blue, Green 125 Blue, Green 250	47K 100K 30K 150K	Expectancy 25,000
INCANDESCANT LAMP	**VOLTS**	**AMPS**	**LIFE HOURS A. C.***
	6/8 12/14 24/28	.04 .08 .04	Expectancy 25,000 15,000 7,000

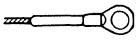
*Estimates only

TERMINAL SELECTION

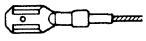
BASIC CAT. NO.	Terminals	Mounting Dimensions	Panel Thickness
40[3]	WL	6.35	6.35
67	C, WL	12.7	1.1[1]
177	C, H, K, WL	12.7	12.0
193	C, WL	12.7	1.1[1]
195	H, WL	8.0	3.0
244C[3]	WL	8.0	6.3
245C	WL	8.0	6.3
273	C, H, K, WL	9.0	2.0
274	C, H, K, WL	9.0	2.0
586	C, H, K, WL	12.7	1.5
589	C, H, K, WL	12.7	1.5
2870	C, WL	12.7	2.0
2950	WL	8.0	1.6[2]
2950C	WL	8.0	1.6[2]
2951	WL	8.0	1.6[2]

1 For thicker panels request lock washers N17.
2 For thicker panels request lock washers N516.
3 Incandescent only

Ring



Female quick connect

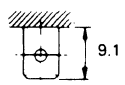


Consult factory for crimping terminals to wire leads.

TERMINALS

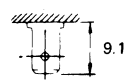
All dimensions in millimeters

C



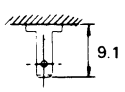
6.3 Tab Terminal
0.8mm thick

H



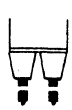
4.8 Tab Terminal
0.8mm thick

K



2.8 Solder Tab
0.8mm thick

WL



Standard wire length 5".
Other lengths available upon request.

20 AWG stranded

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

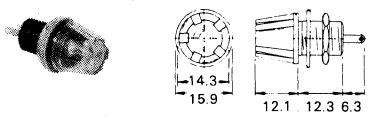
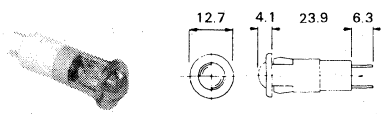
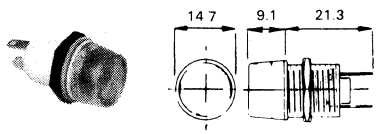
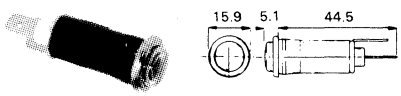
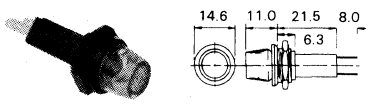
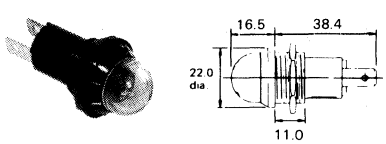
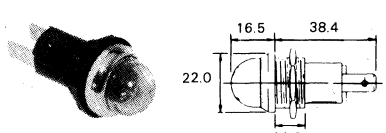
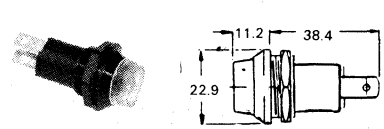
ORDERING INFORMATION

TYPE	BASIC CATALOG NO.	TERMINALS	VOLTAGE	COLOR
FL incandescent **NL** neon	From table	From table **C** **H** **K** **WL**	Incandescent / **Neon** **6** = 6V / **2** = 125V **7** = 12V / **3** = 250V **8** = 24V	**A** Amber **B** Blue **C** Clear **G** Green **R** Red

Specification subject to change without notice.
All combinations not always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

LAMP HOLDERS AND LAMPS

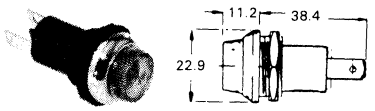
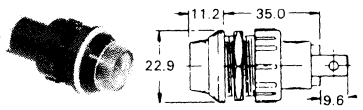
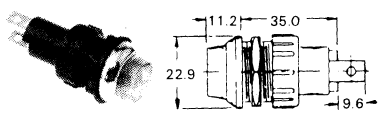
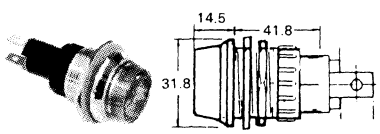
BASIC CATALOG NO.	BODY DETAIL	MTG. HOLE	PANEL THICKNESS*	BEZEL COLOR	RELAMPABLE FROM FRONT	RELAMPABLE FROM REAR	LAMP STYLE**	TERMINAL TYPE
60	 Replacement Lens L111	9.53	8.6	NONE	√		1	SOLDER
61		9.53	0.9-1.14	NONE		√	1	SOLDER
M62		12.7	9.6	NONE	√		2	SOLDER
67		12.7	1.14*	CHROME		√	6	6.3 TAB
116	 Replacement Lens L148	12.0	3.8	BLACK	√		5	2.8 TAB
138	 Replacement Lens L41 (For up to 28V use only)	19.0	6.3	BLACK	√		3	6.3 TAB
138C	 Replacement Lens L41 (For up to 28V use only)	19.0	6.3	CHROME	√		3	6.3 TAB
139	 Replacement Lens L90	19.0	6.3	BLACK	√		4	6.3 TAB

SEE OPPOSITE PAGE FOR ORDERING INFORMATION.

All dimensions in millimeters

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

LAMP HOLDERS AND LAMPS

BASIC CATALOG NO.	BODY DETAIL	MTG. HOLE	PANEL THICKNESS*	BEZEL COLOR	RELAMPABLE FROM FRONT	RELAMPABLE FROM REAR	LAMP STYLE**	TERMINAL TYPE
139C	 Replacement Lens L90	19.0	6.3	CHROME	√		4	6.3 TAB
382	 Replacement Lens L90	19.0	6.3	BLACK	√	√	3	6.3 TAB
392	 Replacement Lens L90	19.0	6.3	CHROME	√	√	3	6.3 TAB
692	 Replacement Lens L117	25.4	8.7	CHROME	√	√	3	6.3 TAB

*Panel thickness can be increased by ordering N17 lock washer.
**See BASIC LAMP STYLES table below.

All dimensions in millimeters

BASIC LAMP STYLES

LAMP STYLE NO.	LAMP TYPE	LAMP PART NUMBERS (BY VOLTAGE) 6	12V	28V	125V NEON	250V NEON
1	MIDGET SCREW	LES 6V	LES 12V	LES 24V	—	—
2	MIDGET FLANGE	381	382	387	—	—
3	MINIATURE BAYONET	47	1891 1892	1829	NT 151-125V	NT 151-250V
4	MINIATURE BAYONET	51	53	—	—	—
5	SUBMINIATURE WEDGE	84	73	85	—	—
6	T-2 BAYONET	BA7-6V	BA7-12V	BA7-24V		

OPTIONS

OPTION 1
FLAT RUBBER WASHER FOR EXTRA SEALING BEZEL/LENS

LAMP HOLDER	BEZEL	LENS
138, 139 382, 392	W23	W24
692	W31	W32

OPTION 2 **M445**
PVC MOLDED REAR TERMINAL INSULATOR:
fit 138, 139, 382, 392, 692

58.4 long x 17.8 dia.

Contact factory for lens engraving information

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

ORDERING INFORMATION

LAMP HOLDER	BASIC CAT NO.	VOLTAGE[1]	LENS COLOR[2]	OPTION 1	OPTION 2
LH	See Table	**6** 6v incandescent **7** 12v incandescent **8** 24/28vincandescent **2** 125v neon **3** 250v neon	**A** amber **B** blue[3] **C** clear **G** green **R** red	**WASHERS** See above table	**M445** Rear Cover

1 Omit for no lamp
2 Transparent, for translucent consult factory
3 Incandescent only

Specifications subject to change without notice. Not all combinations always available.

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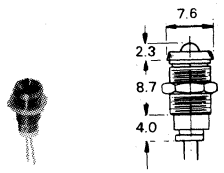
L.E.D. INDICATOR LIGHTS

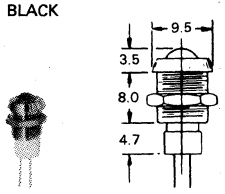
BASIC CAT. NO. IN LEFT-HAND CORNER OF RESPECTIVE L.E.D. INDICATOR LIGHT

All dimensions in millimeters

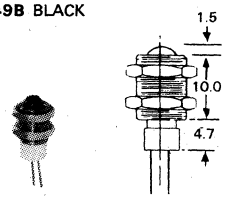
LH 43V CHROME
LH 43VB BLACK



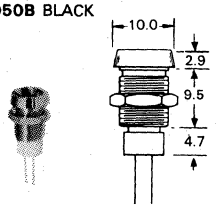
LH 48 CHROME
LH 48B BLACK



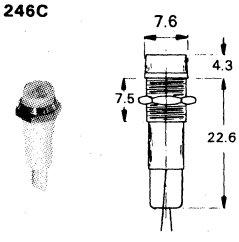
LH 1049 CHROME
LH 1049B BLACK



LH 1050 CHROME
LH 1050B BLACK

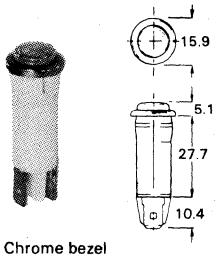


LH 246C



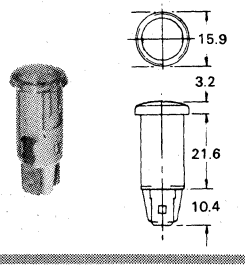
Chrome bezel

LE 67

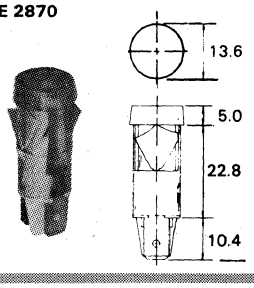


Chrome bezel

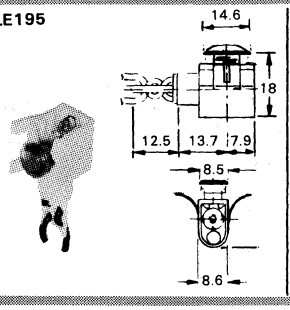
LE 589



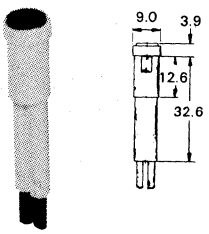
LE 2870



LE195

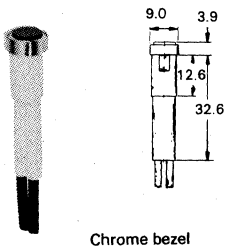


LE 2950



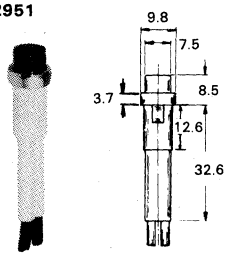
Black body optional

LE 2950C



Chrome bezel

LE 2951

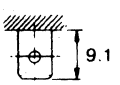


Chrome bezel

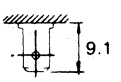
BASIC CATALOG NO.	TERMINAL SELECTION				PANEL MTG	PANEL THICKNESS
	LED LEADS	C	H	WL		
LH43[1]	√				6.3	6.3
LH48	√			√	8.0	5.5
LH1049	√			√	8.0	3.8
LH1050	√			√	8.0	7.0
LH246C[1]	√				8.0	6.3
LE67[2]		√			12.7	1.1
LE589[2]		√	√	√	12.7	1.5
LE2870[2]		√	√	√	12.7	2.0
LE2950[2]				√	8.0	1.6
LE2951[2]				√	8.0	1.6
LE195			√	√	8.0	3.0

1 LED T1 size only
2 Lock washers available for thicker panels. See page 24.

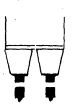
TERMINALS

C 

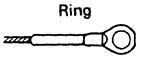
6.3 Tab Terminal
0.8mm thick

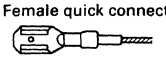
H 

4.8 Tab Terminal
0.8mm thick

WL 

Standard wire length 5."
Other lengths available upon request.
20 AWG stranded.

Ring 

Female quick connect 

Consult factory for crimping terminals to wire leads.

ORDERING INFORMATION

BASIC CATALOG NO.
From above

TERMINAL STYLE
omit for LED leads
C
H
WL

L.E.D. TYPE
Select from opposite page

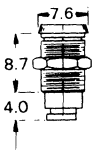
Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 Telex: 19-4645 FAX: (818) 700-9541

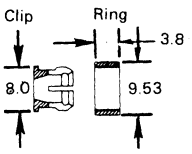
LED LAMPS AND LED HOLDERS

LED HOLDERS ONLY

LH43V CHROME
LH43VB BLACK

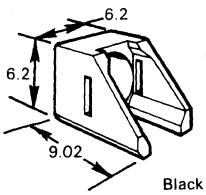


LH 0103 BLACK



Black Plastic

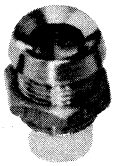
LH 5029 BLACK

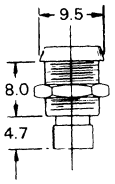


Right angle housing.

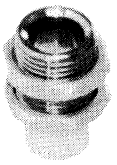
Black Plastic

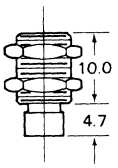
LH48 CHROME
LH48B BLACK



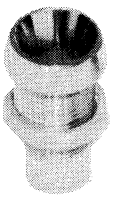


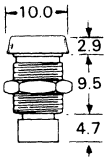
LH1049 CHROME
LH1049B BLACK





LH1050 CHROME
LH1050B BLACK





LED LAMPS AND HOLDERS

T.1 Size 3mm dia

T.1¾ Size 5mm dia

BASIC CATALOG NO.-T.1 SIZE	FORWARD VOLTAGE	POWER DISS.	LUM. INTENSITY	VIEW ANGLE
1301 Red	2.2 25MA	135MW	2.5MCD	60°
1401 Yellow	2.2 20MA	85MW	3.0MCD	60°
1503 Green	2.3 25MA	135MW	5.0MCD	60°

BASIC CATALOG NO.-T.1¾ SIZE	FORWARD VOLTAGE	POWER DISS.	LUM. INTENSITY	VIEW ANGLE
3300 Red	2.2 25MA	135MW	3.5MCD	90°
3400 Yellow	2.2 20MA	85MW	4.0MCD	90°
3502 Green	2.3 25MA	135MW	6.0MCD	75°

LED HOLDERS

BASIC CATALOG NO.	T1	T1¾	PANEL MTG.	PANEL THK.
LH43V	√		6.3	6.3
LH48		√	8.0	5.5
LH0103		√	6.13	3.18
LH1049		√	8.0	3.8
LH1050		√	8.0	7.0
LH5029		√	Right angle mtg.	

LED'S WITH INTEGRAL CURRENT LIMITING RESISTOR

BASIC CATALOG NO.-T.1¾ SIZE	OPERATING VOLTAGE	TYP. MCD	VIEW ANGLE
3601 Red	12V 13mA	4.0	65°
3651 Yellow	12V 13mA	4.0	75°
3681 Green	12V 13mA	4.0	75°

Require no external current limiter with 12V supply

LED's to be used with a D.C. Power Source.

For 28 volt DC add series 1100 OHM ½ watt resistor for models 3601, 3651, 3681.

For other LED types consult factory.

All dimensions in millimeters

ORDERING INFORMATION

BASIC CATALOG NO.

LH (LED Holders)
1301 (LED Lamps)

(For LED lamp and holder complete as one unit refer to opposite page.)

Specifications subject to change without notice.
Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 Telex: 19-4645 FAX: (818) 700-9541

CORD ELECTRONICS INCORPORATED
177 Cantiague Rock Road, Westbury, N.Y. 11590 U.S.A.
Phone: (516) 935-3640 • Tlx: 4758020 • Fax: (516) 935-0780

INCANDESCENT, NEON AND FLUORESCENT LAMPS

This page summarizes the many sub-miniature and miniature incandescent, neon and fluorescent lamps available from CORD. For fast reference, we have shown the size and voltage range that is generally available from stock for each of the different standard lamp bases. Please call or write CORD for our complete lamps catalog.

WIRE TERMINAL

Size	Voltage
T-3/4	1 1/2 - 5V
T-1	1 1/4 - 28V
T-1 1/4	1.3 - 28V
T-1 3/4	1.35 - 48
T-2	4 - 120V
TL-3/4	
TL-1	

MIDGET FLANGED

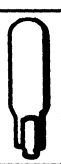
T-3/4	1 1/2 - 5V
T-1	1 1/4 - 28
T-1 1/4	1.3 - 28
T-1 3/4	1.35 - 48
TL-3/4	5V
TL-1	1.5 & 5V

BI-PIN

T-3/4	1 1/2 - 5V
T-1	1 1/4 - 28V
T-1 1/4	1.3 - 28V
T-1 3/4	1.35 - 28V
TL-3/4	5V
TL-1	1.5 & 5V

SCREW BASE

T-1 1/4	1.3 - 28V
T-1 3/4	1.35 - 28V
T-3 1/4	2 - 28V
GTL-3	1.2 - 2.33V
G-2	7-14 - 28V
G-3 1/2	1.25 - 14.4V

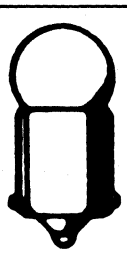


WEDGE BASE

T-1 3/4	6.3 - 28V
T-3 1/4	6.3 - 28V

SLIDE BASE

T-2	4 - 120V



S/C BAYONET

T-3 1/4	2 - 55V
G-3 1/2	6.3 - 18
G-4 1/2	6.5 - 14
G-6	7 - 28
S-8	5 - 28

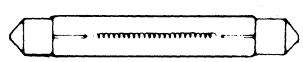
D/C BAYONET

Size	Voltage
G-6	7 - 28
S-8	5 - 28

STD. VOLTAGE LAMPS

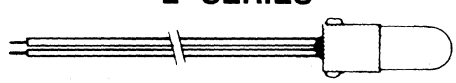
CANDELABRA	S-6	115 - 250V
	T-4 1/2	115V
	C-7	115V
	T-6	115V
	T-7	115V
	T-8	115V
D.C. BAYONET	S-6	115V - 250V
	C-7	115V
	T-7	115V

FUSE LAMP



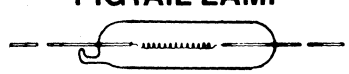
6, 12 and 14.5 volts in lengths of 1.3" and 1.7"

"L" SERIES



2 thru 28 volts
Standard with 6" UL insulated leads.
Plastic lens caps in a variety of colors are available as well.

PIGTAIL LAMP



6 and 12 volt in lengths of 0.68" and 1.05"

NEON LAMPS:

A wide selection of neon lamps with wire terminal, midget flange, telephone slide, bayonet and candelabra bases are available.

MINIATURE FLUORESCENT:

Available in sizes T5 to T10, from 4 to 50 watts in daylight, coolwhite, black light and black light blue.
U shaped and "tight-U" are also available.

If this is how you see LEDs, the ad is over.

The popular myth goes something like this: "An LED, is an LED, is an LED." Or: "If you've seen one, you've seen them all." And of course: "LEDs? They're commodity products."

Notions we at Dialight, steadfastly reject. And once you're familiar with our products, you'll know why.

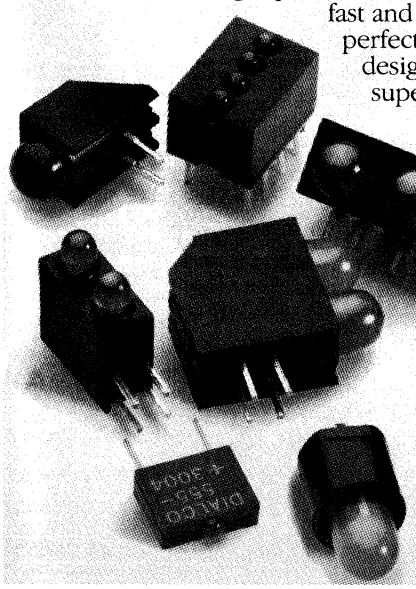
Take our Circuit Board Indicators. Single or multiple discretes aligned in a sturdy plastic housing, complete with their own current limiting resistor. The entire assembly polarity-keyed to guarantee correct insertion.

Each unit is 100% tested—ready to insert for wave soldering. No leads to bend, trim, or break. No time wasted fumbling with discretes.

Dialight pioneered the concept more than fifteen years ago to satisfy the OEM need for fast and reliable circuit board installation of LEDs. And we've been perfecting it ever since. Developing hundreds of standard and custom designs. A heritage of technological advance you can see in our new super-bright gallium aluminum arsenide units.

All meticulously engineered with the understanding that the failure of a "jelly bean product" can cost thousands in end-user downtime, and who-knows-what in customer loyalty.

The same understanding might bring you to call 201-223-9400, or write Dialight Company, 1913 Atlantic Ave., Manasquan, NJ 08736, and ask for our catalog or a product sample. At the very least, it's brought you to the real end of our ad.



DIALIGHT COMPANY A Division of North American Philips

DIALIGHT·KULKA·HHSMITH

Engineering is the only commodity we sell.

DIALIGHT LED CIRCUIT BOARD INDICATORS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Dialight originated the idea of packaging LEDs for easy mounting on PC boards almost 15 years ago. So it's no wonder we now have the industry's widest selection.

Choose single-element LEDs in a wide range of voltages (with or without current-limiting resistors) or QUAD-LED® four-element arrays. We offer standard and high-efficiency LEDs, as well as new super bright models that are 4 times brighter than ordinary LEDs but operate on a fraction of the power.

We have just the right color for your application, too. Red, green, yellow or red/green bicolor. The combinations are virtually limitless. That's why your search for the perfect LED circuit board indicator should begin and end with the company that started it all and has been lighting the way ever since. Dialight.

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
547-2001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	AA
547-2002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
547-2007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
547-2003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
547-2004	Red	—	16mA @ 5.0V	2.0mcd @ 5.0V	
547-2005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
547-2006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
547-2008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
547-2301	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
547-2303	Green	—	4.7mA @ 5.0V	0.5mcd @ 20mA	
547-2401	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
547-2403	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 20mA	
550-0204	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	BB
550-0304	Yellow	3.2V @ 20mA	■	3.2mcd @ 20mA	
550-0404	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0504	Red	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0604	Red	—	15mA @ 12.0V	2.0mcd @ 12.0V	
550-0704	Green	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0804	Yellow	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-3004▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0205	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	CC
550-0305	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0405	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0505	Red	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0605	Red	—	15mA @ 12.0V	2.0mcd @ 12.0V	
550-0705	Green	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0805	Yellow	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-3005▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0206	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	DD
550-0306	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0406	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0506	Red	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0606	Red	—	15mA @ 12.0V	2.0mcd @ 12.0V	
550-0706	Green	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-0806	Yellow	—	15mA @ 5.0V	2.0mcd @ 5.0V	
550-3006▲	Red/Green	2.3V @ 10mA	■	1.8mcd @ 20mA (Red)	
550-0207	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	EE
550-0307	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0407	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0507	Red	—	15mA @ 5V	2.0mcd @ 5.0V	
550-0607	Red	—	15mA @ 12V	2.0mcd @ 5.0V	
550-0707	Green	—	15mA @ 5V	2.0mcd @ 5.0V	
550-0807	Yellow	—	15mA @ 5V	2.0mcd @ 5.0V	
550-3007▲	Red/Green	2.3V @ 20mA	■	1.8mcd @ 20mA	
550-0204-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	FF
550-0304-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0404-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER/PHOTO
550-0504-004 •	Red		15mA @ 5V	2mcd @ 5V	FF
550-0604-004 •	Red		15mA @ 12V	2mcd @ 5V	
550-0704-004 •	Green		15mA @ 5V	2mcd @ 5V	
550-0804-004 •	Yellow		15mA @ 5V	2mcd @ 5V	
550-0205-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	GG
550-0305-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0405-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0505-004 •	Red		15mA @ 5V	2mcd @ 5V	
550-0605-004 •	Red		15mA @ 12V	2mcd @ 5V	
550-0705-004 •	Green		15mA @ 5V	2mcd @ 5V	
550-0805-004 •	Yellow		15mA @ 5V	2mcd @ 5V	
550-0206-004*	Green	2.3V @ 20mA	■	3.2mcd @ 20mA	HH
550-0306-004*	Yellow	2.3V @ 20mA	■	3.2mcd @ 20mA	
550-0406-004*	Red	1.7V @ 20mA	■	2.0mcd @ 20mA	
550-0506-004 •	Red		15mA @ 5V	2mcd @ 5V	
550-0606-004 •	Red		15mA @ 12V	2mcd @ 5V	
550-0706-004 •	Green		15mA @ 5V	2mcd @ 5V	
550-0806-004 •	Yellow		15mA @ 5V	2mcd @ 5V	
550-3006-004*▲	Red/Green	2.3V @ 10mA (Red)	■	1.8mcd @ 10mA (Red)	
		2.3V @ 10mA (Green)	■	1.8mcd @ 10mA (Green)	
551-0205	Green	2.4V @ 20mA	■	2.0mcd @ 20mA	JJ
551-0305	Yellow	2.2V @ 10mA	■	2.5mcd @ 10mA	
551-0405	Red	1.6V @ 20mA	■	2.0mcd @ 20mA	
551-0505	Red	—	16mA @ 5V	0.8mcd @ 5V	
551-0605	Green	—	12mA @ 5V	4mcd @ 5V	
551-0705	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1105	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1205	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1305	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	
551-0207	Green	2.1V @ 10mA	■	2.6mcd @ 10mA	KK
551-0307	Yellow	2.1V @ 10mA	■	2.6mcd @ 10mA	
551-0407	Red	1.7V @ 20mA	■	1.6mcd @ 20mA	
551-0507	Red	—	16mA @ 5V	.8mcd @ 5V	
551-0607	Green	—	12mA @ 5V	4mcd @ 5V	
551-0707	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1107	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1207	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1307	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	
551-0207-004*	Green (D)	2.1V @ 10mA	■	2.6mcd @ 10mA	LL
551-0307-004*	Yellow (D)	2.1V @ 10mA	■	2.6mcd @ 10mA	
551-0407-004*	Red (D)	1.6V @ 20mA	■	1.6mcd @ 20mA	
551-0507-004*	Red (D)	—	16mA @ 5V	.8mcd @ 5V	
551-0607-004 •	Green	—	12mA @ 5V	4mcd @ 5V	
551-0707-004 •	Yellow	—	10mA @ 5V	4mcd @ 5V	
551-1107-004 •	Red	1.8V @ 2mA	■	1.8mcd @ 2mA	
551-1207-004 •	Yellow	1.9V @ 2mA	■	1.6mcd @ 2mA	
551-1307-004 •	Green	1.8V @ 2mA	■	1.6mcd @ 2mA	

†Typical Forward Current is specified for indicators with integral current limiting resistors; typical Forward Voltage is specified for indicators without integral current limiter. *LED array. Specifications are "per LED".
▲Bicolor LED. ■Current limiting required. • Other configurations available. Consult factory.

STANDARD

PART NUMBER	DIFFUSED LED COLOR	TYPICAL FORWARD VOLTAGE†	TYPICAL FORWARD CURRENT†	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
555-2001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	MM
555-2002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
555-2009	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-2007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
555-2003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
555-2004	Red	—	16mA @ 5.0V	2.0mcd @ 10.0V	
555-2005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
555-2006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
555-2008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
555-2301	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-2303	Green	—	4.7mA @ 5.0V	0.5mcd @ 5.0V	
555-2401	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-2403	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 5.0V	
555-3001	Red	1.6V @ 20mA	■	3.0mcd @ 20mA	NN
555-3002	Red	—	20mA @ 3.6V	3.0mcd @ 3.6V	
555-3009	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-3007	Red	—	3.0mA @ 5.0V	0.6mcd @ 5.0V	
555-3003	Red	—	6.0mA @ 5.0V	1.2mcd @ 5.0V	
555-3004	Red	—	16mA @ 5.0V	2.0mcd @ 5.0V	
555-3005	Red	—	14mA @ 10.0V	1.8mcd @ 10.0V	
555-3006	Red	—	10mA @ 14.0V	1.3mcd @ 14.0V	
555-3008	Red	—	3.0mA @ 24.0V	0.4mcd @ 24.0V	
555-4001*	Red	1.6 @ 20mA	■	3.0mcd @ 20mA	PP
555-4007*	Red	—	3mA @ 5.0V	0.6mcd @ 5.0V	
555-4009*	Red	—	1.0mA @ 5V	0.6mcd @ 5V	
555-4003*	Red	—	6mA @ 5.0V	1.2mcd @ 5.0V	
555-4301*	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-4303*	Green	—	4.7mA @ 5.0V	0.5mcd @ 5.0V	
555-4401*	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-4403*	Yellow	—	4.7mA @ 5.0V	0.6mcd @ 5.0V	
555-5001*	Red	1.6V @ 2.0mA	■	3.0mcd @ 20mA	QQ
555-5003*	Red	—	6mA @ 5V	1.2mcd @ 5V	
555-5004*	Red	—	16mA @ 5V	2mcd @ 5V	
555-5007*	Red	—	3mA @ 5V	0.6mcd @ 5V	
555-5009*	Red	—	1mA @ 5V	0.6mcd @ 5V	
555-5301*	Green	2.4V @ 20mA	■	1.0mcd @ 20mA	
555-5401*	Yellow	2.2V @ 20mA	■	2.0mcd @ 20mA	
555-5303*	Green	—	4.7mA @ 5V	0.5mcd @ 20mA	
555-5403*	Yellow	—	4.7mA @ 5V	0.6mcd @ 20mA	
561-0101-050	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	RR
561-0101-060	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-070	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-080	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-090	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0101-100	Red	1.9V @ 5.0mA	■	3.0mcd @ 10mA	
561-0104-XX0	Red	—	5V @ 16mA	2mcd @ 5V	

†Typical Forward Current is specified for indicators with integral current limiting resistors; typical Forward Voltage is specified for indicators without integral current limiter.
*LED array. Specifications are "per LED".
▲Bicolor LED. ■Current limiting required.
• Other configurations available. Consult factory.

HIGH EFFICIENCY Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-2204	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	BB
550-2304	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2404	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2205	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	CC
550-2305	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2405	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2206	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	DD
550-2306	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2406	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2207	Green (D)	2.2V @ 10mA	3mcd @ 10mA	EE
550-2307	Yellow (D)	2.2V @ 10mA	3mcd @ 10mA	
550-2407	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2204-004 *	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	FF
550-2304-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2404-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	

HIGH EFFICIENCY Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-2205-004 *	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	GG
550-2305-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2405-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
550-2206-004 *	Green (D)	2.2V @ 20mA	3.0mcd @ 20mA	HH
550-2306-004 *	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
550-2406-004 *	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-050	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-060	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-070	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-080	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-090	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2101-100	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
561-2201-050	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-060	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-070	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-080	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-090	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2201-100	Green (D)	2.2V @ 20mA	6.0mcd @ 20mA	
561-2301-050	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	RR
561-2301-060	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-070	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-080	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-090	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2301-100	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
561-2401-050	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-060	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-070	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-080	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-090	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2401-100	Red (W.C.)	2.2V @ 10mA	24.0mcd @ 10mA	
561-2501-050	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-060	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-070	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-080	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-090	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2501-100	Green (W.C.)	2.2V @ 20mA	25.0mcd @ 20mA	
561-2601-050	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-060	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-070	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-080	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-090	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	
561-2601-100	Yellow (W.C.)	2.2V @ 10mA	16.0mcd @ 10mA	

SUPER BRIGHT Current Limiting Required

550-5104	Red (D)	1.7V @ 20mA	30mcd @ 30mA	BB
550-5204	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5304	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5404	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5504	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5604	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5704	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5804	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5105	Red (D)	1.7V @ 20mA	30mcd @ 20mA	CC
550-5205	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5305	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5405	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5505	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5605	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5705	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5805	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5106	Red (D)	1.7V @ 20mA	30mcd @ 20mA	DD
550-5206	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5306	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5406	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5506	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5606	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5706	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5806	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	

*LED array. Specifications are "per LED."
• Other configurations available. Consult factory.

SUPER BRIGHT Current Limiting Required

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-5107	Red (D)	1.7V @ 20mA	30mcd @ 20mA	EE
550-5207	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5307	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5407	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5507	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5607	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5707	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5807	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5104-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	FF
550-5204-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5304-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5404-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5504-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5604-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5704-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5804-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5105-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	GG
550-5205-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5305-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5405-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5505-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5605-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5705-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5805-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
550-5106-004*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	HH
550-5206-004*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
550-5306-004*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
550-5406-004*	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
550-5506-004*	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
550-5606-004*	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
550-5706-004*	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
550-5806-004*	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	
561-5101-XX0	Red (D)	1.7V @ 20mA	30mcd @ 20mA	RR
561-5201-XX0	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
561-5301-XX0	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
561-5401-XX0	Amber (D)	2.2V @ 20mA	24mcd @ 20mA	
561-5501-XX0	Red (W.C.)	1.7V @ 20mA	160mcd @ 20mA	
561-5601-XX0	Green (W.C.)	2.1V @ 20mA	80mcd @ 20mA	
561-5701-XX0	Yellow (W.C.)	2.1V @ 20mA	160mcd @ 20mA	
561-5801-XX0	Amber (W.C.)	2.2V @ 20mA	90mcd @ 20mA	

SUPER EFFICIENCY CBIs Operate @ 2mA input current

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-1104	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	BB
550-1105	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	CC
550-1106	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	DD
550-1104-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	FF
550-1105-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	GG
550-1106-004*	Red (D)	1.8V @ 20mA	2.0mcd @ 2mA	HH
550-1204	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	BB

SUPER EFFICIENCY CBIs Operate @ 2mA input current

PART NUMBER	LED COLOR Diffused (D) Water Clear (W.C.)	TYPICAL FORWARD VOLTAGE	TYPICAL LUMINOUS INTENSITY	FIGURE/PHOTO NUMBER
550-1205	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	CC
550-1206	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	DD
550-1204-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	FF
550-1205-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	GG
550-1206-004*	Yellow (D)	1.9V @ 20mA	1.8mcd @ 2mA	HH
550-1304	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	BB
550-1305	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	CC
550-1306	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	DD
550-1304-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	FF
550-1305-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	GG
550-1306-004*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	HH
561-1101-XX0	Red (D)	1.8V @ 2mA	2.0mcd @ 2mA	RR
561-1201-XX0	Yellow (D)	1.9V @ 2mA	1.8mcd @ 2mA	
561-1301-XX0	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	

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552-0111*	Red (D)	1.7V @ 20mA	2mcd @ 20mA	SS
552-0122*	Green (D)	2.3V @ 20mA	3.2mcd @ 20mA	
552-0133*	Yellow (D)	2.3V @ 20mA	3.2mcd @ 20mA	
552-0211*	Red (D)	2.2V @ 10mA	4.0mcd @ 10mA	
552-0222*	Green (D)	2.2V @ 10mA	3.0mcd @ 10mA	
552-0233*	Yellow (D)	2.2V @ 10mA	3.0mcd @ 10mA	
552-0311*	Red (D)	2.2V @ 10mA	2.0mcd @ 5V	
552-0322*	Green (D)	2.2V @ 10mA	4mcd @ 5V	
552-0333*	Yellow (D)	2.2V @ 10mA	2.4mcd @ 5V	
552-0711*	Red/Green (D)	2.3V @ 20mA	6mcd @ 20mA	
552-0811*	Red (D)	1.7V @ 20mA	30mcd @ 20mA	
552-0822*	Green (D)	2.1V @ 20mA	12mcd @ 20mA	
552-0833*	Yellow (D)	2.1V @ 20mA	45mcd @ 20mA	
552-0911*	Red (D)	1.8V @ 2mA	2.0mcd @ 2mA	
552-0922*	Green (D)	1.8V @ 2mA	1.8mcd @ 2mA	
552-0933*	Yellow (D)	1.9V @ 2mA	1.8mcd @ 2mA	

BILEVEL T-1

553-0111*	Red (D)	1.6V @ 20mA	1.6mcd @ 20mA	TT
553-0122*	Green (D)	2.0V @ 10mA	2.6mcd @ 10mA	
553-0133*	Yellow (D)	2.0V @ 10mA	2.6mcd @ 10mA	
553-0211*	Red (D)	1.8V @ 2mA	1.8mcd @ 2mA	
553-0222*	Green (D)	1.8V @ 2mA	1.6mcd @ 2mA	
553-0233*	Yellow (D)	1.9V @ 2mA	1.6mcd @ 2mA	
553-0311*	Red (D)	—	.8mcd @ 5V	
553-0322*	Green (D)	—	4mcd @ 5V	
553-0333*	Yellow (D)	—	4mcd @ 5V	

OTHER COLORS & BRIGHTNESSES AVAILABLE— Contact Factory

***LED array. Specifications are "per LED."**

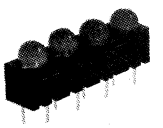
PHOTO AA

PHOTO BB

PHOTO CC

PHOTO DD

PHOTO EE



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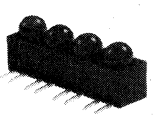


PHOTO GG

TYPICAL ILLUSTRATION

PHOTO HH

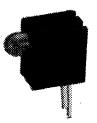


PHOTO JJ

PHOTO KK

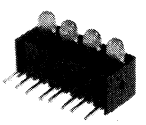


PHOTO LL

PHOTO MM

PHOTO NN

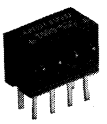


PHOTO PP

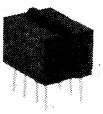


PHOTO QQ

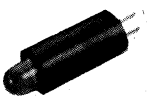
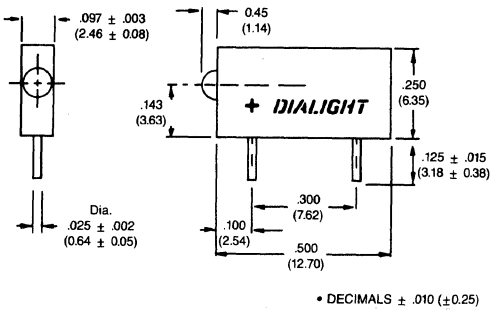


PHOTO RR

PHOTO SS

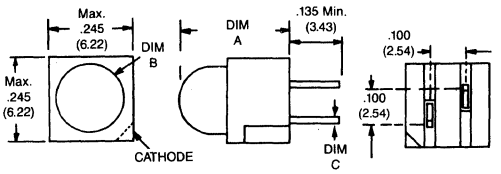
PHOTO TT

FIGURE AA



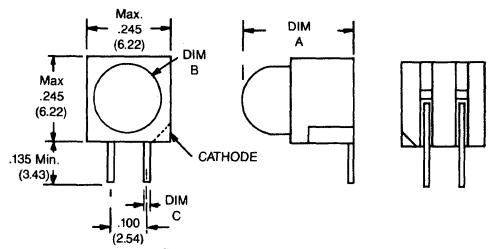
• DECIMALS ± .010 (±0.25)

FIGURE BB



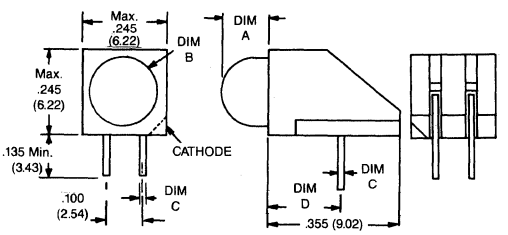
Dimensions	Standard	High Efficiency	550-0504 550-0604
A Max.	.380 (9.65)	.438	.437 (11.10)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)

FIGURE CC



Dimensions	Standard	High Efficiency	550-0505 550-0605
A Max.	.380 (9.65)	.438	.437 (11.10)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)

FIGURE DD



Dimensions	Standard	High Efficiency	550-0504 550-0604
A	.125 (3.18)	.183	.187 (4.75)
B Dia.	.185 (4.70)	.185	.185 (4.70)
C	.020 (0.51)	.020	.025 (0.64)
D	.200 (5.08)	.203	.210 (5.33)

FIGURE EE

550-0207 Green
550-0307 Yellow
550-0407 Red
550-0507 Red with integral resistor for operation at 5V †
550-0607 Red " " " " " 12V †, ††
550-0707 Green " " " " " 5V †, ††
550-0807 Yellow " " " " " 5V †, ††

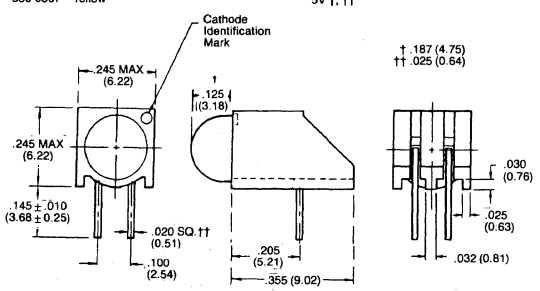
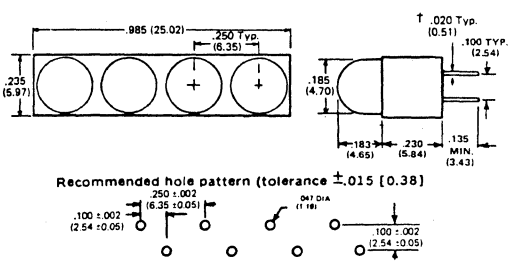


FIGURE FF



Recommended hole pattern (tolerance ±.015 [0.38]

FIGURE GG

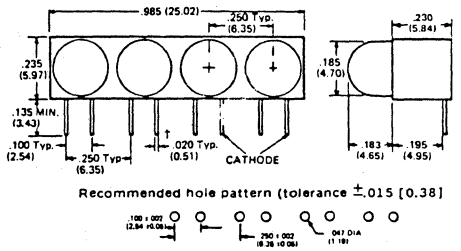
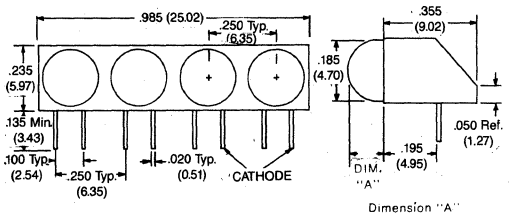


FIGURE HH

QUAD-LED®



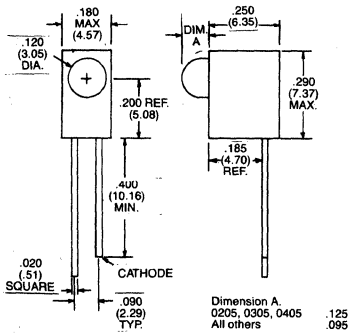
THE CATHODE, AS MARKED, IS THE RED CATHODE FOR THE RED/GREEN BICOLOR LED.

Dimension "A"	
Std.	Hi Eff.
.125	.183

• DECIMALS ± .015 (±0.38)

FIGURE JJ

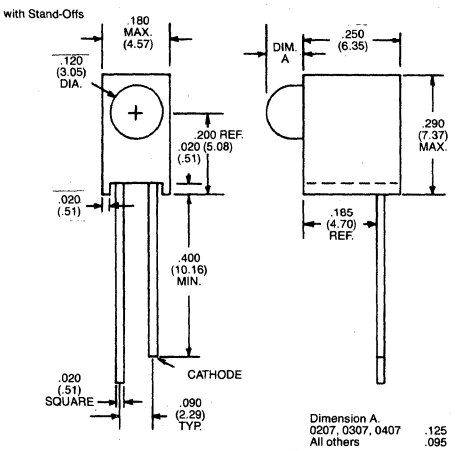
Block Form



Dimension A.	
0205, 0305, 0405	.125
All others	.095

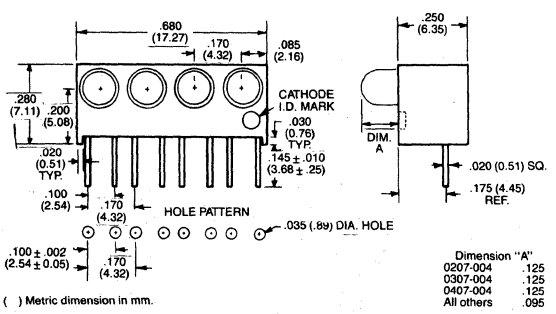
FIGURE KK

with Stand-Offs



Dimension A.	
0207, 0307, 0407	.125
All others	.095

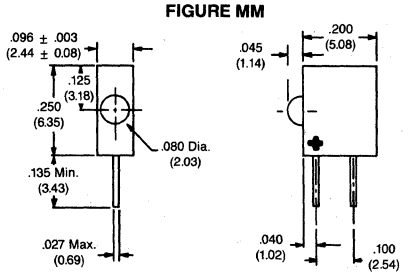
FIGURE LL



( ) Metric dimension in mm.

Dimension "A"	
0207-004	.125
0307-004	.125
0407-004	.125
All others	.095

FIGURE MM



• DECIMALS ± .015 (±0.38)

FIGURE NN

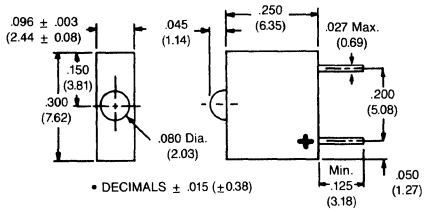
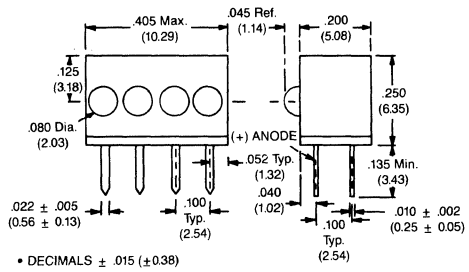


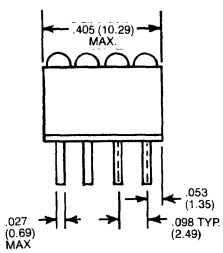
FIGURE PP

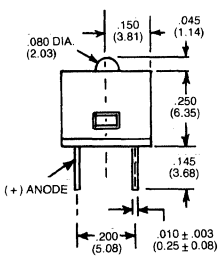
QUAD-LED®



U.S. Pat. No. 4,206,493

FIGURE QQ

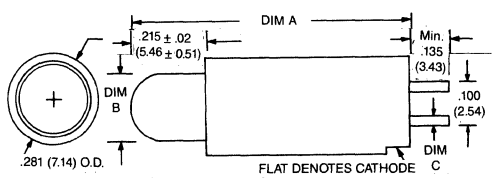




( ) Metric dimension in mm.

Decimals ±0.015 (0.38)

FIGURE RR



DIMENSIONS	STANDARD & HIGH EFFICIENCY
Dimension A + .010 (0.25) − .031 (0.79)	
561XXXX050	0.500 (12.70)
561XXXX060	0.600 (15.24)
561XXXX070	0.700 (17.78)
561XXXX080	0.800 (20.32)
561XXXX090	0.900 (22.86)
561XXXX100	1.000 (25.40)
Dimension B	0.200 (5.08)
Dimension C	0.020 (0.51)

FIGURE SS

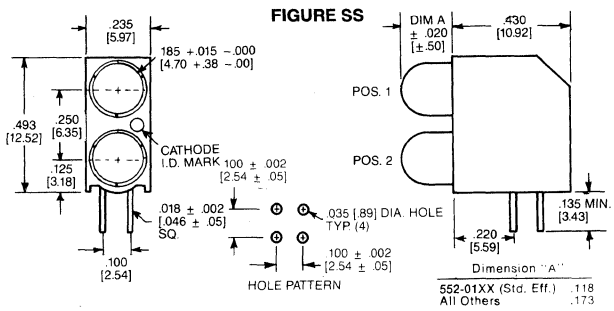
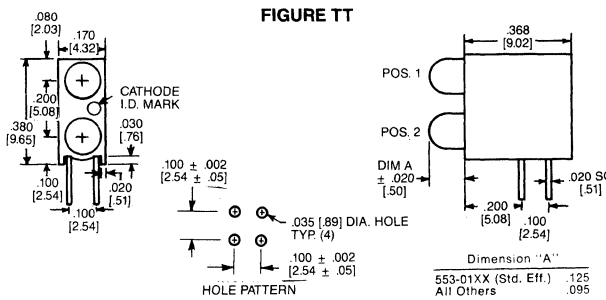


FIGURE TT



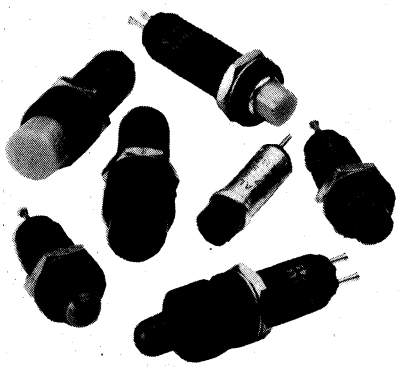
DIALIGHT INDICATOR LIGHTS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Whatever your application calls for in indicator lights, Dialight has your number. Over 1,500,000 to be exact. That's how many different types of indicator lights we offer. One is bound to meet your specs and needs perfectly.

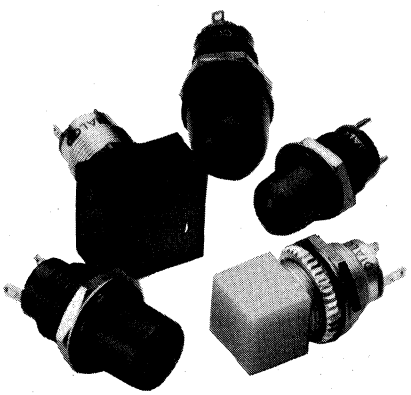
Take our ultraminiature incandescents with plug-in cartridges for example. They come in enough colors to simplify even the most complex front panels. And they make changing lamps a snap. Dialight LEDs, on the other hand, have a service life of over 100,000 hours. We also offer indicators with built-in RFI/EMI shields, open types, as well as watertight, oil-tight and press-to-test models. You'll also be happy to know that all our indicator lights meet or exceed military specs.

ULTRAMINIATURE LED, INCANDESCENT OR NEON INDICATORS—DATALITES®



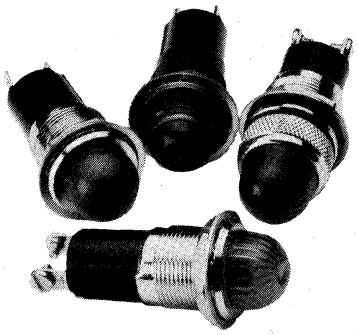
Replaceable plug-in cartridges for 1.35-125V operation. U.L. listed and CSA approved. Indicators mount in 9/32″, 3/8″ and 3/4″ (twin lamp) clearance holes. Meet or exceed MIL-L-3661. Available with red, green, amber, blue, white translucent, light yellow or colorless lenses. Wide range of lens shapes. Custom legends.

SUBMINIATURE INCANDESCENT OR NEON INDICATORS



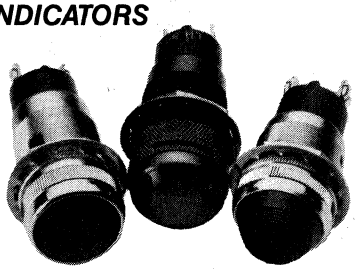
Meet or exceed MIL-L-3661. U.L. listed and CSA approved. Mount in 15/32″, 1/2″ or 17/32″ clearance holes. Incandescent for 1.35 to 28V; neon has built-in current-limiting resistor. Choice of cylindrical, faceted, convex, flat, square and round lens shapes. Custom legends.

MINIATURE INCANDESCENT OR NEON INDICATORS



U.L. listed and CSA approved. Meet or exceed MIL-L-3661. Mount in 9/16″ and 11/16″ clearance holes. Voltages range from 2 to 120V. Available in red, green, amber, blue, white, yellow or colorless lenses. Full range of finishes.

LARGE INCANDESCENT OR NEON INDICATORS



DIALIGHT COMPANY A Division of North American Philips (201) 223-9400

DIALIGHT·KULKA·HHSMITH

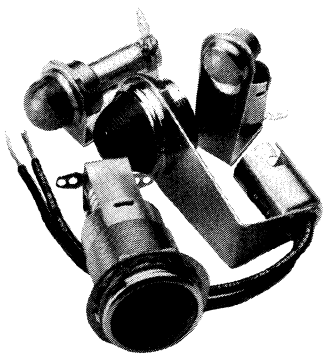
Engineering is the only commodity we sell.

DIALIGHT INDICATOR LIGHTS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

Mount in 1″ clearance hole. U.L. listed and CSA approved. Meet or exceed MIL-L-3661. Incandescent for 2 to 250V; neon has built-in current-limiting resistor. Screw-on or friction-fit lens caps. Bayonet lock caps also available. Mechanical dimmer caps or light shield lens cap available on some models. Choice of flat, convex, torpedo, large torpedo, faceted, torpedo faceted or dome lens shapes.

OPEN TYPE INDICATORS



Mount in 7/16″, 11/16″ or 1″ clearance holes. 2 to 250V models available depending upon series. Tamper-proof construction is available. Choice of flat, convex, faceted, stove-pipe or cylindrical lens shapes.

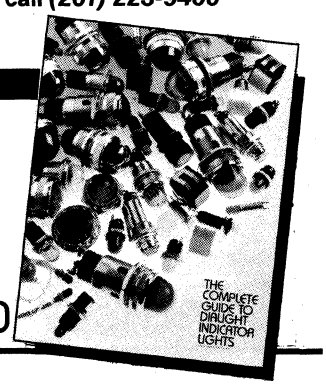
OIL-TIGHT INDICATORS

U.L. listed and CSA approved. Three retained elastomer seals of inert material, consisting of a gasket and two "O" rings, make these indicator lights resistant to permeation by oil, water, dust or fumes. Thus, assuring high reliability in harsh environments. Subminiature and miniature incandescent and neon lamps mount in 15/32″ and 11/16″ clearance holes. Large incandescent and neon lamps mount in 1″ or 1-3/16″ clearance holes. Available in red, green, yellow, blue, white translucent, light yellow and clear colorless. Positive or negative film discs with words, numerals or letters may be ordered for use with some models. Wide range of voltages and specifications available.

PRESS-TO-TEST INDICATORS

Positive safety factors are provided by patented built-in Press-To-Test indicators. Lamps can be checked instantly and accurately without removing them from their assembly. 4-terminal assemblies are available with all indicators and are particularly useful for remote applications. Subminiature, miniature and large Press-To-Test indicators are available for mounting in 15/32″, 5/8″ and 1″ clearance holes respectively. Choice of red, green, yellow, blue, white translucent, light yellow and clear colorless lens colors. Patented shutter-dimming device available on most models. Hot-stamped or engraved legend can be supplied on flat lenses. Meet or exceed QPL approval. NVIS and secure lighting compatible assemblies also available.

For complete specifications, mounting diagrams, ordering information, etc., send for our free product catalog. **Dialight Co., 1913 Atlantic Avenue, Manasquan, NJ 08736. Or call *(201) 223-9400***



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DIALIGHT LED READOUT DISPLAYS

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

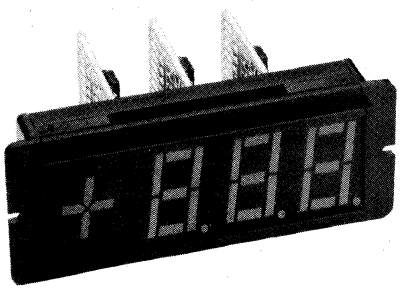
Dialight offers three basic types of LED readout displays: complete assemblies, modules and bezel kits, and discrete readouts. All are excellent choices where power is a limiting factor and IC compatibility, ultra reliability and packaging density are prime requirements.

Readouts come in a variety of sizes, ranging from .270″ to .600″ in character height. Available styles include: 7 segment, hexadecimal, alphanumeric and custom symbols.

Typical viewing distance, in normal ambient, ranges from 10 to 25 feet, with brightness a current variable. Special Dialight filters provide excellent character enhancement, permitting use in higher illumination environments (excluding direct sunlight).

Because Dialight readout displays are virtually immune to shock and vibration, they're particularly valuable in rugged applications. Their solid-state construction offers life measured in years.

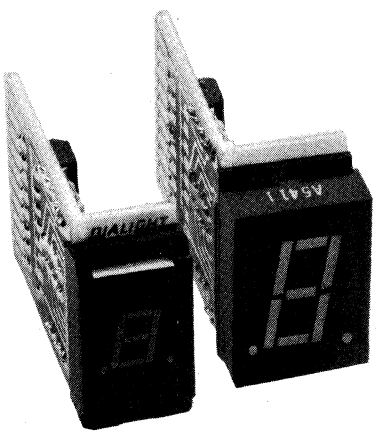
COMPLETE LED ASSEMBLIES



Complete assemblies significantly reduce the design time and cost normally associated with mounting and driving displays. They come complete with readouts and drivers mounted to PC boards in a bezel, making panel mounting easy. They also require only a 5 or 12 VDC power supply and BCD inputs. And they can be wired directly or by using edge-card connectors.

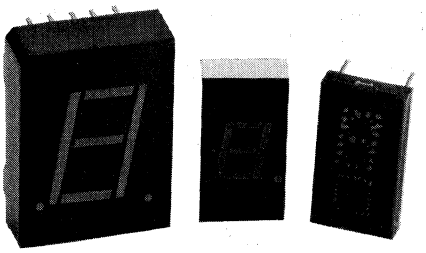
Attractive and bright, these LED readouts have non-glare windows to further enhance visibility. Each assembly is available with anywhere from one to 20 digits or status indicators. Character size ranges from .270″ to .600″ in height. To further increase design flexibility, drive circuitry is available with optional latch or counter. Also available with hexadecimal decoder with latch and CMOS decoder with latch. In addition, polarity indicators are an option. And optional spacers or specialty status symbols can be accommodated for custom assemblies.

LED MODULES



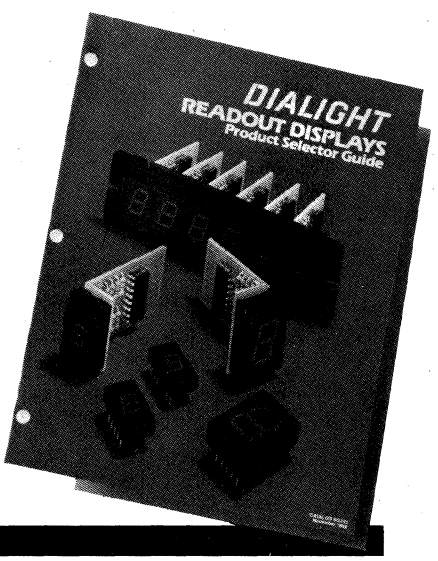
The same modules used in Dialight complete assemblies can be ordered separately, along with easily assembled bezel kits. This allows users to make their own custom displays with a minimum of parts, money and effort. Modules are also available in panel mount types for use without a bezel.

DISCRETE LED READOUTS



Discrete readouts are available in .270″, .300″ and .600″ character heights. Choose from seven segment, hexadecimal with integral drive circuitry and alphanumeric styles. Each readout offers high brightness with a wide viewing angle. Standoffs also allow for easy flux removal from PC boards after wave soldering.

For complete specifications, mounting diagrams, ordering information, etc., send for our free product catalog. **Dialight Co., 1913 Atlantic Avenue, Manasquan, NJ 08736. Or call *(201) 223-9400***



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LEDTRONICS, Inc.
4009 Pacific Coast Hwy., Torrance, Calif. 90505
Tele: 213-676-7996 Fax: 213-676-0108 TLX: 4945454

BASED LED LAMPS
RELAMPABLE PANEL LEDs

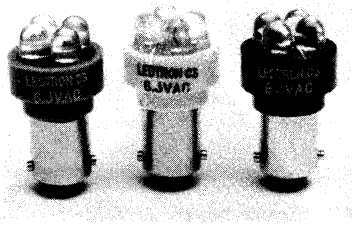
FEATURES:
- Directly Replaces Standard Incandescents
- Long Life, 100,000 Hrs. (10 Years Average)
- Solid-State, Shock/Vibration Proof
- Built-in Current Limiting Resistor for Direct DC or AC Supply Voltages
- Low Current, Power Savings 500% and More
- Voltages from 2V to 60 VDC or 120 VAC

LED TYPES
- Multichip 8-Chip, 6-Chip, 4-Chip, Dual-Chip
- 7-LED, 6-LED, 4-LED Clusters
- Sunlight Visible Ultras Clear/Diffused
- Colors: Red, Orange, Amber, Yellow, Green
- Lens Waterclear, Clear, Diffused
- Special LEDs: Bicolor LEDs, Blinking LEDs, 3000mcd LEDs, Narrow Beam LEDs

T1(3mm), T1¾(5mm), T3¼(9mm) LED SUB-MIDGET, MIDGET, MINIATURE

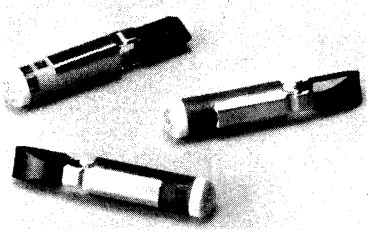
Replaces Incand.—6839, 8022, 714.682, 685, 718, 7240, 7241 etc.
LEDs—Hi-Ultra Red, Ultra, Hi-Efficiency
Lens—Clear Wide Angle, Flat-Top Clear Xtra Wide Angle, Diffused
Colors—Red, Orange, Amber, Lime, Yellow, Std. Green, Pure (Deep) Green
Accessories—Panel Mount LED Lamp Holders/Lens Caps in RFI/EMI, Std. and Water-Proof Types

T3¼ (9mm) & S6 (13mm) LED MINI/CANDELABRA CLUSTER



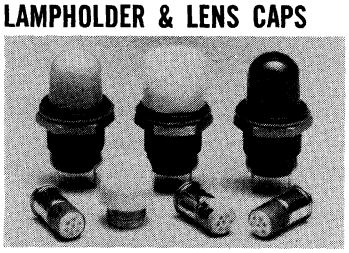
Replaces Incand.—755, 757, 1819, 1829, 1835, 120MB, 24MB, etc.
LEDs—7-LED, 6-LED, 4-LED Clusters in Ultras, 3000mcd, Hi-Efficiency
Lens—Clear Wide Angle, Flat-Top Clear Xtra Wide Angle, Diffused
Colors—Red, Orange, Amber, Lime, Yellow, Std. Green, Pure (Deep) Green
Accessories—Relampable LED Lamp Holders/Lens Caps. Std. & Waterproof

T4.6, T5.5, T6.8, T2 LED TELEPHONE SLIDES (U.S. & EUROPE)



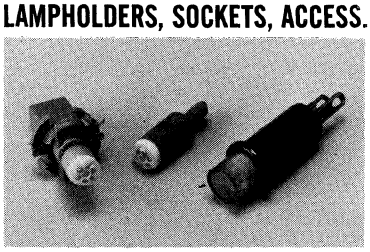
Replaces Incand.—120P5B, 24C5B, 48E5B, 48P5B, 24P5B, 24E1, 24X, etc.
LEDs—Multichip, 6-Chip, Dual-Chip, Ultras, 3000mcd, Hi-Efficiency, Bicolors
Lens—Clear Wide Angle, Flat-Top Clear Xtra Wide Angle, Diffused
Colors—Red, Orange, Amber, Lime, Yellow, Std. Green, Pure (Deep) Green
Accessories—Relampable LED Lamp Holders/Lens Caps

T1¾ (5mm) MID. FLANGE LED LAMPHOLDER & LENS CAPS



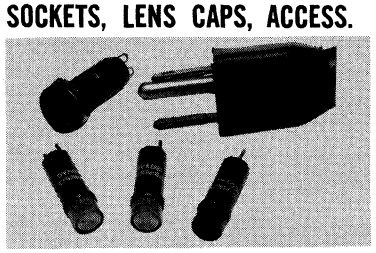
Mounting—Front Mount
Mounting Diameter—0.484″
Uses Ledtronics LED—T1¾ Mid. Flange
Mil Specs—MIL-L3661 LH73 LH89 etc.
Replaces Incand.—327, 387, 394, 382, 385, 330, 328, 345, C9A, NE2D, C9A, M525237
LED Type—Multichip, 6-Chip, Dual-Chip, Ultras, 3000mcd Ultras, Hi-Efficiency, etc.
Lens—Special Fluted Clear, Dome or Cylindrical, Diffused or Clear
Specials—RFI/EMI, Waterproof

T1¾ (5mm) WEDGE BASE LED LAMPHOLDERS, SOCKETS, ACCESS.



Mounting—Front Mount
Mounting Diameter—0.312″
Uses Ledtronics LED—T1¾″ Sub-Miniature Wedge Base LED
Replaces Incand.—73, 74, 84, 85, 86, 17, 18, 37, 56, etc.
LED Type—Multichip, 6-Chip, Dualchip Ultras, 3000mcd Ultras, Hi-Efficiency, etc.
Lens—Cylindrical Flat in Clear or Diffused
Specials—PCB Automotive Sockets

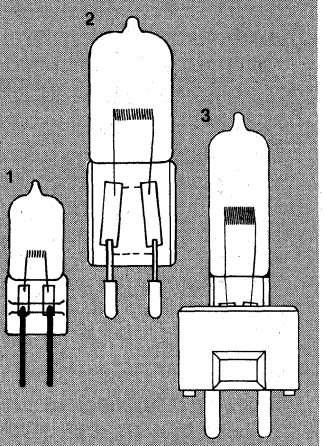
T2 BIPIN CARTRIDGE LED SOCKETS, LENS CAPS, ACCESS.



Mounting—Rear Mount
Mounting Diameter—0.375″
Uses Ledtronics LED—T2 Cartridges
Mil Specs—MIL-L3661
Replaces Incand.—Dialight 247, 249, 250 Littelfuse 900 Series, etc.
LED Type— Multichip, 6-Chip, Dualchip Ultras, 3000mcd Ultras, Hi-Efficiency, etc.
Lens—Special Fluted Clear, Dome, or Cylindrical, Diffused or Clear
Specials—RFI/EMI, Waterproof

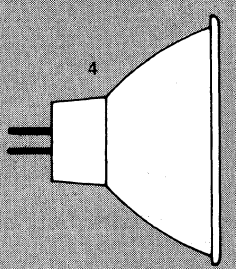
Halogen Lamps

Lamp No.	Volts	Watts	Lumens	Color Temp. (°Kelvin)	Life Hours	Filament	Dimensions D	MOL	LCL	Base	Figure
L7387	6.0	10	200	3200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L6402	6.0	10	150	2900	2000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7388	6.0	20	420	3200	100	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7394	6.0	20	350	3000	2000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7401	12.0	20	420	3150	250	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7404	12.0	20	350	3000	2000	C-6	8.5	30.0	19.5 ± .25	G-4	1
L7389	12.0	50	900	3000	2500	C-6	12.0	44.0	30.0 ± .25	GY6.35	2
L7390	12.0	100	2400	3000	2000	C-Bar	11.0	44.0	30.0 ± .25	GY6.35	2
L7407	12.0	100	3000	3400	50	C-Bar	11.0	44.0	30.0 ± .25	G6.35	2
L6405	24.0	150	4700	3400	50	C-Bar	13.5	50.0	32.0 ± .05	G6.35	2
L7391	24.0	250	5750	3000	2000	C-Bar	15.0	58.0	37.0	GY6.35	2
L9404	12.0	20	350	3000	2000	C-6	10.0	60.0	30.3 ± .25	Snaplock	3
L9389	12.0	50	900	3000	2500	C-6	12.0	60.0	33.3 ± .25	Snaplock	3
L9390	12.0	100	2400	3000	2000	C-Bar	11.0	60.0	33.3 ± .25	Snaplock	3



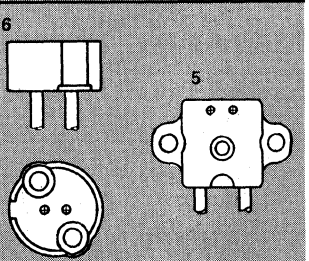
Dichroic Reflector Halogen Lamps

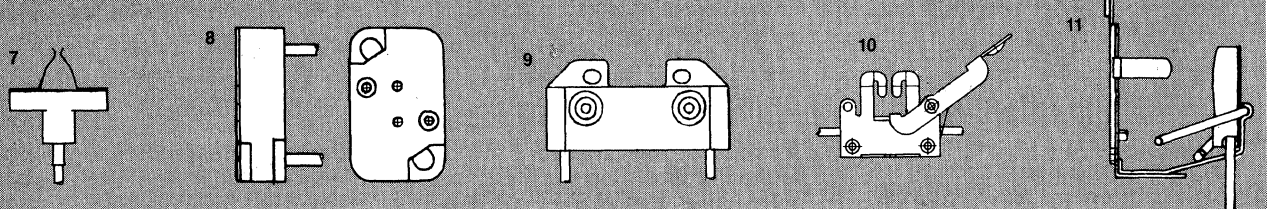
Lamp No.	Volts	Watts	Color Temp. (°Kelvin)	Life Hours	Dimensions MD	MOL	Base	Figure
L510	12.0	28	3050	1000	36.0	35.0	GZ4	4
L512	13.8	25	3125	500	36.0	35.0	GZ4	4
L513	12.0	20	2900	2000	36.0	35.0	GZ4	4
L514	12.0	35	2900	2000	36.0	35.0	GZ4	4
L6408	12.0	75	3000	1500	50.0	42.0	GZ6.35	4
L7405	12.0	100	3400	50	50.0	42.0	GZ6.35	4
L7406	21.0	150	3350	40	50.5	45.0	GX5.3	4



Halogen Lamp Holders

Holder No.	Halogen Lamp Base Types	Figure
H9901	G-4	5
H9941	G-4, GZ4	6
H997	G-4	7
H912	GY6.35, G6.35	6
H701	GY6.35, G6.35	8
H910	G6.35	9
H9971	GY9.5, Snaplock	10
H705	GZ6.35	11
H706	GX5.3	11
H989	GX5.3	6





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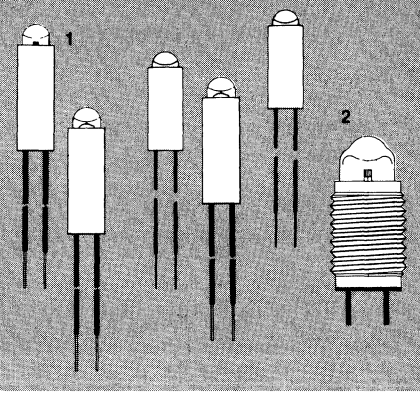
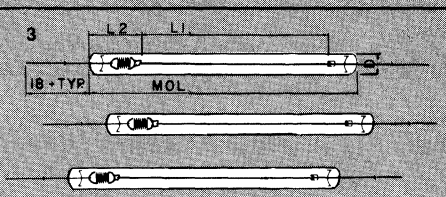
Lens-End Lamps

Lamp No.	Volts	Amps	Lux	Color Temp. (°Kelvin)	Hours	Filament	Diameter	Figure
L1005	2.5	.350	1,550	2,170	30,000	C-6	6.35	1
L1005A	2.5	.350	1,550	2,170	30,000	C-6	6.35	1
L1026A	2.5	.350	2,000	2,250	10,000	C-2R	6.35	1
L1023	2.5	.350	2,100	2,240	15,000	C-6	6.35	1
L1006	3.5	.450	1,600	2,230	50,000	C-6	6.35	1
L1024	3.5	.560	3,800	2,490	5,000	C-6	6.35	1
L1024A	3.5	.560	3,800	2,490	5,000	C-6	6.35	1
L1021	3.5	.600	12,000	2,930	100	C-6	6.35	1
L1007	5.0	.160	800	2,300	20,000	C-2R	6.35	1
L1025	5.0	.240	1,200	2,450	10,000	C-2R	6.35	1
L8006	5.0	.775	7,000	2,370	30,000	C-6	12.7	2
L8008	5.0	.725	12,000	2,400	10,000	C-6	12.7	2



Line Filament Lamps

Lamp No.	Volts	Amps	Watts	Hours	Filament	Length, L_1	L_2	MOL	Diameter	Figure
L9050	3.0	.370	1.10	2,000	S-8	16 ± 1	9 ± .5	36	3.5	3
L9001	4.5	.370	1.65	2,000	S-8	23 ± 1	9 ± .5	43	3.5	3
L9013	6.0	.370	2.22	2,000	S-8	30 ± 1	9 ± .5	50	3.5	3
L9003	12.0	.300	3.60	1,000	S-8	75 ± 1	9 ± .5	92	3.5	3
L9014	12.0	.370	4.45	2,000	S-8	60 ± 1	9 ± .5	77	3.5	3

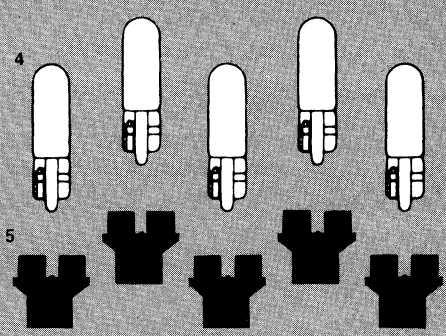


T-5mm (T-1¾) Wedge Base Lamps

Lamp No.	Volts	Amps	M.S.C.P.	Hours	Filament	Base	Figure
86	6.3	.200	.40	50,000	C-2F	Wedge	4
2100	6.3	.040	.40	10,000	C-2V	Wedge	4
73	14.0	.080	.30	25,000	C-2F	Wedge	4
74	14.0	.100	.70	500	C-2F	Wedge	4
17	28.0	.065	.65	5,000	C-2F	Wedge	4

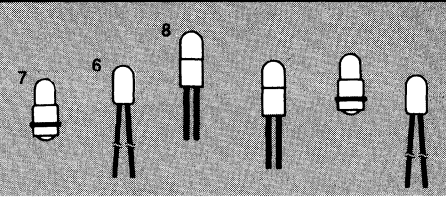
T-5mm (T-1¾) Wedge Base Lamp Holders

Holder No.	Lamp Type	Base	Figure
H710	T-5mm	Wedge	5



T-¾ Subminiature Lamps

Volts	Amps	M.S.C.P.	Life in Hours	Wire 6	Miniature Flanged 7	Bi-Pin 8
5.0	.060	.05	100,000	6833	8913	7114
5.0	.060	.15	3,000	6153	6183	7115
5.0	.075	.09	25,000	7133	8828	7116
5.0	.115	.15	40,000	7153	8270	7118



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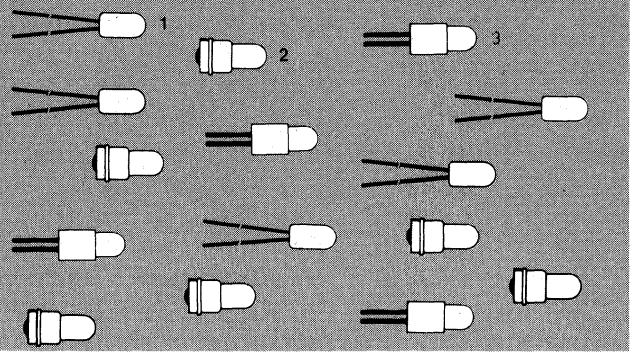
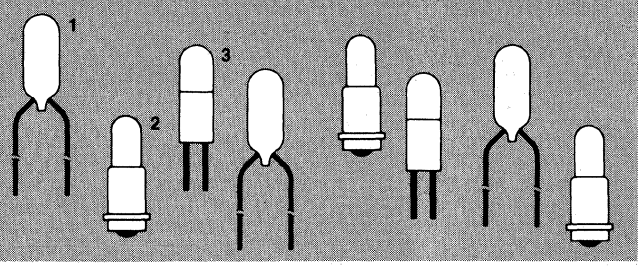
T-1 Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
5.0	.060	.05	100,000	683	685	7683
5.0	.060	.15	5,000	6150	6180	7265
5.0	.075	.09	25,000	713	714	7714
5.0	.080	.16	3,000	7211	7235	7266
5.0	.115	.15	40,000	715	718	7715
5.0	.115	.20	5,000	7213	7236	7267
5.0	.125	.22	5,000	7216	7239	7268
10.0	.027	.10	10,000	7218	7240	8095
12.0	.060	.15	16,000	7219	32	8097
14.0	.065	.15	16,000	8111	8112	8098
18.0	.026	.15	16,000	7220	7241	8099
28.0	.024	.15	16,000	6838	6839	7839



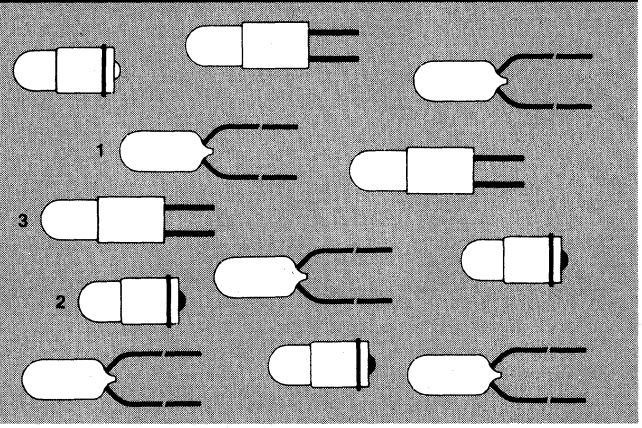
T-1¼ Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
2.5	.40	.55	30	8655	8656	7307
3.0	.19	.25	350	324	8637	7637
5.0	.06	.05	100,000	583	3585	7583
5.0	.115	.15	40,000	515	3518	7515
6.0	.06	.13	3,000	2114	8541	7309
6.0	.20	.63	1,000	634	8628	7628
6.3	.20	.55	5,000	8610	8551	7310
14.0	.08	.50	1,000	8640	8646	7646
28.0	.04	.32	1,000	8627	8632	7632



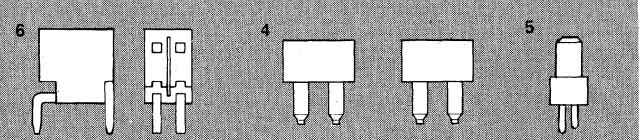
T-1¾ Subminiature Lamps

Volts	Amps	M.S.C.P.	Hours	Wire 1	Flanged 2	Bi-Pin 3
6.3	.20	.40	50,000	2181	381	7381
6.3	.20	.55	3,000	2112	349	7349
10.0	.014	.002	10,000	1869	344	7344
10.0	.04	.08	5,000	2107	367	7367
12.0	.04	.12	10,000	2174	394	7394
14.0	.08	.30	50,000	2182	382	7382
14.0	.08	.50	750	1705	330	7330
14.0	.100	.50	10,000	2162	8918	7373
18.0	.04	.15	10,000	2102	370	7370
22.0	.04	.30	2,000	8425	459	7459
28.0	.04	.20	50,000	2185	385	7374
28.0	.04	.30	25,000	2187	387	7387
28.0	.04	.34	7,000	1764	327	7327
28.0	.065	.65	5,000	8361	7341	7376



Holders for Bi-Pin Lamps

Holder No.	Lamp Type	Lamp Base Type	Specifications	Figure
H714	T1	Bi-Pin	2.54mm o.c. bi-pin	4
H715	T1¾	Bi-Pin	3.17mm o.c. bi-pin	4
H716	T1	Bi-Pin	1.27mm o.c. bi-pin	4
H996	T1	Bi-Pin	1.27mm o.c. bi-pin	5
H719	T1	Bi-Pin	2.54mm o.c. bi-pin	6



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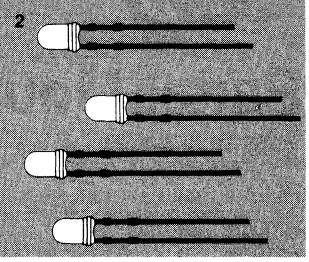
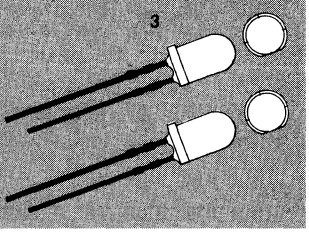
T-1 Visible LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity Minimum	Luminous Intensity Typical	Viewing Angle	Forward Voltage Typical	Forward Voltage Maximum	Peak Wave Length at 20 mA	Figure
RED	E100	Clear	90 mcd	200 mcd	40°	2.1V	3.0V	650 nm	2
ORANGE	E102	Clear	90 mcd	200 mcd	40°	2.1V	3.0V	610 nm	2
YELLOW	E104	Clear	90 mcd	200 mcd	40°	2.2V	3.0V	585 nm	2
GREEN	E106	Clear	90 mcd	200 mcd	40°	2.2V	3.0V	563 nm	2
RED	E112	Diffused	36 mcd	100 mcd	55°	2.1V	3.0V	650 nm	2
ORANGE	E113	Diffused	36 mcd	100 mcd	55°	2.1V	3.0V	610 nm	2
YELLOW	E114	Diffused	36 mcd	100 mcd	55°	2.2V	3.0V	585 nm	2
GREEN	E116	Diffused	36 mcd	100 mcd	55°	2.2V	3.0V	563 nm	2



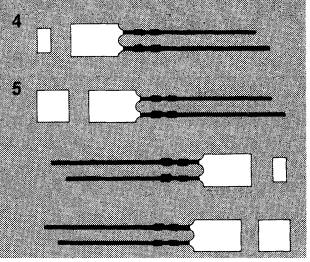
T-1¾ LEDs (Very Bright)

	LED No.	Lens	Luminous Intensity Minimum	Luminous Intensity Typical	Viewing Angle	Forward Voltage Typical	Forward Voltage Maximum	Peak Wave Length	Figure
RED	E118	Diffused	36 mcd	100 mcd	55°	2.1V	3.0V	650 nm	3
ORANGE	E119	Diffused	36 mcd	100 mcd	55°	2.2V	3.0V	610 nm	3
YELLOW	E120	Diffused	36 mcd	100 mcd	55°	2.2V	3.0V	585 nm	3
GREEN	E121	Diffused	36 mcd	100 mcd	55°	2.2V	3.0V	563 nm	3
RED	E280	Clear	300 mcd	500 mcd	30°	1.75V	2.5V	660 nm	3
RED	E281	Clear	500 mcd	700 mcd	30°	1.75V	2.5V	660 nm	3
RED	E282	Clear	700 mcd	1000 mcd	30°	2.0V	3.0V	660 nm	3



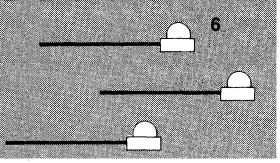
Rectangular & Square LEDs

	LED No.	Lens	Luminous Intensity Minimum	Luminous Intensity Typical	Forward Voltage Typical	Forward Voltage Maximum	Peak Wave Length	Figure
RED	E122	Diffused	.40 mcd	.80 mcd	2.0V	3.0V	650 nm	4
ORANGE	E123	Diffused	.40 mcd	.80 mcd	2.0V	3.0V	610 nm	4
YELLOW	E124	Diffused	.40 mcd	.80 mcd	2.1V	3.0V	585 nm	4
GREEN	E125	Diffused	.40 mcd	1.0 mcd	2.1V	3.0V	562 nm	4
RED	E126	Diffused	.40 mcd	1.0 mcd	2.0V	3.0V	650 nm	5
ORANGE	E127	Diffused	.40 mcd	1.0 mcd	2.0V	3.0V	610 nm	5
YELLOW	E128	Diffused	.40 mcd	1.0 mcd	2.1V	3.0V	585 nm	5
GREEN	E129	Diffused	.40 mcd	1.0 mcd	2.1V	3.0V	562 nm	5



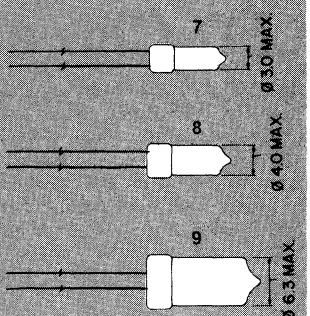
Right Angle LEDs

	LED No.	Lens	Luminous Intensity Typical	Viewing Angle	Forward Voltage Typical	Forward Voltage Maximum	Peak Wave Length	Figure
RED	E108	Transparent	2.5 mcd	60°	2.1V	2.8V	700 nm	6
ORANGE	E109	Transparent	4.0 mcd	60°	2.1V	2.8V	610 nm	6
YELLOW	E110	Transparent	4.0 mcd	60°	2.1V	2.8V	585 nm	6
GREEN	E111	Transparent	4.0 mcd	60°	2.1V	2.8V	565 nm	6



Neon & Fluorescent Glow Lamps

	Lamp No.	Color (Off)	Color (On)	Circuit V (VAC)	Starting V (VAC)	mA	Lumens	Kohm	Hours	Base	Figure
Neon	N501	Clear	Red	90-115	85 max	1.1	.110	33	20,000	Leads	9
Neon	N502	Clear	Red	85-115	65 max	0.9	.050	47	20,000	Leads	8
Neon	N503	Clear	Red	85-115	75 max	1.4	.050	33	20,000	Leads	7
Fluorescent	N504	White	Green	90-115	80 max	0.8	.050	51	20,000	Leads	9
Fluorescent	N505	White	Green	90-115	80 max	1.4	.080	33	20,000	Leads	9
Fluorescent	N506	White	Green	90-115	80 max	0.6	.015	75	20,000	Leads	8
Fluorescent	N507	White	Green	90-115	80 max	0.6	.010	75	20,000	Leads	7
Fluorescent	N508	White	Yellow	90-115	80 max	0.8	.050	51	20,000	Leads	9
Fluorescent	N509	White	Yellow	90-115	80 max	1.4	.080	33	20,000	Leads	9
Fluorescent	N510	White	Blue	90-115	80 max	0.8	.025	51	20,000	Leads	9
Fluorescent	N511	White	Blue	90-115	80 max	1.4	.040	33	10,000	Leads	9



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Gilway
Technical Lamp

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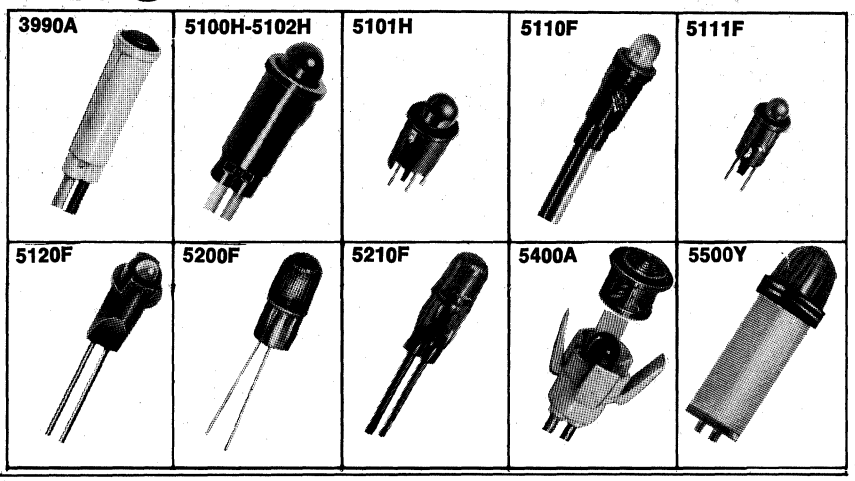
Light Emitting Diodes

Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911 • TELEX 127459

Panel Mounted LEDS

Snap fit in panel

Model	Hole	LED Color(s)	Elec. Conn.
3990A	7/32	R, G, Y	24 AWG
5100H	1/4	R, G, Y, R/G	24 AWG
5102H	1/4	R, A, G	24 AWG
5101H	1/4	R, G, Y	Sq Pin
5110F	5/32	R, G, Y	26 AWG
5111F	5/32	R, G, Y	Sq Pin
5120F	Twst	R, G, Y	26 AWG
5200F	3/16	R, G, Y	26 AWG
5210F	3/16	R, G, Y	26 AWG
5400A	5/16	R, G, Y	24 AWG
5500Y	5/32	R, G, Y	Sq Pin
5502Y	5/32	R, A, Y	Sq Pin

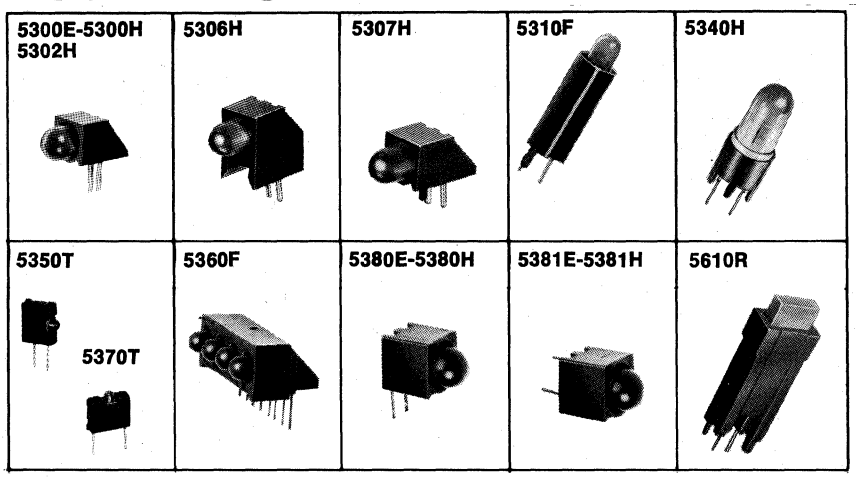


ACTUAL SIZE

PC Board Mounted LEDS

Mount directly to PC board

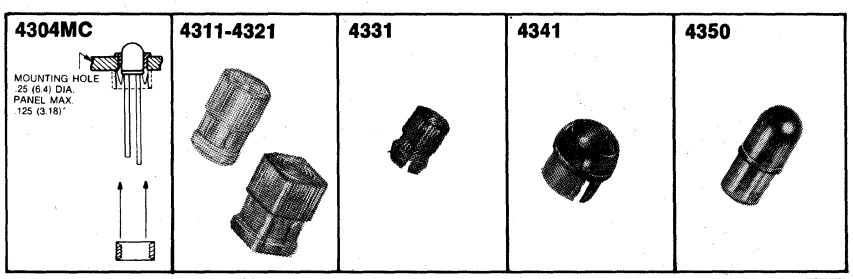
Model	LED Color
5300E	R, G, Y
5300H	R, G, Y, R/G
5302H	R, G, A
5390E	R, G, Y
5390H	R, G, Y
5390H	R, G, A
5306H	R, G, Y
5307H	R, G, Y
5310F	R, G, Y
5340H	R, G, Y
5350T	R, G, Y
5370T	R, G, Y
5360F	R, G, Y Quad
5380E	R, G, Y
5380H	R, G, Y
5381E	R, G, Y
5381H	R, G, Y
5610R	R, G, Y



ACTUAL SIZE

LED Clip and Lenses

4304MC is quick mounting clip to fit 1/4" hole for T-1 3/4 LEDs. 4311 is round 1/4" Fresnel antistatic lens, 4321 is square. 4331 is round 1/64" antistatic miniature lens for T-1 LED. 4341 is 9mm (23/64" antistatic lens with diffusing rings. 4350 is 3/16" wide angle snap in lens for T-1 LEDs.



Surface Mount LED

Designated the model 6200 series, these devices position the LED for easy visibility, particularly in applications where boards are mounted in parallel close to one another.

Model No.	Color	LED	Model No.	Color	LED
6200T1	Red	4307T1	6202T1-5V	Red	4302T1-5V
6200T5	Green	4307T5	6202T3-5V	Amber	4302T3-5V
6200T7	Yellow	4307T7	6202T5-5V	Green	4302T5-5V
6200T1LC	Red	4300T1LC	6202T1-5VLC	Red	4302T1-5VLC
6200T5LC	Green	43005LC	6202T3-5VLC	Amber	4302T3-5VLC
6200T7LC	Yellow	4300T7LC	6202T5-5VLC	Green	4302T5-5VLC

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Bare LEDs

Industrial Devices Inc.
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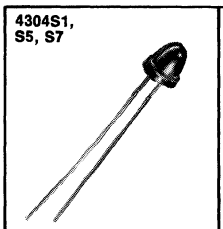
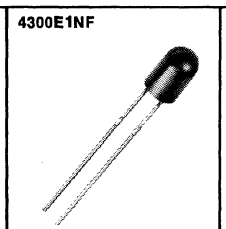
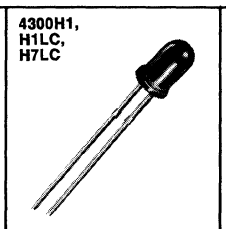
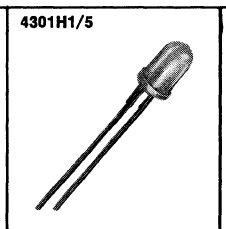
A wide variety of top-quality LEDs in a variety of sizes and package styles.

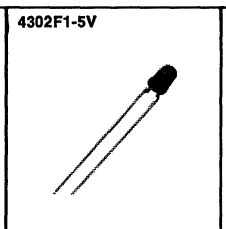
- All IDI LEDs provide bright, unmistakable indication **SUPER-BRITE** LEDs are GaAsP on GaP for red and yellow, **EXTRA-SUPER-BRITE** (series) are ultra bright LEDs utilizing GaA1As construction for red, GaAsP on GaP for amber, and high-efficiency GaP for yellow and green.
- New "LC" LEDs are high efficiency types available in red and yellow, require only 2 mA, ideal for battery-operated devices and limited-current power supplies.
- −5V LEDs have a current-limiting resistor on the chip, are TTL compatible — require no external current-limiting resistors.
- IDI LEDs are available as components, and also in a variety of panel-mounted and printed circuit-board mounted assemblies.

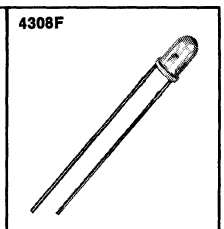


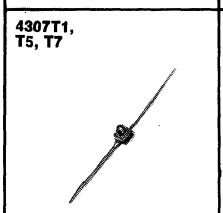


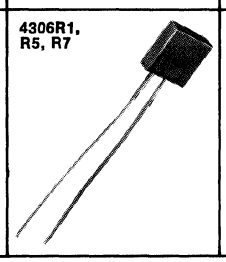


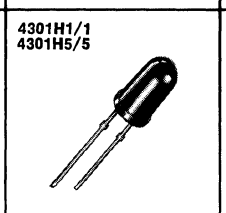


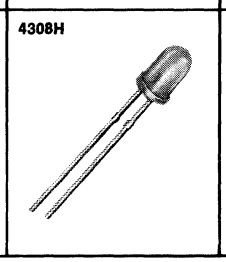


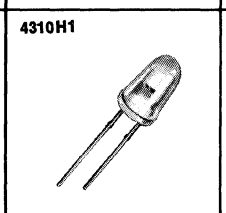


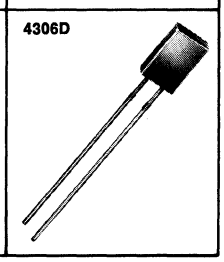












SPECIFICATIONS

* OUTPUT COLOR	* DIFFUSED-NON DIFFUSED	* PACKAGE COLOR	VIEWING ANGLE	MIN. LUM. INTENSITY AT RATED CURRENT	TYP. LUM. INTENSITY AT RATED CURRENT	RATED CURRENT	FORWARD VOLTAGE TYP.	FORWARD VOLTAGE MAX.	CONTINUOUS FORWARD CURRENT, MAX.	PEAK FORWARD CURRENT @ 1 μS-300 PPS.	REVERSE BREAKDOWN VOLTAGE (MIN.)	PEAK WAVELENGTH	POWER			FORWARD CURRENT @ V_r = 5V TYP.	FORWARD CURRENT @ V_r = 5V MAX.	
													DISSIPATION MAX. AT 25°C.	DERATE LINEARLY FROM 25°C.	CAPACITANCE @ V = 0			
	COLOR		DEG.	mcd	mcd	mA	V	V	mA	A	V	nm	mW	mW/C°	P.F.	mA	mA	MODEL NO.
R	D	R	70	0.5	2	20	1.7	2.2	100	1.0	5	660	105	1.14	25	—	—	4300E1NF
R	D	R	125	0.5	1.0	20	1.6	2.0	50	1.0	3	655	100	—	100	—	—	4300F1
R	D	R	50	1.0	1.8	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300F1LC
Y	D	Y	50	1.0	1.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300F7LC
R	D	R	80	0.5	1.6	20	1.7	2.2	100	1.0	5	670	180	2.0	30	—	—	4300H1
R	D	R	50	1.2	2.0	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300H1LC
Y	D	Y	50	1.2	1.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300H7LC
R	D	R	70	0.4	0.8	2	1.8	2.2	7	.007	5	635	27	—	4	—	—	4300T1LC
Y	D	Y	70	0.4	0.8	2	1.9	2.7	7	.007	5	583	24	—	4	—	—	4300T7LC
R/G	D	CLR	—	R-0.6 G-0.6	R-1.8 G-1.8	10	2.2	2.8	25	.06	—	R-697 G-565	115	1.5	100	—	—	4301H1/5
R	D	R	60	0.8	1.5	13	5	7.5	20	—	3	655	—	—	—	13	20	4302F1-5V
R	D	R	90	1.5	4.0	10	5	7.5	15	—	5	635	—	—	—	10	15	4302H1-5V
A	D	A	90	1.5	4.0	10	5	7.5	15	—	5	583	—	—	—	10	15	4302H3-5V
G	D	G	90	1.5	4.0	12	5	7.5	15	—	5	565	—	—	—	12	13	4302H5-5V
R	D	R	80	1.0	2.4	9.6	5	6	13	—	5	635	—	—	—	9.6	15	4302T1-5V
R	D	R	90	1.5	2.5	10	2.0	3.0	30	1.0	5	635	120	—	45	—	—	4303F1
G	D	G	90	2.0	5.0	20	2.2	3.0	30	.09	5	562	120	—	20	—	—	4303F5
Y	D	Y	90	1.5	3.0	20	2.1	3.0	30	1.0	5	585	120	—	45	—	—	4303F7
R	D	R	65	3.0	10	20	2.0	3.0	35	1.0	5	635	120	1.14	45	—	—	4304H1
G	D	G	75	3.0	12	20	2.2	3.0	30	.09	5	562	120	—	20	—	—	4304H5
Y	D	Y	65	2.5	11	20	2.1	3.0	35	1.0	5	585	120	1.14	45	—	—	4304H7
R	D	R	50	2.0	4.0	10	2.0	3.0	35	1.0	5	630	105	1.14	45	—	—	4304S1
G	D	G	50	.5	3.0	10	2.2	3.0	30	.09	5	562	180	—	20	—	—	4304S5
Y	D	A	50	1.5	3.0	10	2.1	3.0	35	1.0	5	585	105	1.14	45	—	—	4304S7
R	N	R	28	17	40	20	2.0	3.0	35	1.0	5	635	120	—	45	—	—	4305H1
G	N	G	35	12	25	20	2.3	3.0	30	.09	5	562	120	—	20	—	—	4305H5
Y	N	Y	28	10	45	20	2.1	3.0	35	1.0	5	585	120	—	45	—	—	4305H7
R	D	R	100	2.5	5.0	25	2.1	3.0	30	.09	5	635	135	—	17	—	—	4306R1
G	D	G	100	1.5	2.5	25	2.3	3.0	30	.09	5	565	135	—	18	—	—	4306R5
Y	D	Y	100	3.0	5.0	20	2.2	3.0	20	.06	5	583	85	—	17	—	—	4306R7
R	D	R	80	1.0	3.0	10	2.2	3.0	30	.06	5	635	120	—	11	—	—	4307T1
G	D	G	70	1.0	3.0	10	2.3	3.0	30	.06	5	565	120	—	18	—	—	4307T5
Y	D	Y	90	1.0	3.0	10	2.2	3.0	20	.06	5	583	120	—	15	—	—	4307T7
R	N	CLR	20	80	160	20	1.7	2.0	50	.3	4	660	100	—	50	—	—	4308H1
G	N	CLR	20	50	80	20	2.1	2.5	50	.1	4	555	125	—	50	—	—	4308H5
Y	N	CLR	20	80	160	20	2.1	2.5	50	.1	4	570	125	—	40	—	—	4308H7

* COLOR CODE: A - AMBER, CLR - CLEAR, G - GREEN, R - RED, Y - YELLOW, D - DIFFUSED, N - NON-DIFFUSED

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Relampable Indicator Lights

Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911 • TELEX 127459

IDI supplies a complete series of relampable incandescent lights. They use the ultra-reliable T-1¾ and T-2 wedge and slide base lamps shown at the bottom of this page. The lamps are replaceable by removing the lens cap and pulling the lamp from the socket. New lamps press into place with little effort. For complete specifications and dimensions call or write for the new IDI technical data catalog.

Model	Mtg Hole	Lamp Type T-1¾	Lamp Type T-2 Pilot	Lamp Type T-2 Indctr	Lens Style	Lens Color	Mntg Type	Termi-nal
4610	3/8"	X			RF	RCAWGBY	Spdnut	Solder
4611	3/8"	X			RF	RCAWGBY	Spdnut	Solder
4100	5/16"	X			RF	See caps	Twist	22 AWG
4104	5/16"	X			RF	See caps	Twist	20 AWG
4110	5/16"	X			RF	See caps	Rivet	Solder
4111	5/16"	X			RF	See caps	Rivet	Solder
4112	5/16"	X			RF	See caps	Opt	Solder
4113	5/16"	X			RF	See caps	Opt	Solder
4120	5/16"	X			RF	See caps	Tab	
4130	Spcl	X			RF	See caps	P/C	P/C
4135	Spcl	X			RF	See caps	P/C	P/C
4136	Spcl	X			RF	See caps	P/C	P/C
4140	5/16"	X			RF	See caps	P/C	Pin
4141	5/16"	X			RF	See caps	P/C	Pin
4142	5/16"	X			RF	See caps	P/C	Pin
4144	5/16"	X			RF	See caps	P/C	Pin
4150	Spcl	X			RF	See caps	Hook	Solder
4151	Spcl	X			RF	RCAWGBY	Snap	Solder
2802	11/16"		X		RD	RCAWGBY	11/16-27	QD
2803	11/16"		X		RF	RCAWGBY	11/16-27	QD
3040	1/2"			X	SF	RCAWGBY	Spdnt	QD
3062	1/2"		X		SF	RCAWGBY	2Spdnt	QD
3001	1/2"			X	RF	See caps	Spdnt	QD
3002	1/2"			X	RF	See caps	Spdnt	QD
3062	1/2"		X		RF	See caps	Spdnt	QD
301–	Cap		>1.5W	>1.5W	Poly	RAWGBY	Snap	
320–	Cap		<1.5W	<1.5W	Pyrex	RWGBY	Push	

RF = Round Flat, RD = Round Dome, SF = Square Flat, R = Red, C = Clear, A = Amber, G = Green, B = Blue, Y = Yellow, QD = Quick Disconnect.

Codes

CALL FOR FREE CATALOG

INCANDESCENT LAMPS

Lamp #	Design Volts	Design Amps	T-1¾	T-2 Pilot	T-2 Indi-cator	Lamp #	Design Volts	Design Amps	T-1¾	T-2 Pilot	T-2 Indi-cator	Lamp #	Design Volts	Design Amps	T-1¾	T-2 Pilot	T-2 Indi-cator
11	2.5	0.200	X			10ASB	10.0	0.009			X	16ESB	16.0	0.035			X
4ESB	4.0	0.035			X	10CSB	10.0	0.015			X	18ESB	18.0	0.035			X
56	5.0	0.115	X			10ESB	10.0	0.035			X	24CSB	24.0	0.015			X
5SLB	5.0	0.120		X		12ESB	12.0	0.035			X	24ESB	24.0	0.035			X
5ESB	5.0	0.035			X	12PSB	12.0	0.170		X		85	28.0	0.040	X		
79	6.0	0.200	X			18	14.0	0.040	X			17	28.0	0.060	X		
6PSB	6.0	0.140		X		73	14.0	0.080	X			28PSB	28.0	0.040		X	
6SLB	6.0	0.120		X		37	14.0	0.090	X			28ESB	28.0	0.035			X
51B	6.0	0.250			X	74	14.0	0.100	X			48ESB	48.0	0.035			X
6ESB	6.0	0.035			X	70	14.0	0.150	X			48PSB	48.0	0.053		X	
84	6.3	0.040	X			14FSB	14.0	0.080			X	60PSB	60.0	0.050		X	
16	6.3	0.150	X			16CSB	16.0	0.015			X	120PSB	120.0	0.025		X	
86	6.3	0.200	X														

Non-Relampable Lights

Industrial Devices Inc.
260 Railroad Ave., Hackensack, New Jersey 07601 • (201) 489-8989 • FAX: 201-489-6911 • TELEX 127459

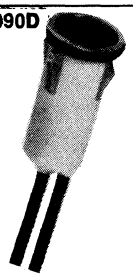
IDI nonrelampable indicator lights are available in a wide variety of models and styles. When properly specified, these lamps will outlast the life of the products they are installed in. For complete specifications and dimensions, ask for the IDI catalog.

Model #	Mtg Hole	Neon Vac	Incan Volts	LED Volts	Lens Type	Lens Color	Mntg Type	Trmnl (Std)
1030D	½″	125/250			RLD	RAWG	Snap	22 AWG
1030QD	½″		6/12/28		RLD	RAWG	Snap	QD
1090D	½″	125/250			RLD	RAWG	Snap	22 AWG
1050A	½″	125/250			RD	RCAWGB	Snap	22 AWG
1050QA	½″		6/12/28		RD	RAWGB	Snap	QD
1090A	½″	125/250			RD	RCAWGB	Snap	22 AWG
1050C	½″	125/250			RF	RCAWG	Snap	22 AWG
1050QC	½″		6/12/28		RF	RAWG	Snap	QD
1090C	½″	125/250			RF	RCAWG	Snap	22 AWG
1050N	½″	125/250			SQF	RCAWG	Snap	22 AWG
1050QN	½″		6/12/28		SQF	RAWG	Snap	QD
1090N	½″	125/250			SQF	RCAWG	Snap	22 AWG
1091M	½″			6/12/24	RD	RGY	Snap	22 AWG
1091QM	½″			6/12/24	RD	RGW	Snap	QD
2620K	⅞″	125/250			RLD	RAWG	Spdnt	22 AWG
2620QK	⅞″	125/250			RLD	RAWG	Spdnt	QD
2620T	⅞″	125/250			RC	RAG	Spdnt	22 AWG
2650T	⅞″	125/250	Flasher		RC	RA	Spdnt	22 AWG
2110A	5/16″	125/250			RLD	RCAWGB	Spdnt	22 AWG
2110QA	5/16″	125/250			RLD	RCAWGB	Spdnt	QD
2195A	5/16″		6/12/28		RLD	RAWGB	Spdnt	22 AWG
2120A	5/16″	125			RLD	RAW	Spdnt	22 AWG
2150A	5/16″	125			RF	RCAWGB	Spdnt	22 AWG
2150QA	5/16″	125			RF	RCAWGB	Spdnt	QD

Model #	Mtg Hole	Neon Vac	Incan Volts	LED Volts	Lens Type	Lens Color	Mntg Type	Trmnl (Std)
2194A	5/16″		6/12/28		RF	RAWGB	Spdnt	22 AWG
2191L	5/16″			6/12/24	RF	RGY	Spdnt	22 AWG
2191QL	5/16″			12/24	RF	RGY	Spdnt	QD
2191U	5/16″			6/12/24	RD	RGY	Spdnt	22 AWG
2191QU	5/16″			12/24	RD	RGY	Spdnt	QD
2990D	5/16″		6/12/28		RC	RAWGB	Spdnt	22 AWG
2990P	½″		6/12/28		RFL	RAWGB	Snap	22 AWG
4700A	5/16″	125			RLD	RAWG	Spcl	22 AWG
2330D	Rect	125			Rect	RAWG	Snap	22 AWG
2330QD	Rect	125			Rect	RAWG	Snap	QD
2390QD	Rect		28		Rect	RAWG	Snap	QD
3620D	Rect	125			Rect	RAWG	Snap	22 AWG
3620QD	Rect	125			Rect	RAWG	Snap	QD
5900K	5/16″ SQ	125			SQFL	RAG	Snap	22 AWG
5991K	5/16″ SQ			12/24	SQFL	RGY	Snap	22 AWG
6010M	⅜″			125 Vac	RD	RAG	3/8-24	22 AWG
6011M	⅜″			250 Vac	RD	RAG	3/8-24	22 AWG
6091M	⅜″			12/24	RD	RGY	3/8-24	22 AWG

NOTES:
RLD = Round Low Dome, RF = Round Flat, RD = Round Dome, SQF = Square Flat, RC = Round Cone, RFL = Round Flat Surface, Rect = Rectangular, SQFL = Square Flat Surface, R = Red, C = Clear, A = Amber, W = White, G = Green, Y = Yellow, B = Blue, QD = Quick Disconnect, Spdnt = Speed Nut.

1030D, 1090D



1030QD

1050A, 1090A

1050QA

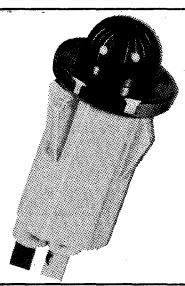
1050C, 1090C

1050QC

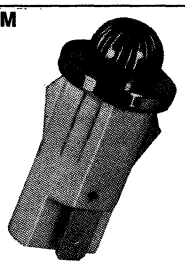
1050N, 1090N

1050QN

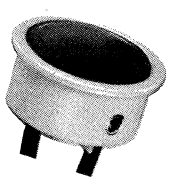
1091M



1091QM



2620K



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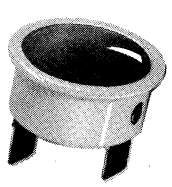

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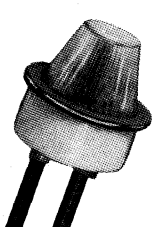

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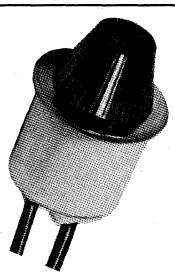
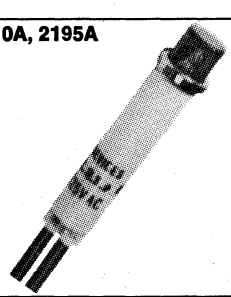


2110A, 2195A



2110QA

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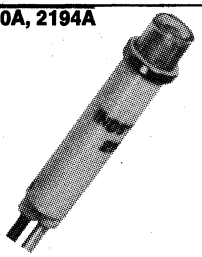
2120A

2150A, 2194A



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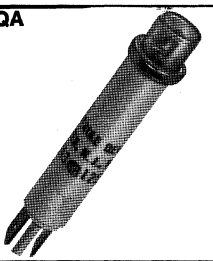
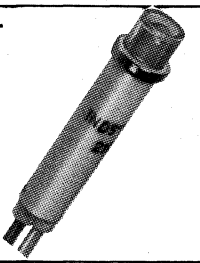


2191L



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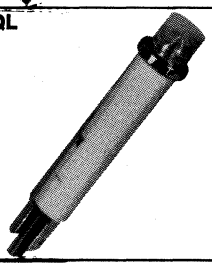
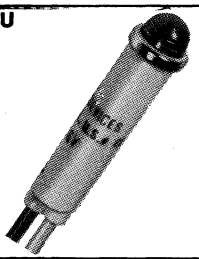
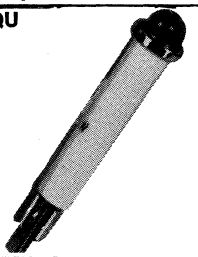


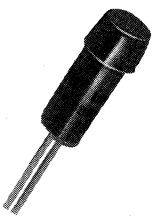
2191U



2191QU



2990D



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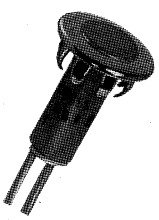

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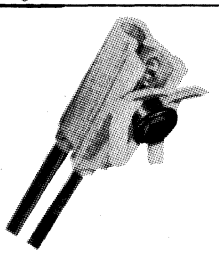

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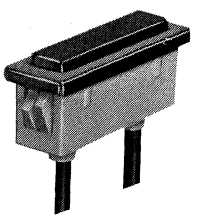

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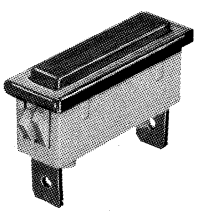
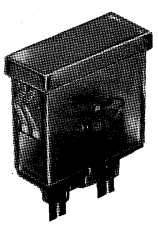


3620D



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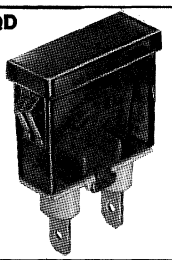
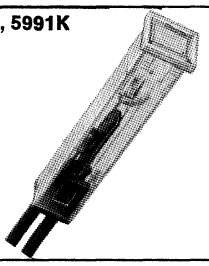
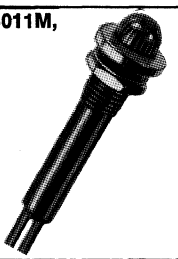


5900K, 5991K

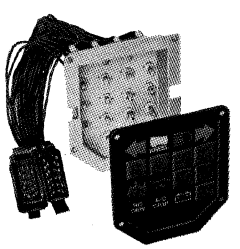


6010M, 6011M, 6091M

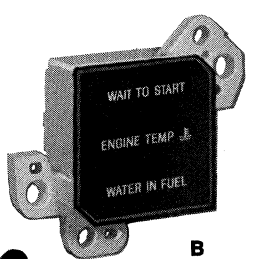


CUSTOM PRODUCTS

In addition to the standard products briefly described on the preceding pages, IDI supplies custom products as shown below: A. 18 lamp bus module; B. Assembly for diesel auto; C. Neon lamp for vaporizer; D. Custom lamps for solenoid operated hydraulic system; E. Automotive instrument lens clusters; F. Wire harness for auto vanity mirror: G. Lamp cluster for bowling scorer; H. Special imprinted lamps and clusters and harnesses.



A



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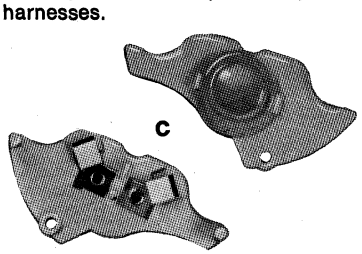

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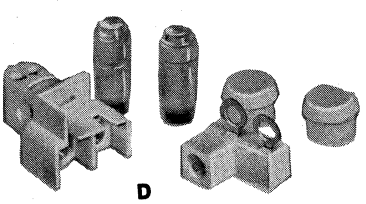

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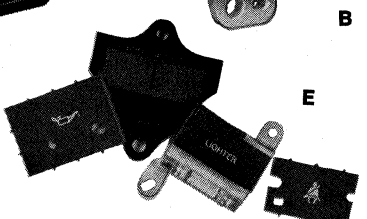

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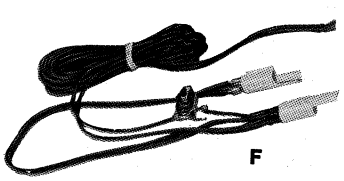

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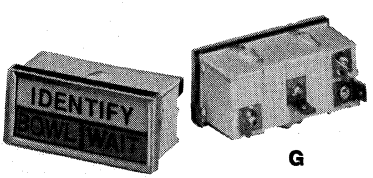

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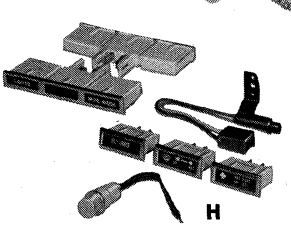

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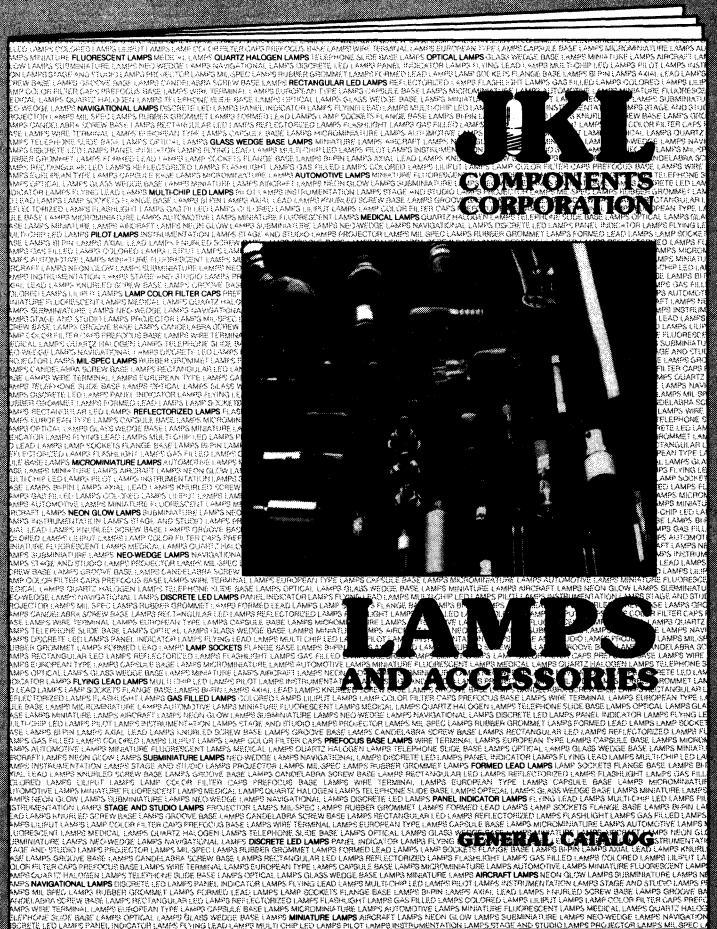

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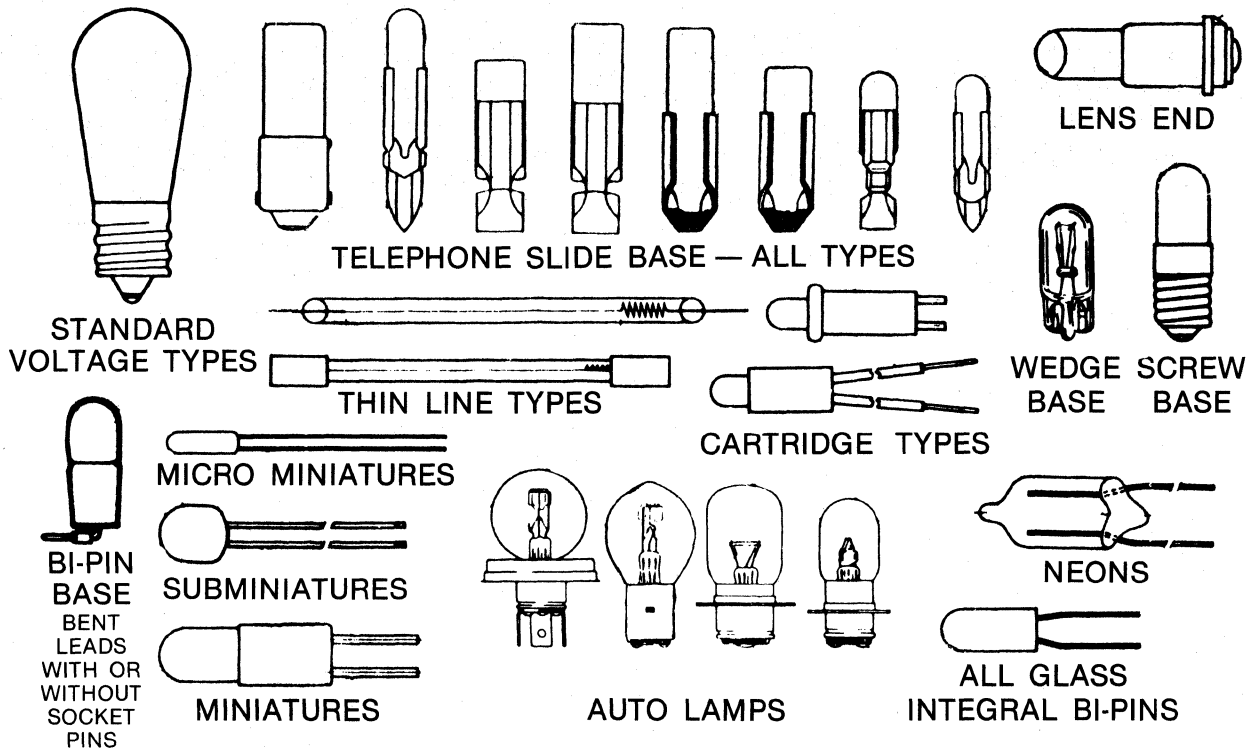

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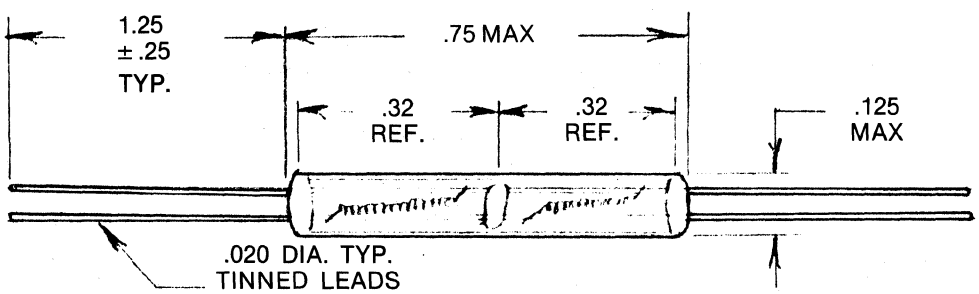

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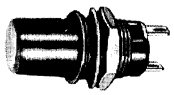
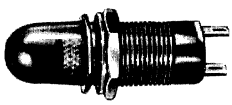
900 Series Cartridge Lamps

Cartridge Lampholders

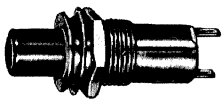


920 Series Subminiature

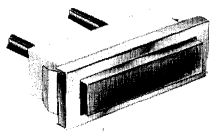


921 Series Subminiature

922, 923, 924 Series Subminiature

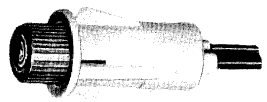


925, 926, 927 Series Subminiature

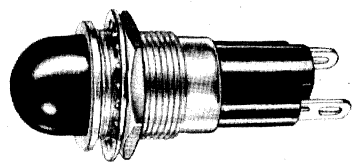


960 Series Rectangular Snap-Mount Plastic

970 Series 5/16" Diameter Snap-Mount Plastic



980 Series 1/2" Diameter Snap-Mount Plastic



930 Series Miniature Lampholders

		CARTRIDGE LAMPS & HOLDERS					SUBMINIATURE LAMPHOLDERS								MINIATURE LAMPHOLDERS	SNAP-MOUNT PLASTIC LITES		
		CARTRIDGE LAMPS		CARTRIDGE LAMPHOLDERS		SOCKETS												
		900 SERIES	901 SERIES	910 SERIES (Mate with 900 SERIES Cartridge lamps)	911 SERIES (Mate with 901 SERIES Cartridge lamps)	910-000-***	920 SERIES	921 SERIES	922 SERIES	923 SERIES	924 SERIES	925 SERIES	926 SERIES	927 SERIES	930 SERIES	960 SERIES (Rectangular)	970 SERIES (5/16" DIA.)	980 SERIES (1/2" DIA.)
MOUNTINGS	FRONT MOUNT						X	X	X	X	X			X	X	X	X	X
	REAR MOUNT			X	X						X	X	X					
	MOUNTING HOLE SIZE			3/8"	3/8"		15/32"	15/32"	15/32"	17/32"	15/32"	3/8"	3/8"	15/32"	11/16"	1.281" X .395"	.312" / .318"	.500" / .510"
	MAXIMUM PANEL THICKNESS			3/8"	3/8"		3/16"	7/16"	1/4"	1/4"	1/4"	1/8"	3/16"	5/16"	3/8"	.090"	W/BEZ .090 W/O BEZ .125	W/BEZ .090 W/O BEZ .125
TERMINATIONS	SOLDER LUG			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
	SOLDER CUP			X	X	X												
	SCREW TYPE														X			
	TURRET PIN			X	X	X												
	6" WIRE LEADS															X	X	X
	1/8" Q.C.																X	
	3/16" Q.C.															X		X
	1/4" Q.C.															X		
	.040 STAIN. BI-PIN	X	X															
	.040 TIN BI-PIN	X	X															
OPTIONS	D-HOLE MOUNTING			X	X										X			
	DRIP-PROOFING														X			
LAMPS	INCANDESCENT	X					X		X	X	X	X	X	X	X	X	X	X
	NEON STANDARD	X	X					X				X	X	X	X	X	X	X
	NEON GREEN		X													X	X	X
	NEON BLUE		X													X	X	X
	LED RED	X															X	
	LED GREEN	X															X	
	LED YELLOW	X															X	
	LAMPS INCLUDED	X	X	NA	NA	NA										X	X	X
UL	LISTED														X	X	X	X
	RECOGNIZED	X	X	X	X		X	X	X	X	X	X	X	X		X	X	X
CSA	APPROVED	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X

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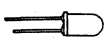
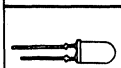
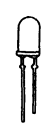
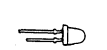
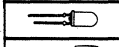
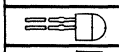
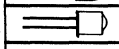
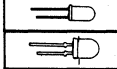
Ultra Bright Selector Guide

Diag.	Part Number	Lens	θ Typ.	Iv mcd Min.	Iv mcd Typ.	Iv mcd Max.	Iv mcd @ mA	V_F (V) Typ.	V_F (V) Max.	V_F (V) @ mA	I_R uA	I_R V_R	MAXIMUM RATINGS (Ta=25°C) I_F (mA)	V_R (V)	Pd (mW)	Pkg.
	MT5000-UR	Water-Clear	12	4000	5000		20	1.8	2.4	20	100	4	50	4	125	A
	MT4000-UR	Water-Clear	12	2500	3700	5000	20	1.8	2.4	10	100	4	50	4	125	A
	MT3200-UR	Water-Clear	12	1600	2400	3200	20	1.8	2.4	10	100	4	50	4	125	A
	MT1600-UR	Water-Clear	12	1000	1600	2000	20	1.8	2.4	10	100	4	50	4	125	A
	MT1500A-UR	Water-Clear	25	1000	1500		20	1.8	2.4	20	100	4	50	4	125	A
	MT1000A-UR	Water-Clear	25	550	1000	1350	20	1.8	2.4	20	100	4	50	4	125	A
	MT500A-UR	Water-Clear	25	300	500	750	20	1.8	2.4	20	100	4	50	4	125	A
	MT360-UR	Milky Diffused	30	26	50		20	1.75	2.5	20	100	4	25	4	55	A
	MT350-UR	Water-Clear	25	47	150	310	20	1.75	2.5	20	100	4	25	4	55	A
	MT340-UR	Red Diffused	30	19	45	120	20	1.75	2.5	20	100	4	25	4	55	A
	MT330-UR	Red Clear	25	46	120	270	20	1.75	2.5	20	100	4	25	4	55	A
	MT250-UR	Red Diffused	35		250		20	1.8	2.4	20	100	4	50	4	125	A
	MT150-UR	Red Diffused	35		150		20	1.8	2.4	20	100	4	50	4	125	A
	MT100-UR	Red Diffused	35	60	100		20	1.8	2.4	20	100	4	50	4	125	A
	MT150F-URC	Water-Clear	30	3200	4000	5000	20	1.8	2.4	20	100	3	50	3	100	B
	MT150F-URB	Water-Clear	30	1600	2300	3200	20	1.8	2.4	20	100	3	50	3	100	B
	MT150F-URA	Water-Clear	30	800	1100	1600	20	1.8	2.4	20	100	3	50	3	100	B
	MT80F-UR †††	Water-Clear	30		200		20	1.7	2.4	20	10	15	50	15	100	B
	MT3000-UR	Water-Clear	8	2000	3000		20	1.8	2.4	20	100	4	50	4	125	C
	MT2000-UR	Water-Clear	8	1300	2000	3000	20	1.8	2.4	20	100	4	50	4	125	C
	MT1000-UR	Water-Clear	8	700	1000	1800	20	1.8	2.4	20	100	4	50	4	125	C
	MT540-CUR	Lt. Red Diffused	30	25	110		20	1.75	2.2	20	100	4	25	4	55	C
	MT540-UR	Red Diffused	30	15	100		20	1.75	2.2	20	100	4	25	4	55	C
	MT540-UG	Green Diffused	30	20	60		20	2.1	2.8	20	5	4	25	4	70	C
	MT540-UY	Yellow Diffused	30	20	60		20	2.1	2.8	20	100	4	25	4	70	C
	MT530-UR	Red Clear	10	50	200		20	1.75	2.2	20	100	4	25	4	55	C
	MT530-UG	Green Clear	10	60	120		20	2.1	2.8	20	5	4	25	4	70	C
	MT530-UY	Yellow Clear	10	60	120		20	2.1	2.8	20	100	4	25	4	70	C
	MT400-UR	Water-Clear	8	170	400	1100	20	1.75	2.5	20	100	4	25	4	55	C
	MT350A-UR	Water-Clear	8	135	400	860	20	1.75	2.5	20	100	4	25	4	55	C
	MT220-UR	Water-Clear	8	50	220		20	1.75	2.2	20	100	4	25	4	55	C
	MT2500-UR	Water-Clear	15	1600	2500		20	1.8	2.4	20	100	4	50	4	125	D
	MT1500-UR	Water-Clear	15	900	1500	2250	20	1.8	2.4	20	100	4	50	4	125	D
	MT800-UR	Water-Clear	15	500	800	1250	20	1.8	2.4	20	100	4	50	4	125	D
	MT500-UR	Water-Clear	15	100	250	720	15	1.75	2.2	20	100	4	25	4	55	D
	MT200-UR	Water-Clear	50	6	22		20	1.75	2.2	20	100	4	25	4	55	D
	MT70-UR	Water-Clear	15		70		20	1.75	2.2	20	100	4	25	4	55	D
	MT900-UR	Water-Clear	40	650	900		20	1.8	2.4	20	100	4	50	4	125	E
	MT600-UR	Water-Clear	40	350	600	900	20	1.8	2.4	20	100	4	50	4	125	E
	MT300-UR	Water-Clear	40	200	300	500	20	1.8	2.4	20	100	4	50	4	125	E
	MT140-SUR	Red Diffused	80	7	25	48	20	1.75	2.2	20	100	4	25	4	55	E
	MT140-UR	Red Diffused	80	4	15		20	1.75	2.2	20	100	4	25	4	55	E
	MT130-SUR	Red Clear	55	14	40	86	20	1.75	2.2	20	100	4	25	4	55	E
	MT130-UR	Red Clear	50	5	20		20	1.75	2.2	20	100	4	25	4	55	E
	MT120-SUR	Red Clear	55	19	50		20	1.75	2.2	20	100	4	25	4	55	E
	MT640-CUR	Lt. Red Diffused	25	22	50	146	20	1.75	2.2	20	100	4	25	4	55	F
	MT640-UR	Red Diffused	20	10	20		20	1.75	2.2	20	100	4	25	4	55	F
	MT640-UG	Green Diffused	20	10	20		20	2.1	2.8	20	5	4	25	4	70	F
	MT640-UY	Yellow Diffused	20	10	20		20	2.1	2.8	20	100	4	25	4	70	F
	MT630-CUR	Lt. Red Clear	15	90	240	560	20	1.75	2.2	20	100	4	25	4	55	F
	MT630-UR	Red Clear	10	20	40		20	1.75	2.2	20	100	4	25	4	55	F
	MT630-UG	Green Clear	10	20	40		20	2.1	2.8	20	5	4	25	4	70	F
	MT630-UY	Yellow Clear	10	20	40		20	2.1	2.8	20	100	4	25	4	70	F
	MT600-CUR	Water-Clear	10	110	300	720	20	1.75	2.5	20	100	4	25	4	55	F
	MT600-CUG	Water-Clear	10	63	150	320	20	2.1	2.8	20	5	4	40	4	120	F
	MT440-UR	Red Diffused	30	10	50		15	1.75	2.2	20	100	4	25	4	55	G
	MT440-UG	Green Diffused	30	10	30		15	2.1	2.8	20	5	4	25	4	55	G
	MT440-UY	Yellow Diffused	30	10	30		15	2.1	2.8	20	100	4	25	4	55	G
	MT430-UR	Red Clear	20	30	100		15	1.75	2.2	20	100	4	25	4	55	G
	MT430-UG	Green Clear	20	30	60		15	2.1	2.8	20	5	4	25	4	55	G
	MT430-UY	Yellow Clear	20	30	60		15	2.1	2.8	20	100	4	25	4	55	G
	MT250-CUR	Water-Clear	60	22	50		20	1.75	2.5	20	100	4	25	4	55	H
	MT240-CUR	Red Diffused	75	10	20	72	20	1.75	2.2	20	100	4	25	4	55	H
	MT240-UR	Red Diffused	75	3	10		20	1.75	2.2	20	100	4	25	4	55	H
	MT230-CUR	Red Clear	60	17	40		20	1.75	2.2	20	100	4	25	4	55	H
	MT230-UR	Red Clear	60	5	20		20	1.75	2.2	20	100	4	25	4	55	H
	MT550-AUR	Water-Clear	76/90		350		20	3.6	4.4	20	100	8	30	8	130	J
	MT2500G-UR †	Water-Clear	8		700		20	1.85	2.2	20	100	4	30	4	75	K
	MT2500E-UR †	Water-Clear	8		500		20	1.85	2.2	20	100	4	30	4	75	K
	MT108L-UR	TO-18	10		1.25mW		20	1.8	2.2	20	100	4	50	4	100	L
	MT1250-UR	Water-Clear	26	850	1250		20	1.8	2.4	20	100	4	50	4	125	M
	MT850-UR	Water-Clear	26	450	850		20	1.8	2.4	20	100	4	50	4	125	M
	MT450-UR	Water-Clear	26	250	450		20	1.8	2.4	20	100	4	50	4	125	M
	MT300-CUG	Water-Clear	15	100	240	500	20	2.1	2.8	20	5	4	40	4	120	N
	MT350A-CUG	Water-Clear	30	63	150	320	20	2.1	2.8	20	5	4	40	4	120	P
	MT511 ††	Water-Clear		.5	1.0mW		20	1.75	2.2	20	10	3	50	3	120	Q

All T_{stg} -30° ~ 100°C All T_{opr} -20° ~ 75°C † T_{opr} -20° ~ 80°C †† T_{opr} -20° ~ 85°C ††† Typical wavelength is 700 nm.

Contact factory for the following: 2:1 brightness binning; sorting for luminous intensity, power output, wavelength, etc.
Typical wavelength for UR devices is 660 nm; UG is 565 nm; UY is 585 nm.

All information in this guide is subject to change without prior notice.

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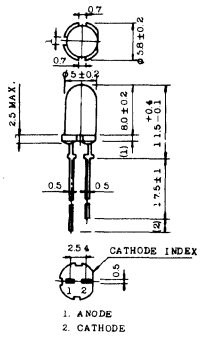
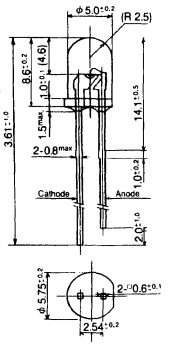
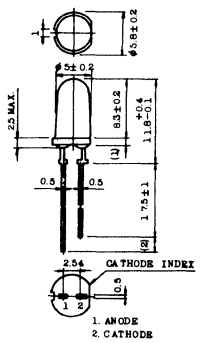
A - T1¾ ROUND



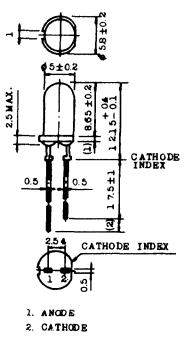
B - T1¾ ROUND



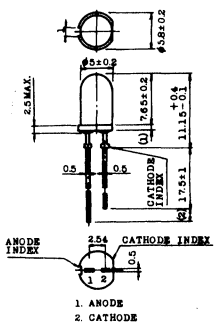
C - T1¾ TAPERED



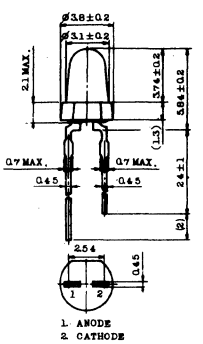
D - T1¾ ROUND



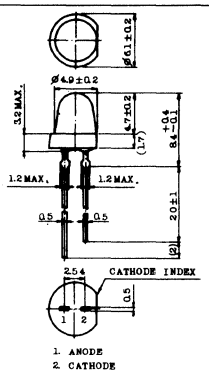
E - T1¾ ROUND



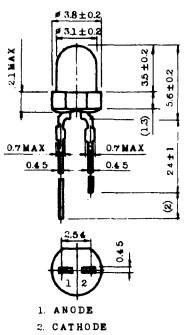
F - T1 TAPERED



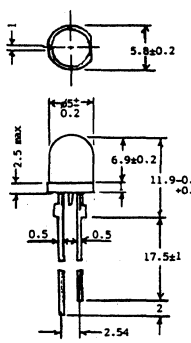
G - T1¾ LOW PROFILE



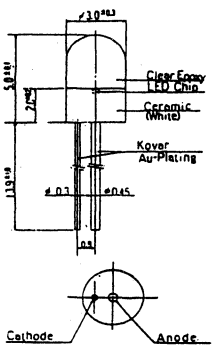
H - T1 ROUND



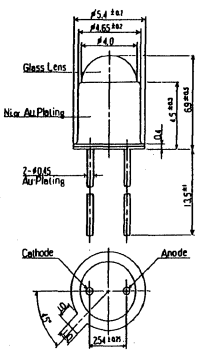
J - T1¾ 2-CHIP ROUND



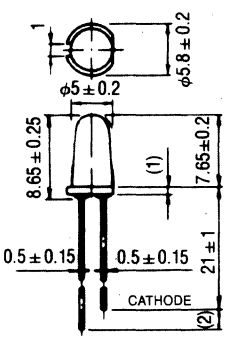
K - 3mm CERAMIC STEM



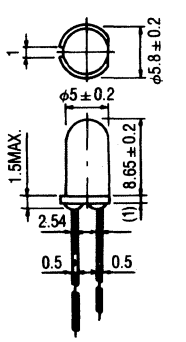
L - TO-18 METAL CAN



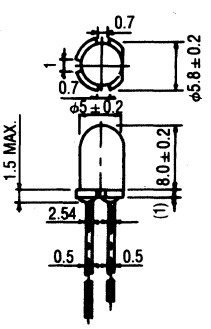
M - T1¾ TAPERED



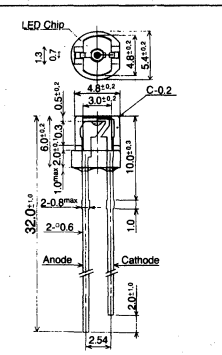
N - T1¾ ROUND



P - T1¾ ROUND



Q - T1¾ FLAT TOP



Straight leads are available on most part types. Consult factory for details.

Specialists in Ultra Optics

marktech international, corp.

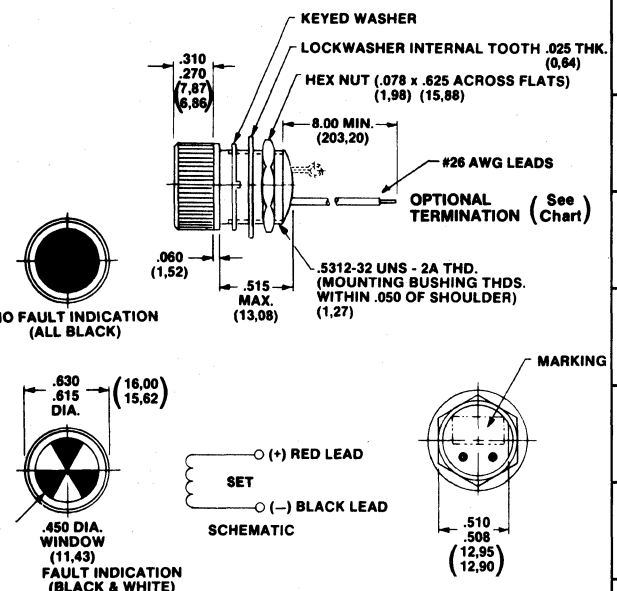
120 Broadway
Menands, NY 12204
(518) 436-5865
FAX (518) 436-5877

MIL-I-83287 (Indicators, Fault Locating) QPL Quick Reference Chart

MINELCO INC. | Talley™ Industries
135 SOUTH MAIN ST. • THOMASTON, CT 06787-0459
Tel: 203-283-8261 • TWX 710-475-1091

NOTE: All QPL families of products shown in this chart are offered with expanded choices of voltage, termination style, display color, or other special configurations. Though such additional models are not part of the QPL listing, all meet the environmental specifications. Send for the complete catalog.

M83287/1
MINELCO MI 61S FAMILY



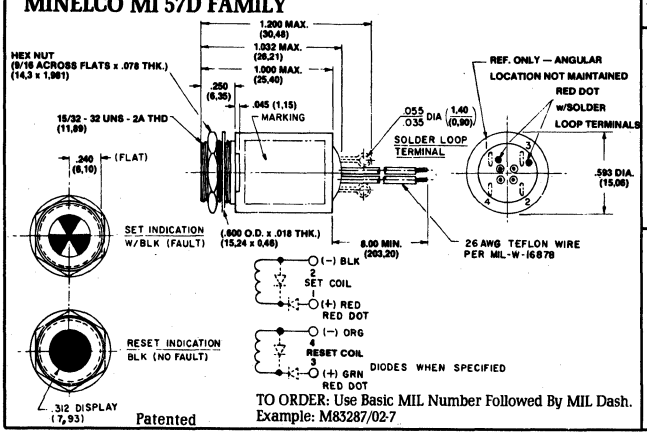
Patented

TO ORDER: Use Basic MIL Number Followed By MIL Dash.
Example: M83287/01-5

MIL DASH NO	NOMINAL VOLTAGE	COIL RESISTANCE OHMS ±10%	LENS COATING NO	LENS COATING YES	TERMINATION WIRE LEADS	TERMINATION LOOP TERM.	MINELCO PART NUMBER
01	3	9	•		•		MI 61S-3-M01
02						•	MI 61S-3-M02
03				•	•		MI 61S-3-M03
04						•	MI 61S-3-M04
05	5	25	•		•		MI 61S-5-M05
06						•	MI 61S-5-M06
07				•	•		MI 61S-5-M07
08						•	MI 61S-5-M08
09	6	37	•		•		MI 61S-6-M09
10						•	MI 61S-6-M10
11				•	•		MI 61S-6-M11
12						•	MI 61S-6-M12
13	12	145	•		•		MI 61S-12-M13
14						•	MI 61S-12-M14
15				•	•		MI 61S-12-M15
16						•	MI 61S-12-M16
17	24	590	•		•		MI 61S-24-M17
18						•	MI 61S-24-M18
19				•	•		MI 61S-24-M19
20						•	MI 61S-24-M20
21	28	800	•		•		MI 61S-28-M21
22						•	MI 61S-28-M22
23				•	•		MI 61S-28-M23
24						•	MI 61S-28-M24
25*	28*	400	•		•		MI 61S-20-M25
26*						•	MI 61S-20-M26
27*				•	•		MI 61S-20-M27
28*						•	MI 61S-20-M28

***NOTE: Devices in this group are designed for use with unregulated power systems per MIL-STD-704.**

M83287/2
MINELCO MI 57D FAMILY



Patented

TO ORDER: Use Basic MIL Number Followed By MIL Dash.
Example: M83287/02-7

MIL DASH NO	NOMINAL VOLTAGE	COIL RESISTANCE OHMS ±10%	LENS COATING NO	LENS COATING YES	TERMINATION WIRE LEADS	TERMINATION LOOP TERM	DIODES NO	DIODES YES	MINELCO PART NUMBER
01	28	800 (per coil)	•		•		•		MI 57D-28-M01
02								•	MI 57D-28-M02
03						•	•		MI 57D-28-M03
04								•	MI 57D-28-M04
05				•	•		•		MI 57D-28-M05
06								•	MI 57D-28-M06
07						•	•		MI 57D-28-M07
08								•	MI 57D-28-M08
09*	28* (See Note Above)	400 (per coil)	•		•		•		MI 57D-20-M09
10*								•	MI 57D-20-M10
11*						•	•		MI 57D-20-M11
12*								•	MI 57D-20-M12
13*				•	•		•		MI 57D-20-M13
14*								•	MI 57D-20-M14
15*						•	•		MI 57D-20-M15
16*								•	MI 57D-20-M16

MIL-I-83287 (Indicators, Fault Locating) QPL Quick Reference Chart

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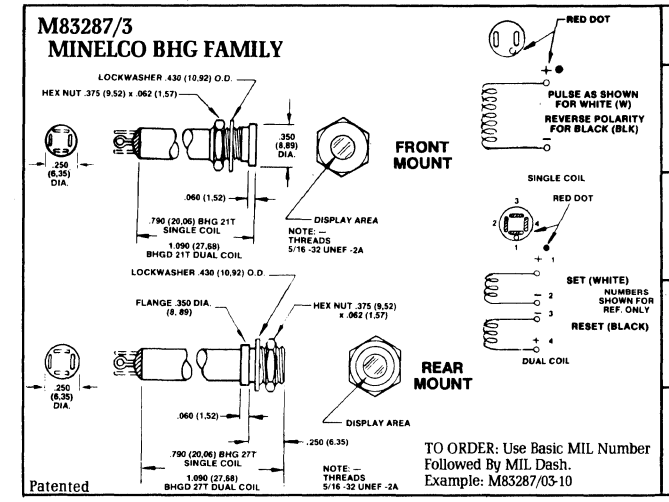
Tel: 203-283-8261 • TWX 710-475-1091

M83287/3 MINELCO BHG FAMILY

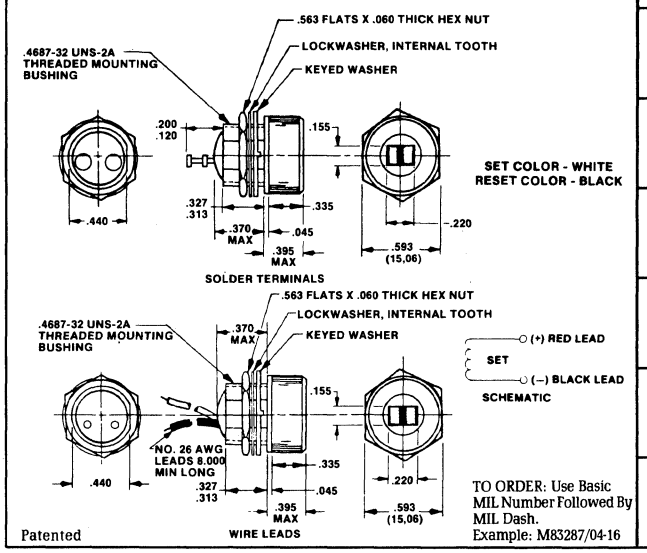


Patented

TO ORDER: Use Basic MIL Number Followed By MIL Dash.
Example: M83287/03-10

MIL DASH NO	NOMINAL VOLTAGE	COIL RESISTANCE OHMS ±10%	MOUNT	COIL CONFIGURATION DUAL	COIL CONFIGURATION SINGLE	MINELCO PART NUMBER
01	3	13.8	FRONT MOUNT	•		BHGD 21T-3-W/BLK
02	6	55				BHGD 21T-6-W/BLK
03	12	220				BHGD 21T-12-W/BLK
04	24	880				BHGD 21T-24-W/BLK
05	28	1200				BHGD 21T-28-W/BLK
06	3	13.8				BHG 21T-3-W/BLK
07	6	55				BHG 21T-6-W/BLK
08	12	220			•	BHG 21T-12-W/BLK
09	24	880				BHG 21T-24-W/BLK
10	28	1200				BHG 21T-28-W/BLK
11	3	13.8	REAR MOUNT	•		BHGD 27T-3-W/BLK
12	6	55				BHGD 27T-6-W/BLK
13	12	220				BHGD 27T-12-W/BLK
14	24	880				BHGD 27T-24-W/BLK
15	28	1200				BHGD 27T-28-W/BLK
16	3	13.8				BHG 27T-3-W/BLK
17	6	55				BHG 27T-6-W/BLK
18	12	220			•	BHG 27T-12-W/BLK
19	24	880				BHG 27T-24-W/BLK
20	28	1200				BHG 27T-28-W/BLK

M83287/4 MINELCO MI 51LP FAMILY

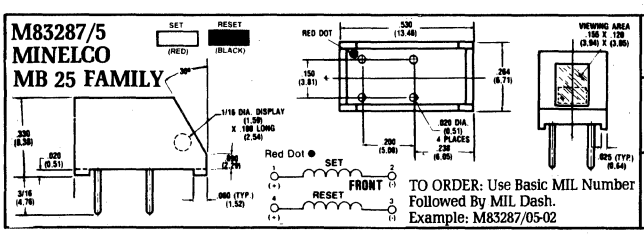


Patented

TO ORDER: Use Basic MIL Number Followed By MIL Dash.
Example: M83287/04-16

MIL DASH NO	NOMINAL VOLTAGE	COIL RESISTANCE OHMS ±10%	LENS COATING NO	LENS COATING YES	TERMINATION WIRE LEADS	TERMINATION SOLDER TERM.	MINELCO PART NUMBER
01	1.5	45	•		•		MI 51LP-1.5-W/BLK
02				•			MI 51LP-1.5-W/BLK-S414
03			•			•	MI 51LP-1.5-W/BLK
04				•			MI 51LP-1.5-W/BLK-S414
05	3	180	•		•		MI 51LP-3-W/BLK
06				•			MI 51LP-3-W/BLK-S414
07			•			•	MI 51LP-3-W/BLK
08				•			MI 51LP-3-W/BLK-S414
09	6	720	•		•		MI 51LP-6-W/BLK
10				•			MI 51LP-6-W/BLK-S414
11			•			•	MI 51LP-6-W/BLK
12				•			MI 51LP-6-W/BLK-S414
13	12	2880	•		•		MI 51LP-12-W/BLK
14				•			MI 51LP-12-W/BLK-S414
15			•			•	MI 51LP-12-W/BLK
16				•			MI 51LP-12-W/BLK-S414
17	24	11,500	•		•		MI 51LP-24-W/BLK
18				•			MI 51LP-24-W/BLK-S414
19			•			•	MI 51LP-24-W/BLK
20				•			MI 51LP-24-W/BLK-S414
21	28	15,700	•		•		MI 51LP-28-W/BLK
22				•			MI 51LP-28-W/BLK-S414
23			•			•	MI 51LP-28-W/BLK
24				•			MI 51LP-28-W/BLK-S414

M83287/5 MINELCO MB 25 FAMILY



TO ORDER: Use Basic MIL Number Followed By MIL Dash.
Example: M83287/05-02

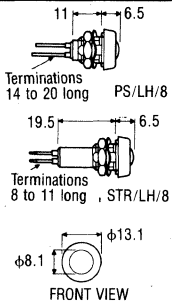
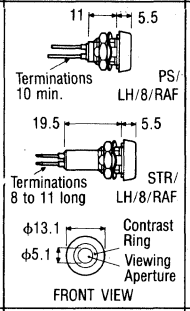
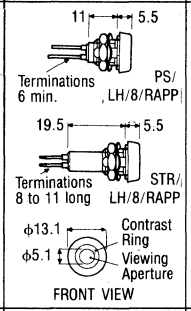
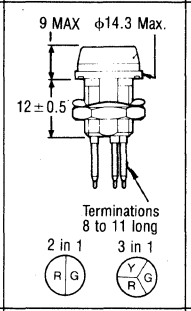
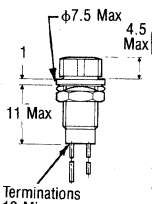
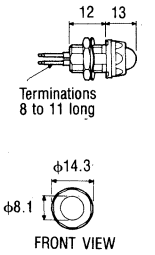
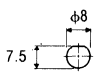
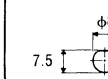
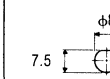
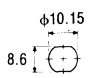
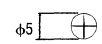
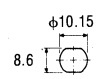
MIL DASH NO	NOMINAL VOLTAGE	COIL RESISTANCE OHMS ±10%	LENS COATING NO	LENS COATING YES	MINELCO PART NUMBER
01	5	140	•		MB 25-5-M01
02				•	MB 25-5-M02
03	12	855	•		MB 25-12-M03
04				•	MB 25-12-M04

OXLEY SEALED MILITARY & PROFESSIONAL LED INDICATOR LAMPS

With Sunlight Viewability, NVG Compatibility, EMC, and Secure Lighting Features

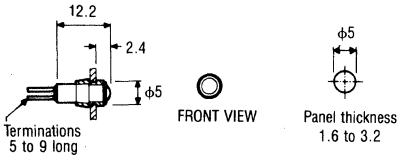
Approved for MILITARY APPLICATIONS to DESC Selected Item Drawings 85122 and 87019

(See Oxley in Product Section B·2440, MIL COMPONENTS, Page B·1013)

Series	Panel, front and rear sealing	STR/LH/8	STR/LH/8/RAF	STR/LH/8/RAPP	2/STR/LH23/10 3/STR/LH23/10	OXL/MIL/50	STR/LH23/10/—
	Panel and front seating	PS/LH/8	PS/LH/8/RAF	PS/LH/8/RAPP			
Outline Dimensions (mm)							
Mounting Details (mm)		 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 3 max.	 Panel thickness 6.5 max.	 Panel thickness 1 to 4	 Panel thickness 6.5 max.
Special Features		Plano-convex lens to provide even illumination over a large area of emission. Special functions available:— Low current (Type—/LC) Flashing (Type—/5/Z) Bi-color (Type 2/—) Integral resistor types for operation from 5, 12, 15, 24 or 28Vd.c. supplies available.	Sunlight viewable up to 100,000 lux. Focused light source for optimum forward viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Sunlight viewable up to 100,000 lux. Pin-point light source for very wide angle viewing. Contrast ring. Optional anti-reflection coating. NVIS/NVG compatible types available.	Multicoloured 2 in 1 and 3 in 1 lamps with segmented display areas. Standard segment colors shown in front views above 2 in 1 lamp has two LED's independently terminated. 3 in 1 has common cathode configuration as standard.	Miniature Lamps, high brightness LEDs (100% screened and burnt-in) in a 7.5 mm diameter aluminum package, similar in construction to the STR/-series lamps, MIL/50 fits a 5mm diameter hole for applications where panel space is limited.	Replacement for obsolescent incandescent types. Integral current limiting resistor and protection diode for operating from 5, 12, 15, 24 or 28 V d.c. supplies. Domed lens fitted as standard to give wide viewing angle.
Electro-magnetic Screening Mesh (Type-/-/-/SES)		Option on STR/LH/8 only	Option on STR/LH/8/RAF only	Option on STR/LH/8/RAPP only	Not Available	Available	Not Available
Standard Features		Rugged construction with sealed glass lenses. Panel sealing to a depth of 20 meters of sea water. High brightness LED's. 100% burnt in to optimize reliability. Black anodized shroud to enhance visual appearance, all metal construction for grounding when panel mounted. Nut mounted. STR/-types have sealed rear terminations. Pigtail terminations available for STR/-types.					

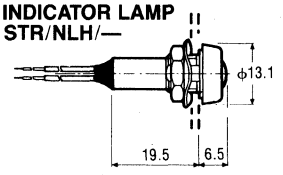
OTHER OXLEY DISPLAY PRODUCTS

MINIATURE LED INDICATOR LAMP, TYPE SSI/5



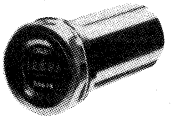
Barb® Cone-Lock self locking mounting technique for rapid assembly. SSI/5 Black anodized body version available for optimum contrast.

HIGH BRIGHTNESS SEALED NEON INDICATOR LAMP TYPE: STR/NLH/—



Similar packaging to above LED types, these lamps incorporate integral resistor for 110 or 240 Vac. This rugged military style panel seal indicator incorporates a glass lens and can, if required, be fitted with an Electro-magnetic screening mesh.

OXLEY SOLID STATE ELAPSED TIME INDICATORS, EVENT COUNTERS AND EQUIPMENT CONDITION MONITORS

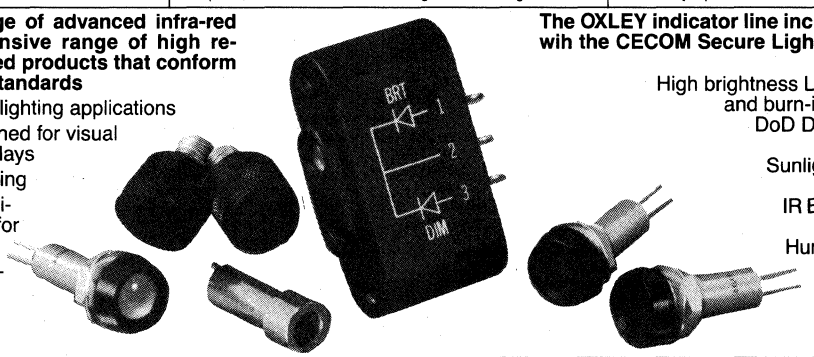


FEATURES:
- Non-Volatile Semiconductor Memory
- Accurate Quartz Crystal Timing
- Military Specifications

Oxley meets the challenge of advanced infra-red technology with an extensive range of high reliability and quality assured products that conform to exacting U.S. military standards

- NVIS compatible cockpit lighting applications
- Color discrimination retained for visual warning and caution displays
- NVG Visible Covert Lighting
- Spectoradiometrically calibrated infra-red emitters for avionic formation lights.
- Custom NVG/NVIS Compatible Lighting

NVIS/NVG COMPATIBLE LIGHTING



The OXLEY indicator line includes parts complying wih the CECOM Secure Lighting Program.

- High brightness LEDs 100% screening and burn-in to MIL-S-19500 US DoD DESC Selected items.
- Sunlight readable displays
- IR Blocking Optical Filters
- Human factor engineered

IR FREE SECURE LIGHTING

IF YOU DON'T SEE WHAT YOU WANT HERE, CALL US.

OXLEY INC., 25 BUSINESS PARK DRIVE, PO BOX 814, BRANFORD, CT 06405
TWX. 910-350-6660 • FAX (203) 481-6971 • TEL. (203) 488-1033

OXLEY

NEI Ferranti-Packard

NEI FERRANTI-PACKARD ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

DISPLAY COMPONENTS

Ferranti-Packard light reflecting electro-magnetic display components offer the user numerous benefits such as...

1. Excellent Visibility Utilizing a range of fluorescent colors in addition to white, the contrast ratio of an F-P display actually improves as the ambient light increases, ensuring excellent visibility both in low ambient light and direct sunlight.

2. High Reliability Virtually maintenance free operation is achieved since there are no lamps to burn out, and no mechanical linkages or bearings to wear.

3. Lower Power Consumption Because of our unique patented technology, no power is required to maintain the display, and only minimal energy is required to change the status of display.

4. Ruggedness Modules and indicators are highly resistant to shock and vibration and are ideally suited to mobile applications or displays in a high vibration environment.

COLORS The displays are available in a range of fluorescent colors including green, yellow, red and orange, in addition to white. For a complete listing of standard and non-standard colors, refer to the individual product data sheet.

CHARACTER SIZE The general rule for selecting the optimum character size is to allow approximately 26mm (1 in.) of character height for every 15m (50 feet) of viewing distance. This will vary slightly depending on the color selected and the ambient light conditions.

STATUS INDICATORS Disk sizes are 7.6mm (0.3 in.) 8.9mm (0.35 in.) and 13mm (0.53 in.) diameter. A 13mm (0.5 in.) square flag is used in the series 50. These devices are current operated and can be driven from source voltages ranging from 3.3 Vdc to 25 Vdc, depending upon the model selected. Indicators are available for panel mounting or direct PCB mounting. Consult the individual data sheets to determine the indicator best suited for your requirements.

Typical applications include: Transient Recorders, Industrial Process Displays, Fault Indicators, Portable Field Equipment, Continuous Matrix Display

PRE-ENCODED MODULES These modules are designed for applications where a limited number of character symbols are required. Standard modules provide the numerals 0 to 9 plus blank. Non-standard modules can be supplied with up to 12 alphanumeric or special characters including blank. Three character heights are available, 70mm (2.7 in.), 104mm (4.1 in.) and 215mm (8.4 in.). Each character is encoded into the winding of the module coils and no external character generation is required. A single current pulse of 1 millisecond duration applied to the selected control wire erases the existing character and displays the desired character. The pulse can be driven from a single capacitor discharge circuit.

Typical applications include: Weigh-Scale Readouts, Industrial Instrumentation Displays, Cash Register Readouts for parking lots and toll booths, Scoreboards, Time/Temperature Displays, Vehicle Destination Signs.

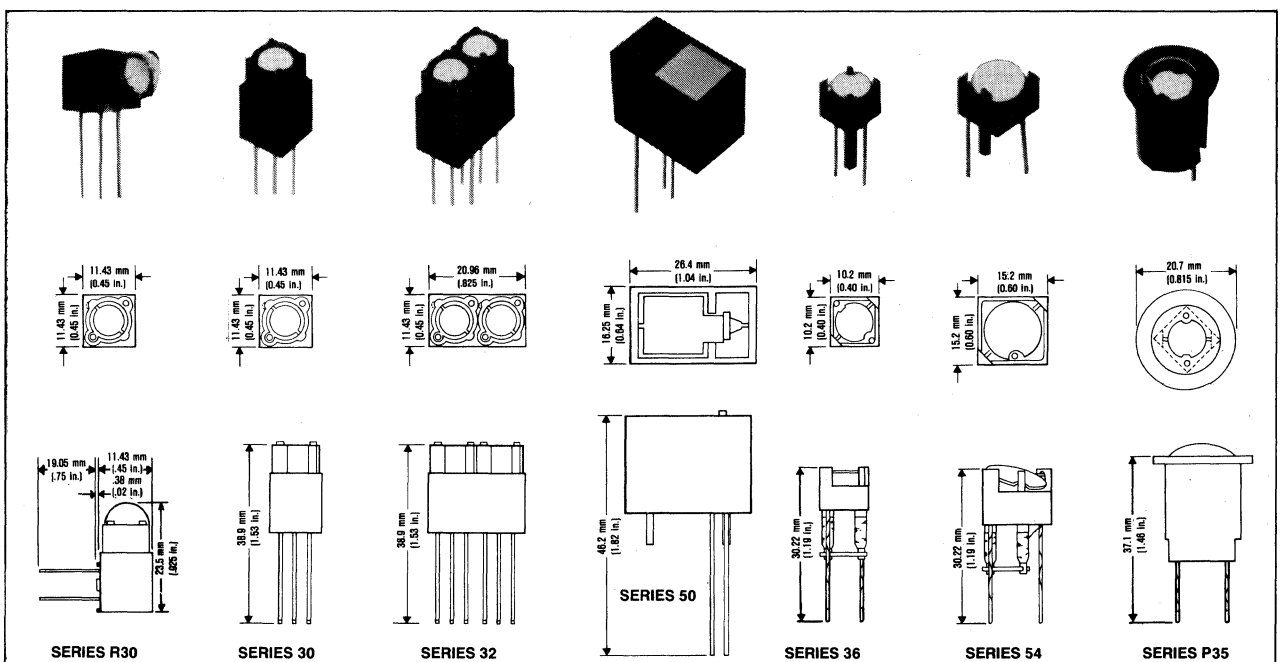
ALPHANUMERIC MODULES These modules offer the user a complete alphanumeric or special character capability. Each module contains 35 light reflecting disks or elements arranged in a 5 x 7 matrix. Five character heights are available — 70mm (2.7 in.), 104mm (4.1 in.), 215mm (8.4 in.), 328mm (12.9 in.) and 452mm (17.8 in.).

Typical applications include: Scoreboard Displays, Advertising Displays, Message Signs, Traffic Control Signs, Industrial Displays, Passenger Information Displays and Vehicle Destination Signs.

7 SEGMENT MODULES The 7 segment module is basically a numeric readout, but it can display a limited number of alpha characters within its 7 segment format. Five character heights are available — 26mm (1.0 in.), 135mm (5.3 in.), 230mm (9.0 in.), 305mm (12.0 in.) and 457mm (18.0 in.).

Typical applications include: Gasoline Pump Displays, Weigh Scale Readouts, Cash Register Readouts, Time/Temperature Displays, Gas Pricing Signs, Speed Limit Signs, Scoreboards, Industrial Displays.

STATUS INDICATORS



Specifications and Operating Parameters

Series	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°C) (Ω)	Minimum Pulse Duration	Minimum Pulse (V) at 20°C	Data Sheet Reference	Disk Dia	Flag Size	Weight
R30 + 30	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.16 oz., 4.5 g
32	– 40 to 92°C	up to 95%	250mA	12Ω ± 10%	1.5 ms	3.3V	372	7.62 mm, 0.30 in.	—	0.28 oz., 8.0 g
50	– 40 to 75°C	up to 95%	53mA	430 ± 10%	1.5 ms	25V	372	—	12.7 mm, 0.50 x 0.50 in.	0.50 oz., 14.2 g
36	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	8.9 mm, .350 in.	—	0.07 oz., 2.0 g
54	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	372	13.46 mm, .53 in.	—	0.11 oz., 3.2 g
P35	– 40 to 75°C	up to 95%	250mA	27 ± 10%	1 ms	10V	372	8.9 mm, .350 in.	—	0.14 oz., 3.9 g

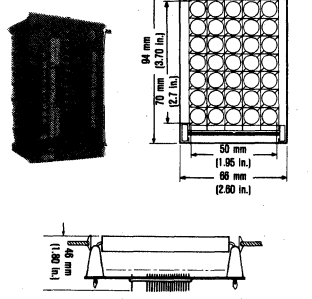
* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

NEI Ferranti-Packard

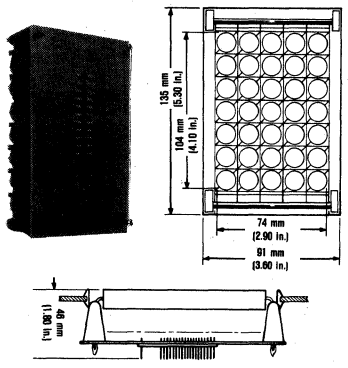
NEI FERRANTI-PACKARD ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

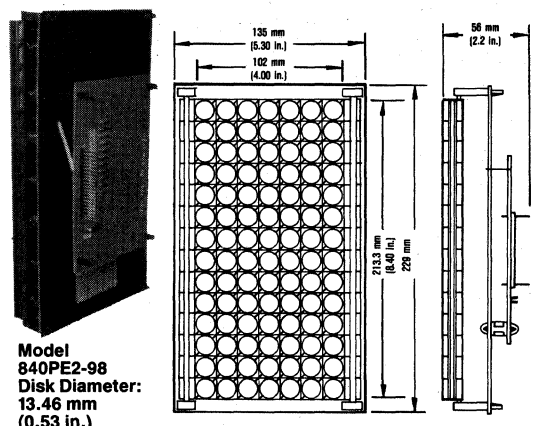
PRE-ENCODED MODULES



Model 270PE2-35
Disk Diameter: 8.9 mm (0.35 in.)
Weight: 142g



Model 410PE2-35
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 227g

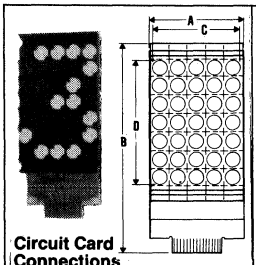


Model 840PE2-98
Disk Diameter: 13.46 mm (0.53 in.)
Weight: 570g

Specifications and Operating Parameters

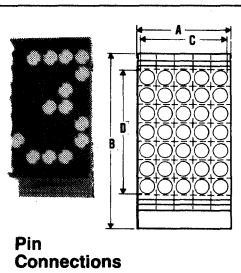
Model Number	Temperature Range	Relative Humidity (non-condensing)	Minimum Pulse Current	Coil Resistance (at 20°V) (Ω)	Minimum Pulse Duration	Minimum Pulse Voltage at	Data Sheet Reference
270PE2-35	– 40 to 75°C	up to 95%	10A	4.3 ± 10%	1 ms	48 V	778
410PE2-35	– 40 to 75°C	up to 95%	12A	5.5 ± 10%	1 ms	72 V	751
840PE2-98	– 40 to 75°C	up to 95%	16A	5.9 ± 10%	1 ms	96 V	759

ALPHANUMERIC MODULES



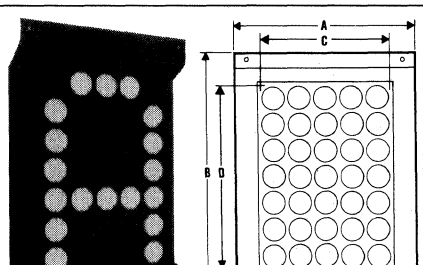
Circuit Card Connections

Model 270XY5-35SC
Model 410XY5-35SC



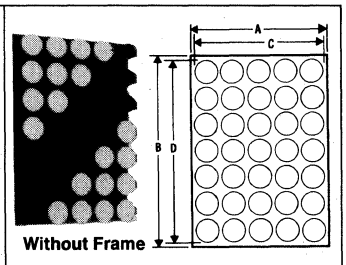
Pin Connections

Model 271XY5-35SC
Model 411XY5-35SC



With Frame

Model 842XY2-35SC
Model 1202XY2-35SC
Model 1802XY2-35SC



Without Frame

Model 840XY2-35SC
Model 1200XY2-35SC
Model 1800XY2-35SC

Specifications and Operating Parameters

Model Number	Temp. Range	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance (at 20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°	A x B	C x D	E	Disk Diameter	Weight (g)	Data Sheet Ref
270XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 x 116 in. 2.03 x 4.57	50 x 70 1.95 x 2.70	28.9 1.14	8.9 0.35	98g	797
410XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 x 167 mm 3.03 x 6.60	74 x 104 2.93 x 4.10	32 1.26	13.46 0.53	139g	797
271XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 52 x 116 in. 2.03 x 4.57	50 x 70 1.95 x 2.70	39.8 1.57	8.9 0.35	98g	797
411XY5-35SC	– 40 to 75°C	up to 95%	350mA	18.2 ± 10%	1 ms	7.5V	mm 77 x 167 in. 3.03 x 6.60	74 x 104 2.93 x 4.10	42 1.69	13.46 0.53	139g	797
842XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 215 x 312 in. 8.45 x 12.5	150 x 213 5.9 x 8.4	74 2.9	24 0.95	992g	586
1202XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 317 x 457 in. 12.5 x 18.0	231 x 328 9.1 x 12.9	81 3.2	38 1.5	1786g	586
1802XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 457 x 660 in. 18.0 x 26.0	320 x 452 12.6 x 17.8	91 3.6	56 2.2	3317g	586
840XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 163 x 221 in. 6.4 x 8.7	150 x 213 5.9 x 8.4	84 3.29	24 0.95	425g	586
1200XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 244 x 335 in. 9.6 x 13.2	231 x 328 9.1 x 12.9	87 3.42	38 1.5	595g	586
1800XY2-35SC	– 40 to 75°C	up to 95%	3.0A	4 ± 10%	1 ms	16V	mm 333 x 457 in. 13.1 x 18.0	320 x 452 12.6 x 17.8	95 3.75	56 2.2	822g	586

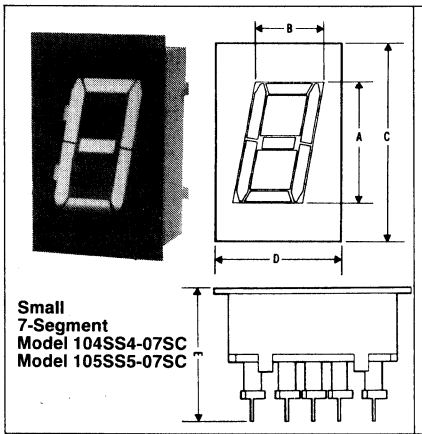
*All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

NEI Ferranti-Packard

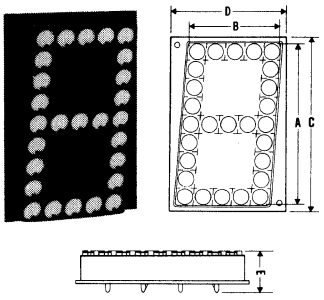
NEI FERRANTI-PACKARD ELECTRONICS

6030 AMBLER DRIVE, MISSISSAUGA, ONTARIO L4W 2P1 CANADA
416/624-3020 TELEX: 06-961437 FAX: 416/625-6197

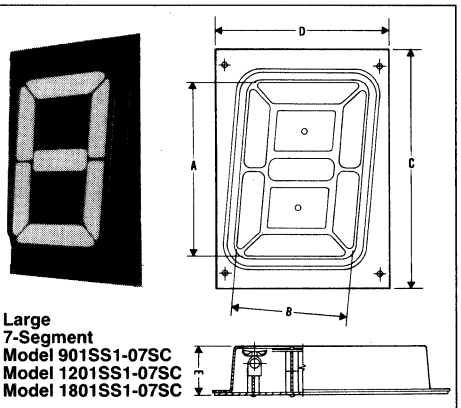
7-SEGMENT MODULES



Small
7-Segment
Model 104SS4-07SC
Model 105SS5-07SC



Disk Matrix
7-Segment
Model 531SS2-07SC



Large
7-Segment
Model 901SS1-07SC
Model 1201SS1-07SC
Model 1801SS1-07SC

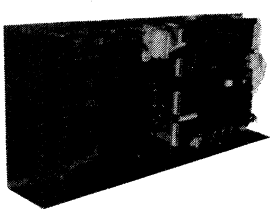
Specifications and Operating Parameters

Model Number	Temp. Range °C	Relative Humidity non-condensing	Min. Pulse Current	Coil Resistance at (20°C) (Ω)	Min. Pulse Duration	Min. Pulse* Voltage at 20°C	A x B	C x D	E	Weight (g)	Data Sheet Reference
104SS4-07SC	–40 to 75	up to 95%	1A	6.8 ± 10%	650μs	12	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	12.3	777
105SS5-07SC	–40 to 75	up to 95%	335 mA	45 ± 10%	1ms	19	mm 25.4 x 14 in. 1.00 x 0.55	42.9 x 27.3 1.69 x 1.075	29 1.123	13.8	777
531SS2-07SC	–40 to 75	up to 95%	1.8A	A, D, G, -60hms B, E -4-50hms C, F -3-60hms	1 ms	See Data Sheet 531	mm 135 x 76.2 in. 5.3 x 3.0	155.7 x 105.4 6.13 x 4.15	33 1.3	150	531
901SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 230 x 152 in. 9.0 x 6.0	312 x 230 12.3 x 9.0	76 3.0	936	200
1201SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 305 x 203 in. 12.0 x 8.0	457 x 318 18.0 x 12.5	76 3.0	1360	200
1801SS1-07SC	–40 to 75	up to 95%	3.0A	8 ± 10%	1ms	32	mm 457 x 305 in. 18.0 x 12.0	660 x 457 26.0 x 18.0	79 3.1	2495	200

(1) All erase coils connected in series.
(2) Individual erase coils. If connected in series the erase voltage must be 26V minimum.

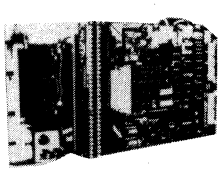
* All products are current operated. Voltages shown are for reference only. Minimum drive voltage must be selected to achieve specified current over the full operating temperature range.

DRIVE UNITS



FP601 CONTROLLER

The Ferranti-Packard Series FP601 Controller is a small, high speed, solid-state device which contains the power supply, logic and drive circuitry required to operate Ferranti-Packard alphanumeric display modules, Model 271XY5-35 and Model 411XY5-35. The suggested mounting is in a protected area preferably within the sign enclosure. Main features include remote driver board capability and various writing directions. (Data Sheet 601.)

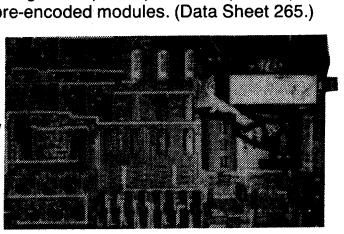


TYPE 1001 CONTROLLER

The 1001 Controller is a versatile, low cost powerful microprocessor based unit for use with displays using Ferranti-Packard large alphanumeric modules: (215mm) 8.4", (328mm) 12.9", and (457mm) 18", alphanumeric modules (70mm) 2.7", (104mm) 4.1", and large seven segment modules: (230mm) 9", (305mm 12", (457mm 18". The main feature of the 1001 Controller is its capability to store and cycle messages. (Data Sheet 1001.)

SERIES 300 DRIVER/DECODER BOARD

The Series 300 driver/decoder boards provide a simple, economical method of driving small display systems comprising either (70mm) 2.7 inch, (104mm) 4.1 inch or (215mm) 8.4 inch type DCP pre-encoded modules. (Data Sheet 265.)



MODEL 700DD DRIVER/ DECODER BOARD
MODEL 701DD DRIVER/ DECODER BOARD

The Model 700DD 7 bar module driver/decoder board provides a simple, economical method of driving small display systems utilizing (230mm) 9 inch, (305mm) 12 inch, (457mm) 18 inch large 7 bar modules. (Data Sheet 700.)

The Model 701DD 7 bar module driver/decoder board drives small display systems utilizing 135mm (5.3 in.) disk matrix segment modules. (Data Sheet 701.)

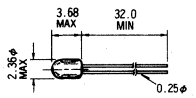
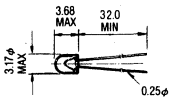
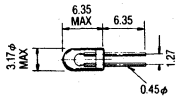
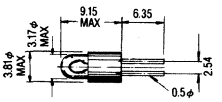
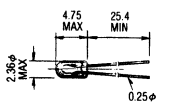
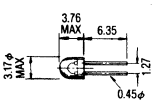
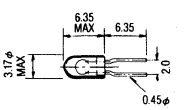
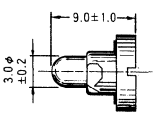
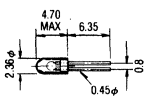
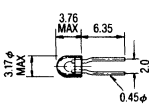
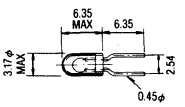
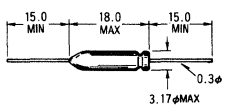
PRINCIPLES OF OPERATION

Alphanumeric Modules/Status Indicators
The basic display element is a magnetic disk. Short pulses of current in the coil assembly set the magnetic field in the stator pins in either one direction or the other. Each disk rotates to line up with the stator field and shows either its black side, or colored side.

Small 7-Segment Modules
The basic display element is a magnetic segment which pivots on its axis. Short pulses of current in the coil under each segment set the magnetic field in the stator pins in either one direction or the other. Attraction or repulsion by a segment's bar magnet, retracts or shows a segment.

OSHINO

WIDE VARIETY SUB-MINIATURE INCANDESCENT LAMPS

T-3/4 Short Wire Terminal	T-1 Short Wire Terminal	T-1 IBP-A	T-1 Bi-Pin, Type-E
			
T-3/4 Wire Terminal	**T-1 Short IBP-A**	**T-1 IBP-G**	**T-1 Neowedge**
			
T-3/4 IBPS	**T-1 Short IBP-G**	**T-1 IBP-E**	**T-1 Axial Leads**
			
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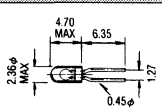	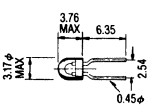	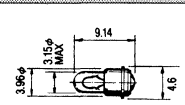	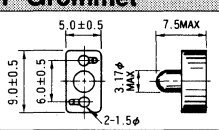
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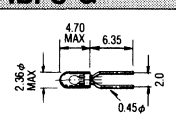	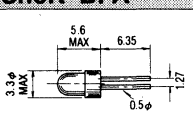	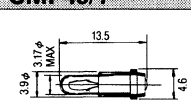	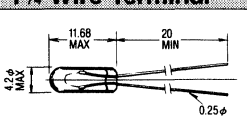
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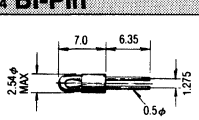	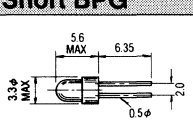	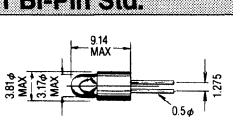	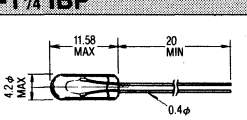
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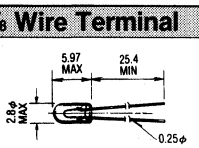
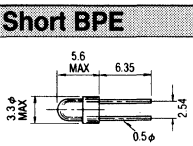
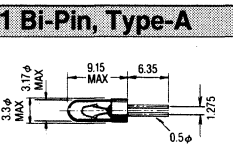
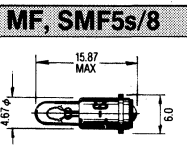
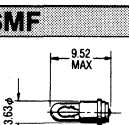
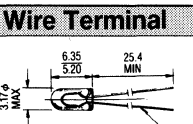
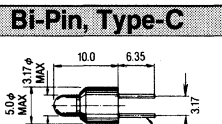
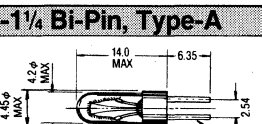
			
T-7/8 SMF	**T-1 Wire Terminal**	**T-1 Bi-Pin, Type-C**	**T-1 1/4 Bi-Pin, Type-A**
			

Unit in mm

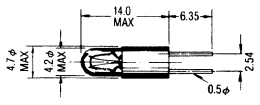
OSHINO ELECTRIC LAMP WORKS, LTD.
2-5-2, Minami-Shinagawa, Shinagawa-ku, Tokyo, 140 Japan.
Tel: 03-471-8548 Telex: 242-2117 Facsimile: 03-450-3939

WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, CA 92708-4272
Tel: (714) 545-5560 Telex: 678459 WAMCO INC. Facsimile: (714) 545-6093

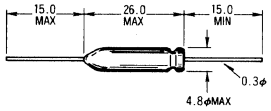
LAMPS

TYPICAL APPLICATIONS AEROSPACE, AUTOMOTIVE TELECOMMUNICATION, etc.

T-1¼ Bi-Pin, Type-E



T-1½ Axial Leads



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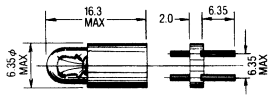
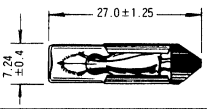


T-2 PSB Slide



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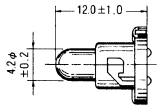
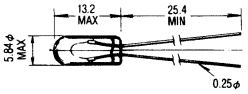


T-1¾ Wire Terminal



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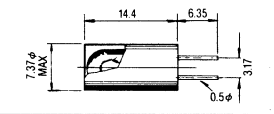

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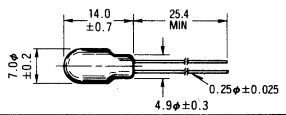
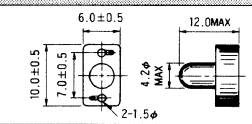
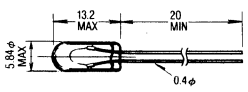


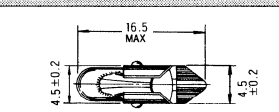
T-1¼ Grommet



T-1¾ IBP



T-4.5 Slide



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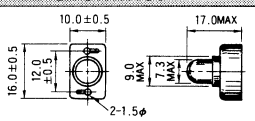
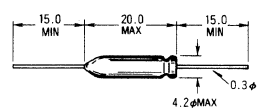
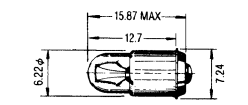


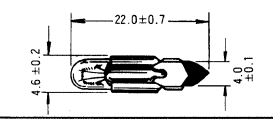
T-1¼ Axial Leads



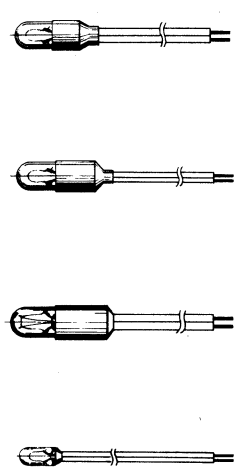
T-1¾ MF, MF6s/8



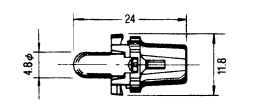
T-4.6 Slide



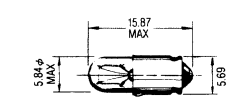
LEAD LAMPS



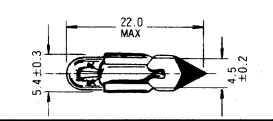
T-1½ PBA



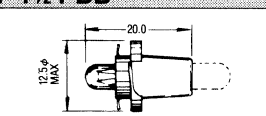
T-1¾ MG, MG5.7s/9



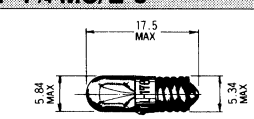
T-5.5K Slide



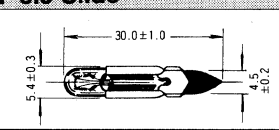
T-1½ PBB



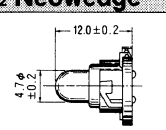
T-1¾ MS/E-5



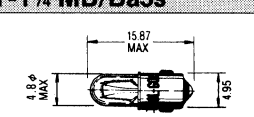
T-5.5 Slide



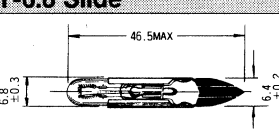
T-1½ Neowedge



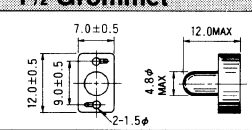
T-1¾ MB/Ba5s



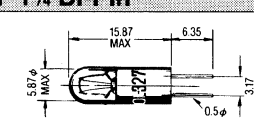
T-6.8 Slide



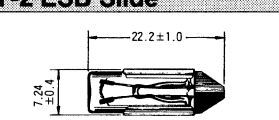
T-1½ Grommet



T-1¾ Bi-Pin



T-2 ESB Slide



Unit in mm

OSHINO ELECTRIC LAMP WORKS, LTD.
2-5-2, Minami-Shinagawa, Shinagawa-ku, Tokyo, 140 Japan.
Tel: 03-471-8548 Telex: 242-2117 Facsimile: 03-450-3939

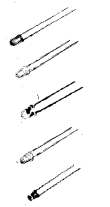
WAMCO, INC.
11555-A Coley River Circle, Fountain Valley, CA 92708-4272
Tel: (714) 545-5560 Telex: 678459 WAMCO INC. Facsimile: (714) 545-6093

SHARP®
Optoelectronics

LED Lamps

φ3 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Green (HL)	Yellow-Green	Yellow-green (HL)	Lemon Yellow	Yellow	Sunset Orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective long	GL3PR8	GL3HD8	GL3PG8	GL3KG8	GL3NG8	GL3EG8	GL3PY8	GL3HY8	GL3HS8
Milky diffusion	Reflective long		GL3HD18		GL3KG18					
Colored trans	Reflective long	GL3PR43	GL3HD43	GL3PG43	GL3KG43	GL3NG43	GL3EG43	GL3PY43	GL3HY43	GL3HS43
Colorless trans	Reflective long	GL3PR44	GL3HD44	GL3PG44	GL3KG44	GL3NG44	GL3EG44	GL3PY44	GL3HY44	GL3HS44
Colored trans	Reflective long	GL3PR47	GL3HD47	GL3PG47	GL3KG47	GL3NG47	GL3EG47	GL3PY47	GL3HY47	GL3HS47

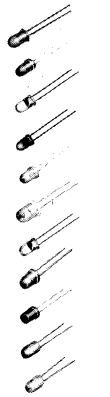


φ4 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective Long	GL4PR8	GL4HD8	GL4PG8	GL4NG8	GL4EG8	GL4HY8	GL4HS8

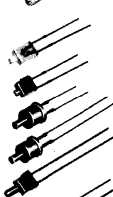
φ5 Cylinder LED Lamps

Lens type	Lead frame	Red		Green	Green (HL)	Yellow-Green	Yellow-green (HL)	Lemon Yellow	Yellow	Sunset Orange
		GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Colored diffusion	Reflective long	GL5PR8	GL5HD8	GL5PG8	GL5KG8	GL5NG8	GL5EG8	GL5PY8	GL5HY8	GL5HS8
Colored trans	Reflective long	GL5PR40	GL5HD40	GL5PG40		GL5NG40	GL5EG40		GL5HY40	GL5HS40
Colored trans	Reflective long	GL5PR41	GL5HD41	GL5PG41	GL5KG41	GL5NG41	GL5EG41	GL5PY41	GL5HY41	GL5HS41
Colored trans	Reflective long	GL5PR42	GL5HD42	GL5PG42	GL5KG42	GL5NG42	GL5EG42	GL5PY42	GL5HY42	GL5HS42
Colorless trans	Reflective long		GL5HD43	GL5PG43		GL5NG43	GL5EG43		GL5HY43	GL5HS43
Colorless trans	Reflective long	GL5PR44	GL5HD44	GL5PG44	GL5KG44	GL5NG44	GL5EG44	GL5PY44	GL5HY44	GL5HS44
Colorless trans	Reflective long	GL5PR45	GL5HD45	GL5PG45	GL5KG45	GL5NG45	GL5EG45	GL5PY45	GL5HY45	GL5HS45
Colorless trans	Reflective long	GL5PR46			GL5KG46					
Colored trans	Reflective long	GL5PR47	GL5HD47	GL5PG47	GL5KG47	GL5NG47	GL5EG47	GL5PY47	GL5HY47	GL5HS47
Colored trans	Reflective long						GL5EG48			
Colorless trans	Reflective long						GL5EG49			



Convex LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
φ1.6	Colored diffusion	Standard	GL2PR7			GL2NG7		GL2HY7	
	Colored diffusion	Standard	GL2PR9			GL2NG9		GL2HY9	
φ2	Colored diffusion	Standard	GL2PR1		GL2PG1	GL2NG1		GL2HY1	
	Colored diffusion	Standard long	GL2PR2						
	Colored diffusion	Reflective long	GL2PR6	GL2HD6	GL2PG6	GL2NG6	GL2EG6	GL2HY6	GL2HS6

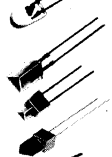


Arch LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
2.5×5.0	Colored diffusion	Reflective long	GL8PR2	GL8HD2	GL8PG2	GL8NG2	GL8EG2	GL8HY2	GL8HS2

Triangle LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Green (HL)	Yellow-green	Yellow-green (HL)	Yellow	Lemon yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaP	GaAsP on GaP
Equilateral triangle (Side: 5.6)	Colored diffusion	Reflective long	GL9PR3		GL9PG3		GL9NG3	GL9EG3	GL9HY3		
Equilateral triangle (Side: 3.0)	Colored diffusion	Reflective long	GL8PR49	GL8HD49	GL8PG49		GL8NG49	GL8EG49	GL8HY49		GL8HS49
Isosceles triangle (Base: 3.0 Height: 4.5)	Colored diffusion	Reflective long	GL8PR28	GL8HD28	GL8PG28	GL8KG28	GL8NG28	GL8EG28	GL8HY28	GL8PY28	GL8HS28



Rectangle LED Lamps

Radiation shape (mm)	Lens type	Lead frame	Red		Green	Green (HL)	Yellow-green	Yellow-green (HL)	Yellow	Lemon yellow	Sunset orange
			GaP	GaAsP on GaP	GaP	GaP	GaP	GaP	GaAsP on GaP	GaP	GaAsP on GaP
1.5×2.8	Colored trans	Reflective standard		GL8HD1	GL8PG1		GL8NG1		GL8HY1		
1.9×3.9	Colored trans	Reflective long	GL8PR5	GL8HD5	GL8PG5		GL8NG5	GL8EG5	GL8HY5		GL8HS5
2.5×5.0	Colored diffusion	Reflective long	GL8PR7	GL8HD7	GL8PG7		GL8NG7	GL8EG7	GL8HY7		GL8HS7
2.5×6.0	Colored diffusion	Reflective long	GL8PR9	GL8HD9			GL8NG9	GL8EG9	GL8HY9		GL8HS9
2.0×5.0	Colored diffusion	Reflective long	GL8PR21	GL8HD21	GL8PG21	GL8KG21	GL8NG21	GL8EG21	GL8HY21	GL8PY21	GL8HS21
	Milky diffusion	Reflective long	GL8PR31		GL8PG31				GL8HY31		
	Colored diffusion	Reflective long	GL8PR26	GL8HD26	GL8PG26		GL8NG26	GL8EG26	GL8HY26		GL8HS26
1.2×5.9	Colored diffusion	Reflective long	GL8PR27	GL8HD27	GL8PG27		GL8NG27	GL8EG27	GL8HY27		GL8HS27
1.5×3.9	Colored diffusion	Standard	GL9PR10	GL9HD10			GL9NG10	GL9EG10	GL9HY10		
1.8×3.9	Colored diffusion	Standard	GL9PR22	GL9HD22			GL9NG22	GL9EG22	GL9HY22		
2.0×4.5	Colored diffusion	Reflective long	GL8PR23	GL8HD23	GL8PG23		GL8NG23	GL8EG23	GL8HY23		GL8HS23
1.0×5.0	Colored diffusion	Reflective long	GL8PR24	GL8HD24	GL8PG24	GL8KG24	GL8NG24	GL8EG24	GL8HY24	GL8PY24	GL8HS24
1.5×4.5	Colored diffusion	Standard	GL9PR25				GL9NG25	GL9EG25	GL9HY25		
2.0×1.5×2pcs	Colored diffusion	Reflective long	GL8PR40	GL8HD40	GL8PG40	GL8KG40	GL8NG40	GL8EG40	GL8HY40		GL8HS40
1.9×1.9×2pcs	Colored diffusion	Reflective standard	GL9PR41				GL9NG41		GL9HY41		
2.0×3.2	Colored trans	Reflective long	GL8PR25	GL8HD25	GL8PG25	GL8KG25	GL8NG25	GL8EG25	GL8HY25	GL8PY25	GL8HS25
	Colored diffusion	Reflective long	GL8PR29								
3.0×3.0	Colored diffusion	Reflective long	GL8PR48	GL8HD48	GL8PG48		GL8NG48	GL8EG48	GL8HY48		GL8HS48
5.0×5.0	Colored diffusion	Reflective long	GL8PR22	GL8HD22	GL8PG22		GL8NG22	GL8EG22	GL8HY22	GL8PY22	GL8HS22

Note:
HL indicates high-luminosity

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SHARP Optoelectronics

Dichromatic LED Lamps/High-luminosity LED Lamps/ Super-luminosity LED Lamps/Mini-mold Lamps

Dichromatic LED Lamps

GL5NP5 SERIES

GL5NP27 SERIES

GL8NP5 SERIES

GL9NP2 SERIES

GL9NP4 SERIES

GL9NP24 SERIES

Note: HL indicates high-luminosity

Appearance	Radiation shape	Lens type	Yellow-green + Red	Yellow-green + Red	Yellow-green (HL) + Red	Yellow-green (HL) + Red	Yellow-green (HL) + Yellow	Yellow + Red	Red + Green
			GaP + GaP	GaP + GaAsP on GaP	GaP + GaAsP on GaP	GaP + GaP	GaP + GaAsP on GaP	GaAsP on GaP + GaP	GaP + GaP
Cylinder	5	Milky diffusion	GL5NP5	GL5ND5	GL5ED5	GL5EP5		GL5HP5	GL5RG5
		Colorless trans.	GL5NP27	GL5ND27	GL5ED27	GL5EP27		GL5HP27	
Rectangle	1.9×3.9	Milky diffusion	GL8NP5	GL8ND5	GL8ED5			GL8HP5	
	2.0×5.0	Milky diffusion	GL9NP2	GL9ND2	GL9ED2		GL9EH2	GL9HP2	
	5.0×5.0	Milky diffusion	GL9NP4	GL9ND4	GL9ED4			GL9HP4	
	1.0×5.0	Milky diffusion	GL9NP24	GL9ND24	GL9ED24			GL9HP24	

Notes: Lead Frame — Reflective long

High-luminosity LED Lamps

Model No.	Radiation shape (mm)	Radiation color	Radiation material	Lens type	Absolute maximum ratings				Electro-optical characteristics				
					I_F (mA)	V_R (V)	P (mW)	Topr (°C)	Iv (mcd) MIN.	Iv (mcd) TYP.	V_F (V) TYP.	V_F (V) MAX.	I_F (mA)
GL3TR8	3(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	30	60	1.75	2.20	20
GL3TR43	3(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	10	20	1.75	2.20	20
GL3TR44	3(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	45	110	1.75	2.20	20
GL3TR47	3(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	2.5	5.0	1.75	2.20	20
GL5TR8	5(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	40	80	1.75	2.20	20
GL5TR43	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	200	500	1.75	2.20	20
GL5TR47	5(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	2	4	1.75	2.20	20
GL3LR8	3(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	70	140	1.75	2.20	20
GL3LR43	3(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	20	40	1.75	2.20	20
GL3LR47	3(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	7	14	1.75	2.20	20
GL5LR8	5(Cylinder)	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	100	200	1.75	2.20	20
GL5LR40	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	600	1200	1.75	2.20	20
GL5LR41	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR42	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	80	160	1.75	2.20	20
GL5LR43	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	600	1200	1.75	2.20	20
GL5LR44	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR47	5(Inverse cone)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	5	12	1.75	2.20	20
GL5LR48	5(Cylinder)	Red	GaA/As on GaAs	Colored trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL5LR49	5(Cylinder)	Red	GaA/As on GaAs	Colorless trans.	50	5	110	−25 ~ +85	170	340	1.75	2.20	20
GL8LR2	Rectangle	Red	GaA/As on GaAs	Colored diffusion	50	5	110	−25 ~ +85	25	50	1.75	2.20	20

Notes: Lead Frame — Reflective long

Super-luminosity LED Lamps

Model No.	Radiation shape (mm)	Radiation color	Radiation material	Lens type	Absolute maximum ratings				Electro-optical characteristics				
					I_F (mA)	V_R (V)	P (mW)	Topr (°C)	Iv (mcd) MIN.	Iv (mcd) TYP.	V_F (V) TYP.	V_F (V) MAX.	I_F (mA)
GL5UR46	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	250	400	1.85	2.50	20
GL5UR2K	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	1400	2000	1.85	2.50	20
GL5UR2K1	5(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	1400	2000	1.85	2.50	20
GL5UR3K	5(Cylinder)	Red	GaA/As on GaA/As	Colored trans.	30	4	75	−25 ~ +85	2400	3000	1.85	2.50	20
GL5UR3K1	5(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	2400	3000	1.85	2.50	20
LT9512U	10(Cylinder)	Red	GaA/As on GaA/As	Colorless trans.	30	4	75	−25 ~ +85	4000	5000	1.85	2.50	20

Notes: Lead Frame — Reflective long

LED Mini-mold Lamps

GL1PR11 SERIES

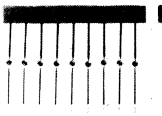
GL1PR21 SERIES

GL1PR111 SERIES

GL1PR112 SERIES

GL1PR211 SERIES

GL1PR212 SERIES



LT1P11A SERIES LT1P21A SERIES

Note: HL indicates high-luminosity

Appearance	Radiation shape (mm)	Lens type	Red		Red (HL)	Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
			GaP	GaAsP on GaP	GaAlAs on GaAs	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
Mini-mold	2	Colored diffusion	GL1PR11	GL1HD11	GL1TR11	GL1PG11	GL1NG11	GL1EG11	GL1HY11	GL1HS11
		Colorless trans.	GL1PR21	GL1HD21	GL1TR21	GL1PG21	GL1NG21	GL1EG21	GL1HY21	GL1HS21
		Colored diffusion	GL1PR111	GL1HD111		GL1PG111	GI1NG111	GL1EG111	GL1HY111	GL1HS111
		Colored diffusion	GL1PR112	GL1HD112		GL1PG112	GL1NG112	GL1EG112	GL1HY112	GL1HS112
		Colorless trans.	GL1PR211	GL1HD211		GL1PG211	GL1NG211	GL1EG211	GL1HY211	GL1HS211
		Colorless trans.	GL1PR212	GL1HD212		GL1PG212	GL1NG212	GL1EG212	GL1HY212	GL1HS212
		Colored diffusion	LT1P11A*	LT1D11A*	LT1T11A*	LT1G11A*	LT1N11A*	LT1E11A*	LT1H11A*	LT1S11A*
		Colorless trans.	LT1P21A*	LT1D21A*	LT1T21A*	LT1G21A*	LT1N21A*	LT1E21A*	LT1HS1A*	LT1S21A*

*Taping type, Tape width: 38mm, Taping: 2,000pcs/tape

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Chip LED Devices/LED Mini Lamps/ Constant Voltage Diodes/ LED Lamps for Light Source/LED Large Lamps

Chip LED Devices

GL1PR51 SERIES

GL1TR52 SERIES

GL1PR53 SERIES

LT1P51A SERIES

Radiation shape (mm)	Lens type	Red		Red (HL)	Green	Yellow-green	Yellow-green (HL)	Yellow	Sunset orange
		GaP	GaAsP on GaP	GaAlAs on GaAs	GaP	GaP	GaP	GaAsP on GaP	GaAsP on GaP
1.5×2.9 ×1.1t	Colored diffusion	GL1PR51	GL1HD51	GL1TR51	GL1PG51	GL1NG51	GL1EG51	GL1HY51	GL1HS51
	Colorless trans.			GL1TR52					
	Milky diffusion	GL1PR53	GL1HD53		GL1PG53	GL1NG53	GL1EG53	GL1HY53	GL1HS53
	Colored diffusion	LT1P51A*	LT1D51A*	LT1T51A*	LT1G51A*	LT1N51A*	LT1E51A*	LT1H51A*	LT1S51A*
	Colorless trans.			LT1T52A*					
	Milky diffusion	LT1P53A*	LT1D53A*		LT1G53A*	LT1N53A*	LT1E53A*	LT1H53A*	LT1S53A*

Chip LED Devices (Dichromatic Radiation Type)

Radiation shape (mm)	Lens type	Yellow-green + Red		Yellow-green (HL) + Red		Yellow-green (HL) + Red (HL)	Yellow + Red	Yellow-green + Yellow
		GaP + GaP	GaP + GaAsP on GaP	GaP + GaAsP on GaP	GaP + GaP	GaP + GaAlAs on GaAs	GaAsP on GaP + GaP	GaP + GaAsP on GaP
1.5×2.9 ×1.1t	Colorless trans.					GL1ET52		
	Milky diffusion	GL1NP53	GL1ND53	GL1ED53	GL1EP53	GL1ET53	GL1HP53	GL1NH53
	Colorless trans.					LT1ET52A*		
	Milky diffusion	LT1NP53A*	LT1ND53A*	LT1ED53A*	LT1EP53A*	LT1ET53A*	LT1HP53A*	LT1NH53A*

*Taping type, Tape width: 8mm, Taping: 3,000pcs/reel

LED Mini Lamps

Specification		Red				Yellow-green		
		GaAsP on GaAs	GaP	Taping type		GaP	Taping type	
General specification			LT8001P	LT8101P*1	LT8201P*2	LT8001N	LT8101N*1	LT8201N*2
Constant voltage diode specification	I_F = 1mA : $V_{F\ MAX.}$ = 1.60V I_F = 10μA : $V_{F\ MIN.}$ = 1.25V	LT8002R*						
	I_F = 1mA : $V_{F\ MAX.}$ = 1.85V I_F = 10μA : $V_{F\ MIN.}$ = 1.55V		LT8002P	LT8102P*1	LT8202P*2	LT8002N	LT8102N*1	LT8202N*2
	I_F = 1mA : $V_{F\ MAX.}$ = 1.90V I_F = 10μA : $V_{F\ MIN.}$ = 1.60V		LT8003P	LT8103P*1	LT8203P*2	LT8003N	LT8103N*1	LT8203N*2

*Non-radiation type *1 Tape width: 64mm *2 Tape width: 38mm Taping: 2,000 pcs/tape

LED Lamps for Light Source

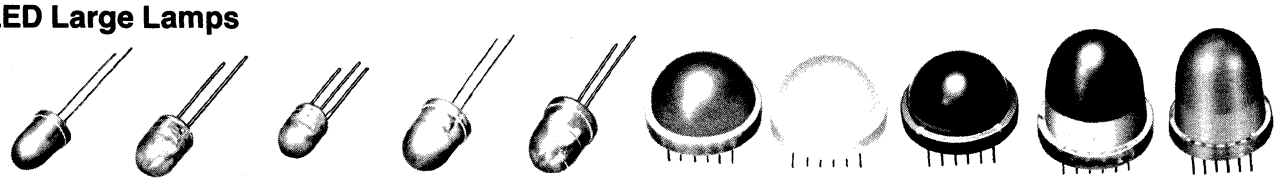
Appearance	Radiation shape (mm)	Lens type	Model No.	Radiation material	Radiation Wavelength
Cylinder	5	Colorless transparency	LT9800D	GaAsP on GaP	635nm
			LT9800E	GaP	565nm
			LT9800H	GaAsP on GaP	585nm
			LT9800L	GaAlAs on GaAs	660nm
			LT9800V		700nm

Constant Voltage Diodes

Specification	GaAsP on GaAs	GaP
I_F = 1mA : $V_{F\ MAX.}$ = 1.60V I_F = 10μA : $V_{F\ MIN.}$ = 1.25V	LT8500R	
I_F = 1mA : $V_{F\ MAX.}$ = 1.76V I_F = 10μA : $V_{F\ MIN.}$ = 1.55V		LT8500P

Note: Non-transmissive type (black resin)

LED Large Lamps


LT9507D SERIES LT9550L SERIES LT9550EL SERIES LT9512D SERIES LT9560L SERIES LT9520D SERIES LT9521D SERIES LT9525D SERIES LT9526D SERIES LT9527U

Radiation shape (mm)	Lens type	Red (HL)			Red	Yellow	Yellow-green (HL)	Yellow-green (HL) + Red (HL)	Yellow-green + Red
		GaAlAs on GaAlAs	GaAlAs on GaAs	GaAlAs on GaAs	GaAsP on GaP	GaAsP on GaP	GaP	GaP + GaAlAs on GaAs	GaP + GaAsP on GaP
φ7.5	Colored diffusion		LT9552U		LT9507D	LT9507H	LT9507E		
	Colorless trans.		LT9550L				LT9550E	LT9550EL	LT9550ED
φ10	Colored diffusion	LT9562U			LT9512D	LT9512H	LT9512E		
	Colorless trans.	LT9512U	LT9560L	LT9560T					
φ20	Colored diffusion				LT9520D	LT9520H	LT9520E		
	Milky diffusion				LT9521D	LT9521H	LT9521E		
	Colored diffusion				LT9525D	LT9525H	LT9525E		
	Colored diffusion				LT9526D	LT9526H	LT9526E		
	Milky diffusion	LT9527U							

Note: HL indicates high-luminosity

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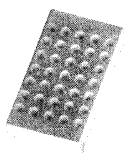
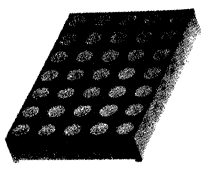
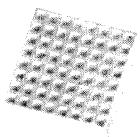
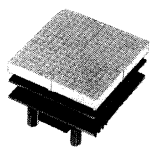
Dot Matrix LEDs/Dot Matrix LED Units

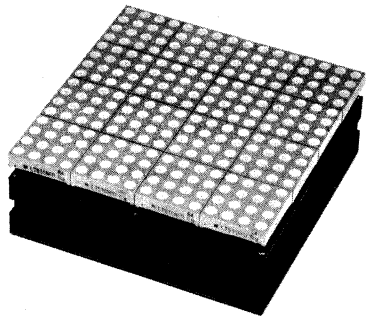

LT5101P series


LT5103D series


LT5105D series

LT5107D series


LT1401E series


LT1421ED

Dot Matrix LEDs

Type	Character height (inch)	Column pins	Red		Yellow-Green	Yellow-Green (HL)	Yellow	Yellow-Green (HL) + Red
			GaP	GaAsP on GaP	GaP	GaP	GaAsP on GaP	GaP + GaAsP on GaP
5 × 7 dot matrix	0.33	Anode Cathode	LT5001P		LT5001N			
			LT5002P		LT5002N			
	1.08		LT5101P	LT5101D		LT5101E		
			LT5102P	LT5102D		LT5102E		
	1.8			LT5103D		LT5103E		
				LT5104D		LT5104E		
8 × 8 dot matrix	1.05			LT5105D		LT5105E	LT5105H	
				LT5106D		LT5106E	LT5106H	
4 × 4 dot matrix	0.9			LT5107D		LT5107E	LT5107H	LT5107ED
				LT5108D		LT5108E	LT5108H	LT5108ED

Dot Matrix LED Units

Type	Construct of Dots	Dot Pitch (mm)	Size (mm)	Color	Power Supply	Duty Cycle
LT1401D	16 × 16	3.8	60 × 60	Red	5V 1.6A	1/8
LT1401S	16 × 16	3.8	60 × 60	Sunset Orange	5V 1.6A	1/8
LT1401E	16 × 16	3.8	60 × 60	Green	5V 1.6A	1/8
LT1421ED	16 × 16	7.5	120 × 120	Green-Red	5V 3.2A	1/16
LT1460ED*	16 × 16	4	64 × 64	Green-Red	5V	1/16
LT1450ED*	16 × 16	6	96 × 96	Green-Red	5V	1/16
LT1441M	16 × 16	10	160 × 160	Green-Red	± 5V 6.4A	Static

*Soon Available

For Infrared LED's, please refer to Section 4800, page A•2142.

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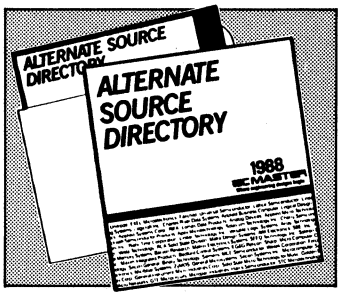

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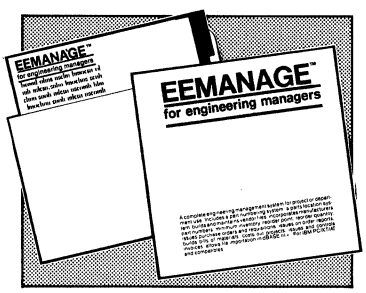

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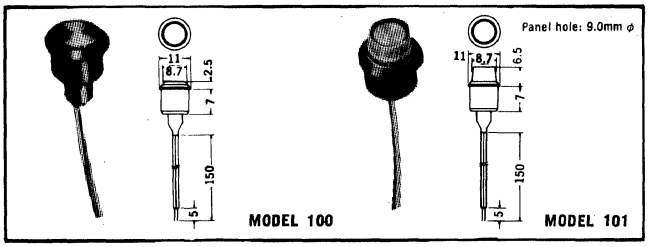
MODELS 100/101 — MODULAR INDICATORS

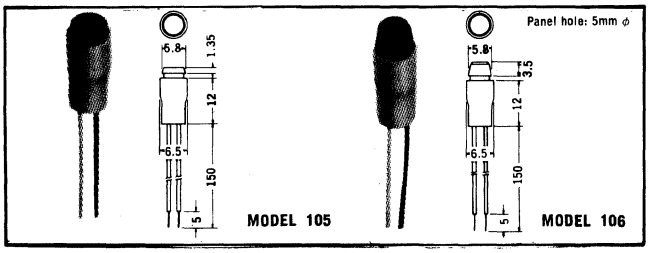


Modular concept provides low cost and great versatility. Rubber bushing snaps into 9mm panel cut out. Lens then snaps into bushing from front while light source fits in from behind. Ordering example: F606-101-R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	F606	5-6.3V	50		
Incandescent	F614	12-14V	80	100-R Red	101-R Red
Incandescent	F628	24-48V	40	100-A Amber	101-A Amber
Neon	N5115	100-120V AC	1.5	100-G Green	101-G Gren
Green Glow	G5115	100-120V AC	1.5	100-B Blue	101-B Blue
Red LED	L-617RL	2.0 Typ	10	100-W White	101-W White
Green LED	L-617GL	1.9 Typ	10	100-C Clear	101-C Clear
Yellow LED	L-617YL	1.9 Typ	10		

MODELS 105/106 — MODULAR INDICATORS

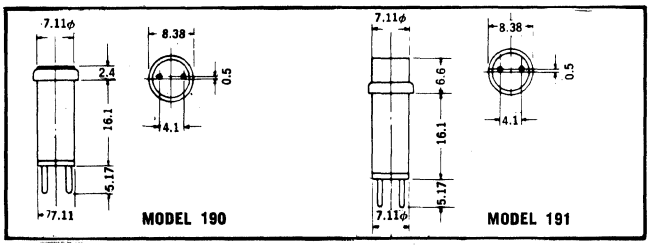


Miniature modular concept requires only 5mm panel hole. They are installed by pressing the lens through the panel from the front into the rubber bushing containing the lamp on the back. Ordering example: F305-105-R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	F305	4-6V	60		
Incandescent	F314	12-14V	40	105-R Red	106-R Red
Incandescent	F328	24-28V	24	105-A Amber	106-A Amber
Neon	N3115	100-120V AC	1.0	105-G Green	106-G Green
Red LED	L-317RL	2.0 Typ	10	105-B Blue	106-B Blue
Green LED	L-317GL	1.9 Typ	10	105-W White	106-W White
Yellow LED	L-317YL	1.9 Typ	10		

MODELS 190/191 — CARTRIDGE LAMPS

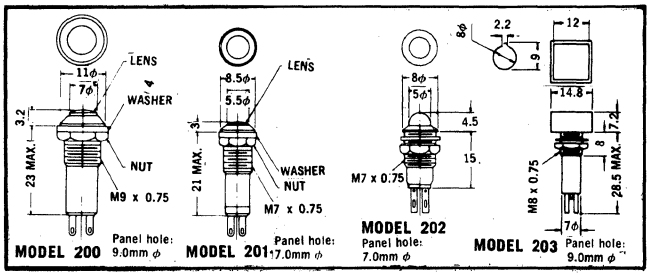


Cartridge style lamps are available in both flush and top hat type lens. Can be used in place of similar types from other manufacturers. Cartridge Lamp holders are also available as CLH-B (black) or CLH-S (silver).

SPECIFICATIONS — LIGHT SOURCE — LENSES

Light Source	Type	Voltage	mA	Flush Lens	Top Hat Lens
Incandescent	CLF06	5-7V	200		
Incandescent	CLF14	12-14V	80	190-R Red	191-R Red
Incandescent	CLF28	24-28V	40	190-Y Yellow	191-Y Yellow
Neon	CLN115	110-120	1.5	190-G Green	191-G Green
Green Glow	CLG	110-120	1.5	190-B Blue	191-B Blue
Red LED	CLLR	2.0	10	190-W White	191-W White
Green LED	CLLG	1.9	10	190-C Clear	191-C Clear
Yellow LED	CLLY	1.9	10		

MODELS 200 to 203 — INCANDESCENT INDICATORS

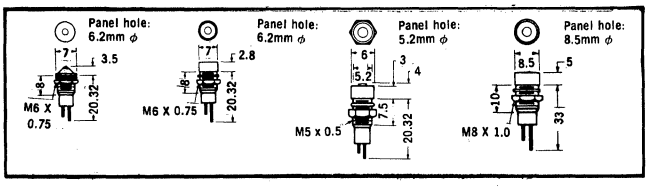


Model 200 is rugged chrome plated brass with long life T1¾ lamp. Model 201 is smaller version of 200 above. Model 202 is chrome plated brass with removable lens for lamp replacement. Model 203 is designed to accommodate custom legends and is front relampable.

SPECIFICATIONS — LIGHT SOURCE — LENSES

Series	Type	Voltage	mA	Lens
200	FA06	5-7	50	R — Red
	FA14	12-14	30	
201	FB06	5-7	50	Y — Yellow
	FB14	12-14	30	
202	FK05	4-6	60	G — Green
	FK14	12-14	40	
	FK28	24-28	24	B — Blue
203	FJ06	5-7	200	
	FJ14	12-14	80	W — White
	FJ28	24-28	40	

MODELS 406 to 409 — SOLID STATE INDICATORS

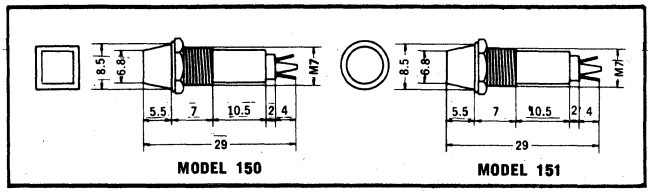


All of chrome plated brass except 409 is black anodized only, with low current LED lamp. Ordering example: LED-406R

SPECIFICATIONS — LIGHT SOURCE — LENSES

Type	Color (All)	Volts (All)	MA (All)	MCD
LED-406	R — Red	2.0	1.0	1.2
LED-407	G — Green			
LED-440	Y — Yellow			
LED-409				

MODELS 150/151 — UNIVERSAL INDICATORS



Attractive, low cost plastic assembly, mounts in 7mm hole with nut and washer supplied. Square or round in a variety of light sources and colors. Ordering example: F151-12R

HOW TO ORDER: XX - 15X - XXX

LIGHT SOURCE	SHAPE	VOLTS	COLOR
F — Incandescent	0 — Square	06 — 6 Volts	A — Amber
L — LED	1 — Round	12 — 12 Volts	G — Green
NR — Neon, w/resistor		24 — 24 Volts	R — Red
		10 — 110 Volts	C — Clear
		20 — 220 Volts	B — Blue
			Y — Yellow

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- *Xenon flash tubes*
- *Bulbs*
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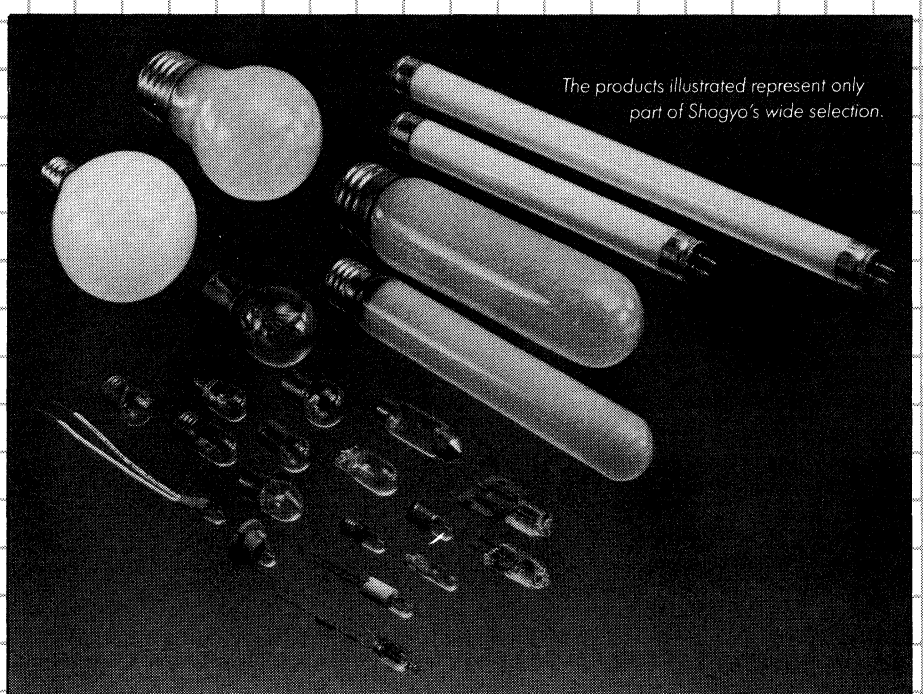
- *Bases*

And featuring:
- *A comprehensive variety of styles, sizes, shapes, volts, amps, watts, filament shapes, and terminals (wire, bi-pin, flanged, wedge, knerled, midget grooved, bayonet and slide base).*



The products illustrated represent only part of Shogyo's wide selection.

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You need a solution!
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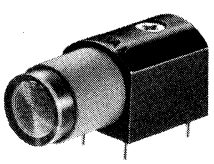
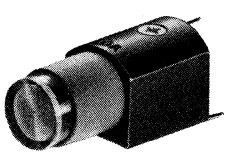
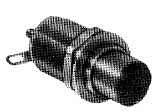
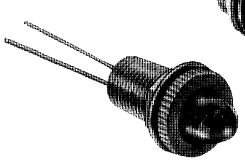




For the last 30 years The Sloan Company has been providing the finest indicator lights available.

For military applications, it's important to know that all of our material and processes meet or exceed military specs.





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Oiltight?

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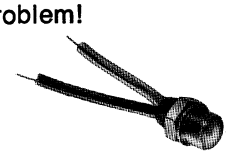
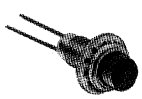


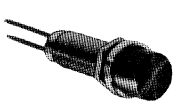


Maybe you have a high voltage circuit in a Radio Frequency sensitive environment. We handle that in every shape and size.

In the event that you don't see what you are looking for here, call us, you will find our staff most obliging. You will be pleasantly surprised to find how few you may have to order and how fast you can get them.

Free samples and prototypes available.

We will be glad for the opportunity to help you to find or develop the product you envisioned.



The Sloan Company

P.O. Box #367, 7704 San Fernando Road, Sun Valley, CA 91353
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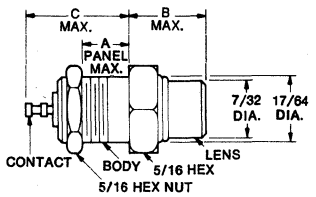
PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

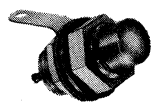
MODEL 102S

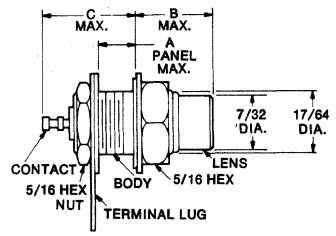


Utilizes the T-1 flanged-based incandescent lamp or LED. An internal silicone rubber pressure pad maintains electrical contact with the lamp and is an effective front-to-back of panel moisture seal.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Delrin per LP-392
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
HDWE—Brass SAE 72 Nickel Plate QQ-N-290 Phenolic per MIL-P-15035 Nylon MIL-M-20693

MODEL 102SI



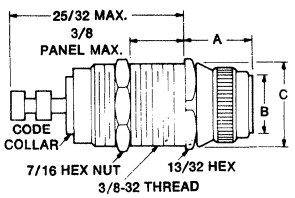


This is the two-terminal version of the basic 102S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

NOTE 1—Both the 102S and the 102SI are available in four body styles: S-(above) provides a bright hex flange on the panel, SK-is a knurled flange, SS-a short low-profile hex, and SR-(above left) a small, plain flange.
NOTE 2—The 102S and 102SI are available in several lens styles: Q, QB, DSC, DS, STD. (Contact Factory)
NOTE 3—The 102 series can be furnished in a waterproof version, and can be RF shielded. (Contact Factory)

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

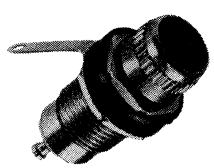
MODEL 855S

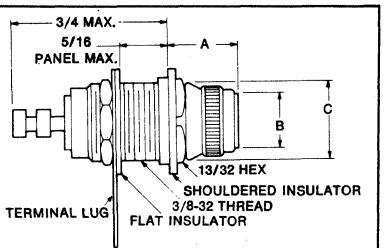


Among the features of the 855 Series are • Small Mounting Size • Front Relamping • Interchangeable Lens Assemblies. Contact pressure is maintained by a silicone rubber pressure pad which seals out moisture front to back of panel. Uses T-1¾ Flanged Base lamp, incandescent or LED.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Butyrate LP-349 Lexan LP-393 Nylon MIL-M-20693 Aluminum 2040-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727
CODE COLLAR—Nylon MIL-M-20693
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Linen Base Phenolic MIL-P-15035

MODEL 855SI





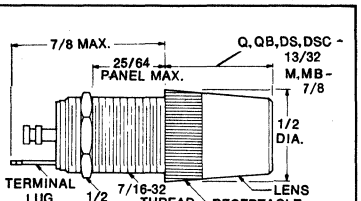
The 855SI Model is the two-terminal version of the 855S Model. It is created by the addition of special insulating hardware (above) which includes a solder lug as the second terminal.

NOTE: Available in Lens styles—Q, QB, DSC, DS, STD, M, MB, D, SE, DDS, U and I, see last page.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693
LENS—Lexan LP-393 Butyrate LP-349 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FRONT RELAMP INCANDESCENT OR LED

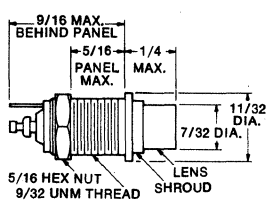
MODEL 856



A two-terminal, front-relampable indicator light designed to use the T-1¾ midget flange based incandescent bulb or LED. An internal silicone-rubber pressure-pad maintains electrical contact inside the lamp body. It also provides an effective moisture seal front to back.
NOTE: Available in lenses styles: Q, QB, DSC, DS, M and MB.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 Nylon MIL-M-20693 Delrin per LP-329
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

MODELS—121, 122—123, 124



The 121 Model lamp holder is a two terminal, front relampable indicator light specifically designed for use with T-1 Midget Flange Based incandescent or LED lamps. The 122 is a waterproof version of the 121. The Model 123 is the same but with the more conventional #6-32 screw body. The 124 is the waterproof version of the 123. Available in lens styles: STB, STC, DS, DSC, QB, Q.

MATERIAL & PROCESSES
BODY—Alum. 2024 Anodize MIL-A-8625 Nylon MIL-M-20693 Delrin per LP-392
LENS—Lexan LP-393 Alum. 2024 Brass SAE 72 Anodize per MIL-A-8625 Nickel Plate QQ-N-290
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727

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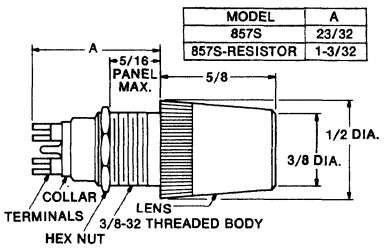
PANEL MOUNT FIXED LAMP

MODEL 857

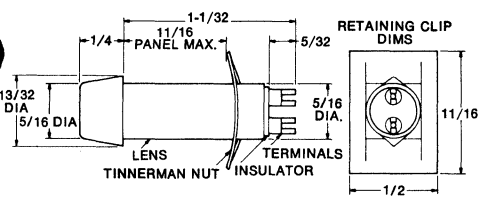


A sub-miniature fixed neon, offering optimum light dispersion and direction. Uses, Hi-Brightness or other NE-2 Series unbased bulb with or without resistors. Mounted in a ⅜ dia. hole with resistor, the Model 857 can be used directly on commercial line currents (115 VAC).

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290 General Purpose Phenolic
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate per MIL-T-10727
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 858



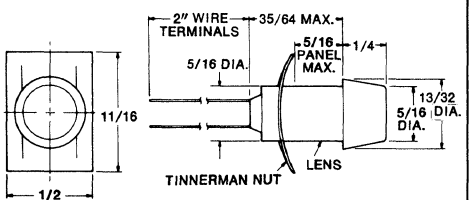
Uses the T-2 unbased neon lamp or can be supplied with the T-1 or T-1¾ unbased incandescent lamp. It accommodates long neon lamps (C2A Type) without dropping resistor built-in, as well as short neon lamps (A1C Type) with dropping resistor built-in. When resistor is built-in it can be used directly on commercial line current (115 volts A.C.). For LED applications see note below.

FOR LED APPLICATIONS LED can be supplied as a special in red, green and amber with or without built-in resistor. Voltage up to 28 volts available. (Contact factory).

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish
INSULATOR—General Purpose Phenolic

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 859

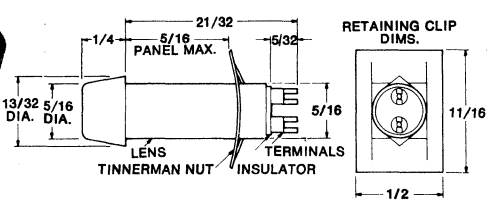


Uses the T-2 unbased neon lamp and long neon lamps without dropping resistor or with dropping resistor. It can also accommodate short neon lamps (A1C type) with or without resistor. With resistor the 859 Series can be used directly with commercial current (115 volts A.C.). Incandescent unbased lamps (T-1 or T-1¾) can also be furnished.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
NEON OR INCANDESCENT

MODEL 862

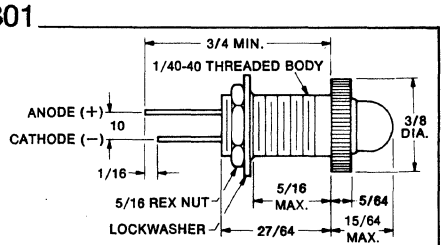


The 862 series accommodates short (A1C) neon lamps only with no resistor built in. Useful where space is limited behind the panel and offers wire wrap™ terminals for soldering.

MATERIAL & PROCESSES
LENS—Butyrate LP-349
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
INSULATOR—General Purpose Phenolic
TINNERMAN NUT—Carbon Steel Phosphate Oil Finish

PANEL MOUNT FIXED LAMP
LED

MODEL 1L301

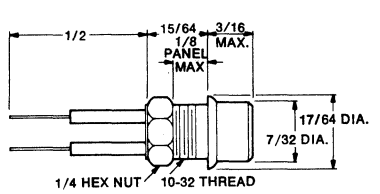


Designed for applications requiring LED indication without a lens. The 1L301 Model provides high brightness in the smallest threaded metal body available in the industry. Termination is by wire leads. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
HDWE—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—.02 Sq. Solid Cu. Tin plated for solderability

PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 105S/1L5S



Featuring a T-1 unbased commercial or MIL-Spec. lamp. Standard unit has two ½" long leads. Longer leads furnished upon request. RFI shielding and waterproofed version available. The 1L5S is the LED indicator model.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625
HDWE.—Brass SAE 72 Nickel Plate QQ-N-290
TERMINALS—32 AWG Solid Cu.

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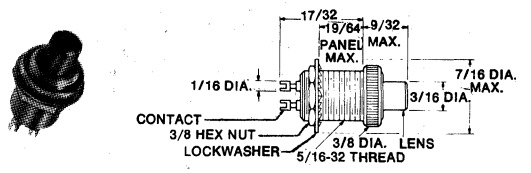
PANEL MOUNT FIXED LAMP
INCANDESCENT/LED

MODEL 106S/1L6



Specifically designed for use with T-1 unbased MIL-Spec., commercial incandescent or LED light source. Can be installed from front or rear of panel.

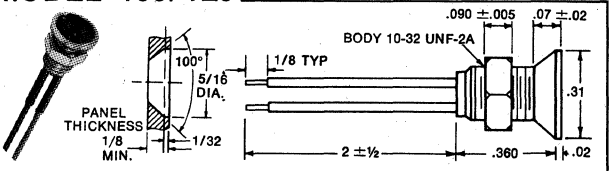
The light source in Model 1L6 is a special high bright T-1¾ LED protruding from a metal body. No lens is provided. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC.

NOTE: The 1L6 is available in red only.

MATERIAL & PROCESSES
BODY/HEX NUT/RD NUT—Brass SAE 72 Nickel Plated QQ-N-290
TERMINALS—Brass SAE 72 Tin Plate MIL-T-10727
LENS—Lexan LP-393 Nylon MIL-M-20693

T-1 UNBASED INCANDESCENT/LED PANEL MOUNT FIXED LAMP

MODEL 109/1L9



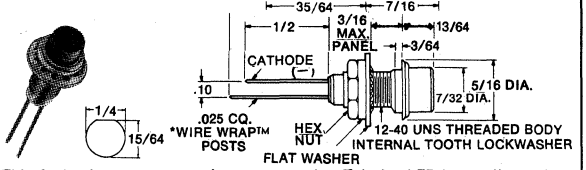
The new flush mount design can be used only with any T-1 size LED or incandescent lamp, including the new super bright LED which gives luminous intensity and color never before possible in the T-1 size. LED colors include red, green and amber with red, green amber, clear and white transparent and translucent lens, and are available with or without a resistor and RFI shielding.

The incandescent models offer the brightness and variety of incandescent colors, including red, green, amber, blue, white and clear with either transparent or translucent lens, and the option of RFI shielding.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate QQ-N-290
LENS—Lexan LP-393
TERMINALS—26 AWG Stranded Cu. MIL-W-16878 24 AWG Solid Cu. **MIL-W-16878**
HARDWARE—Brass SAE 72 Nickel Plate QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L501



This Series incorporate a red, green or amber T-1 size LED in an all-metal threaded body. Available with wire leads or wire wrap™ terminals. Two kinds of color contrast lenses are provided. When unlit, the white or clear lens material alone is visible. When lit, the color LED shows through plainly, giving the appearance of a lens which changes color.

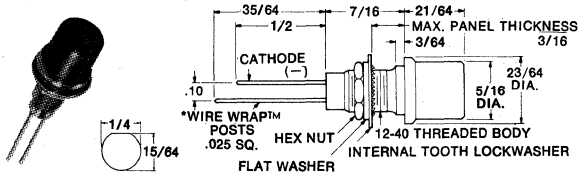
Built-in dropping resistors allow these units to be powered from sources up to 14VDC.

Available with either a round body or flat sided "D" body for consistent terminal location and ease of tightening. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693
TERMINALS—Phosphor Bronze ¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED

MODEL 2L601

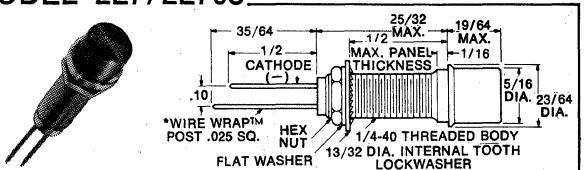


The 2L601 Model incorporates a red, green or amber T-1¾ size Hi-Bright LED in an all-metal threaded body, suitable for panel mounting. Large lens permits 180° visibility, up to 50 mcd. Termination is by wire-wrap™ posts, or wire leads. Lenses available in transparent material for head-on viewing or translucent material for side viewing. Built-in dropping resistors allow these units to be powered from sources up to 14 VDC. Bodies come round or in flat sided "D" for ease of tightening and consistent terminal location. *Gardener—Denver

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290
LENS—Nylon per MIL-M-20693 or Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
HI-BRIGHT LED

MODEL 2L7/2L703

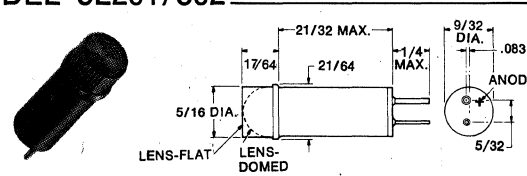


Utilizes a T-1¾ Hi-Bright LED. Permits 180° visibility, up to 50 mcd. The lens incorporates Fresnel rings and flutes which allow maximum distribution of light output. Also available with plain lens (no flutes or rings). Termination is by wire leads or wire-wrap™ post. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. 2L703 is waterproof version bodies can be round or "D" type.

MATERIAL & PROCESSES
BODY—Brass SAE 72 Nickel Plate per QQ-N-290 Nylon per MIL-M-20693
LENS—Lexan per LP-393
TERMINALS—Phosphor Bronze—¾ Hard Tin Plate per MIL-T-10727
Wire per MIL-W-16878 24 AWG Solid Cu. 26 AWG Stranded Cu.
HDWE.—Brass SAE 72 Spring Steel per MIL-W-6986 Nickel Plate per QQ-N-290

PANEL MOUNT FIXED LAMP
LED/INCANDESCENT/NEON

MODEL 5L201/502



These rugged aluminum cartridges incorporate LED, incandescent or neon light sources. Termination is by stainless steel pins suitable for use with a solder lug socket connector, wire wrap™ post adapter or lead wire terminal connector. *Gardener—Denver

Lens styles are flat or domed in transparent or translucent material. All lenses are furnished with fresnel rings for maximum distribution of light output.

MATERIAL & PROCESSES
BODY—Aluminum 3003 Anodize MIL-A-8625
LENS—Butyrate LP-349 Lexan LP-393
TERMINALS—Stainless Steel
HDWE.—General Purpose Phenolic Brass SAE 72 H.T. Spring Steel (Not shown).

The Sloan Company

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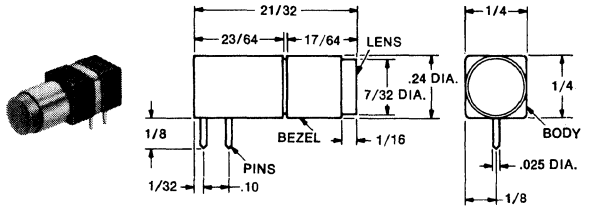
CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

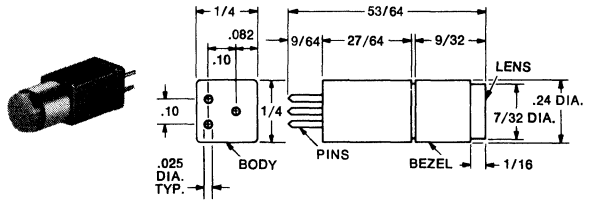
MODEL 101
PARALLEL MOUNT



Designed specifically for printed circuit board mounting. Uses any T-1 flange based lamp.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

MODEL 111
PERPENDICULAR MOUNT

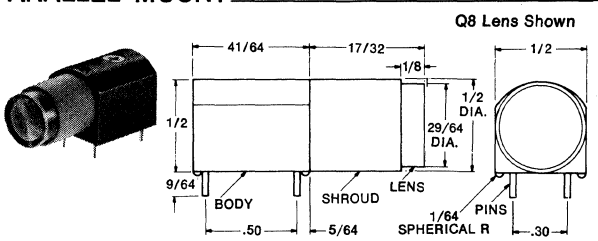


Same features as 101 Model but unit mounts perpendicular to surface of printed circuit board.

MATERIAL & PROCESSES
BODY—General Purpose Phenolic Nylon MIL-M-20693
LENS—Lexan LP-393 Nylon MIL-M-20693 Aluminum 2024-T4 Anodize MIL-A-8625 Brass SAE 72 Nickel Plate per QQ-N-290
TERMINAL PINS—Brass SAE 72 Tin Plate MIL-T-20727 Berylium Copper

CIRCUIT BOARD MOUNT FRONT RELAMP INCANDESCENT OR LED

MODEL 864
PARALLEL MOUNT

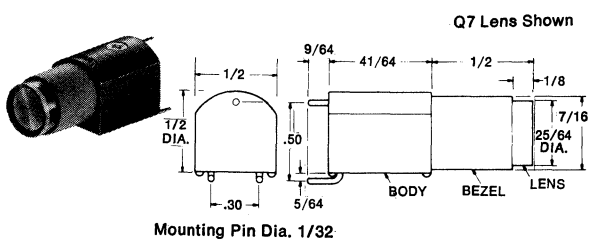


Mounting Pin Dia. 1/32

Designed specifically for printed circuit board mounting. May be used where illumination is need for the circuit board area as well as enunciation thru a panel.
Lens styles available in two diameters: 7/16" (7 series) Q7, QB7, DSC7, DS7 and ½" diameter (8 series) QB, QB8, DSC8, DS8.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

MODEL 874
PERPENDICULAR MOUNT



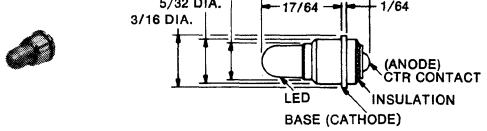
Mounting Pin Dia. 1/32

Same features as 864 Model but unit mounts perpendicular to surface of printed circuit board. Also available in two lens sizes.

MATERIAL & PROCESSES
BODY—Brass SAE 72 General Purpose Phenolic Linen Based Phenolic MIL-P-15035 Nylon MIL-M-20693 Nickel Plate QQ-N-290
LENS—Lexan LP-393 Nylon MIL-M-20693 Brass SAE 72 Aluminum 2024-T4 Nickel Plate QQ-N-290 Anodize MIL-A-8625
TERMINALS—Brass SAE 72 Tin Plate MIL-7-10727 Phosphor Bronze QQ-W-321

T-1 MIDGET FLANGED BASE LED

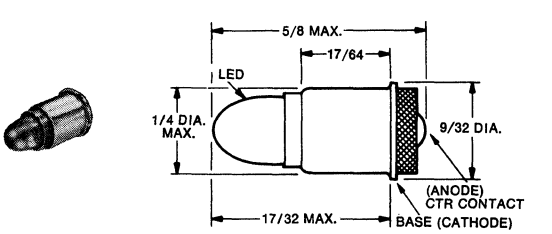
MODEL 4L001



The 4L001, available in diffused lens material is the Sloan T-1 based LED designed to offer diode reliability as a replacement unit in T-1 hardware. When maximum light output is desired using based LEDs in indicator applications, it is recommended that the lens be of transparent material with Fresnel rings. If translucent material is desired, then the lens should be without Fresnel rings.

T-1¾ MIDGET FLANGED BASE LED

MODEL 5L001



The versatile T-1¾ based LED is available in red, green or amber. Viable voltage range is 2.1 volts to 28 volts with power dissipation up to 400mW. Built-in dropping resistors allow these units to be powered from sources up to 28 VDC. The higher voltage capability permits the Sloan T-1¾ based LED to be used as direct replacement for incandescent bulbs in applications where light intensity is not critical but diode reliability is required.

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GENERAL INFORMATION:

- RFI shielding available with virtually all models.
- It is wise to avoid using blue or green lenses with neon lamps.
- It is also wise to avoid using blue lenses with LED lamps.
- Ultra-bright, multichip and other exotic lamps available.
- All materials meet or exceed applicable military specs.

HOW TO ORDER

Example

LED 2L5 — RL — DL — 5/20

2L5	RL	DL	5/20
Model No.	Lens Color Transparent Red Lexan	Lens Style Domed Fresnel	Voltage/current

INCANDESCENT OR NEON

855S — A — STD. — 327

855S	A	STD.	327
Model No.	Lens Color Amber Gen. Purpose	Lens Style Standard	Lamp Type

INCANDESCENT LAMP ELECTRICAL SPECIFICATIONS

T-1 LAMPS

LAMP	VOLTS	CURRENT (mA)	MSCP	LIFE (K HRS.)	INDUSTRY STD. NO
FB60	5	.060	.050	100	685*
FB59	28	.024	.150	16	—
FB44	18	.028	.150	10	—
					*MS-24515

T-1¾ LAMPS

327	28	.04	.340	4000	—
328	6	.20	.600	1000	—
387	28	.04	.300	7000	—

NEON LAMP ELECTRICAL SPECIFICATIONS

LAMP WITH RESISTOR	VOLTS A.C. OR D.C.	AMPS NOMINAL	WATTS NOMINAL	LIFE	RESISTOR
A1B	105-125	.03	1/25	25,000	220K
A1C	105-125	1.2	1/7	25,000	47K
A9A (NE-2E)	105-125	0.7	1/12	25,000	100K
C2A (NE-2H)	105-125	1.9	1/4	25,000	30K

NOTE: A1C and NE2H are high brightness. Other lamps available. Life figures for A.C—Life at D.C. ½ A.C. (Approx.). 862 Series cannot be supplied with resistor. We suggest that you do not order neon with Green or Blue lenses.

IMPORTANT: The lamps shown represent the most popular types normally requested. MANY OTHER LAMPS ARE AVAILABLE—PLEASE CONTACT FACTORY.

COLOR TABLE

LENS MATERIAL	LEXAN	LEXAN	GENERAL PURPOSE	BUTYRATE
Color	Transparent	Translucent	Translucent	Transparent
Red	RL	RLUC	R	RTP
Green	GL	GLUC	G	GTP
Blue	BL	BLUC	B	BTP
Amber	AL	ALUC	A	ATP
Clear	CL	—	—	CTP
White	—	WLUC	W	W

LED LAMP INFORMATION

We have virtually any LED you want. The two basic sizes are T-1 and T-1¾ with flanged bases. The brightest varies with color, with green lowest to red highest. To order extra or super bright lamps simply add 01 or 04 to the model number. One more suggestion do not order LEDs with blue lenses.

NO.	LAMP TYPE	T-1	T-1¾
—	Standard-Bright	2 mcd	3-8 mcd
01	Extra-Bright	8-18 mcd	15-18 mcd
04	Super-Bright	20 mcd	60-80 mcd

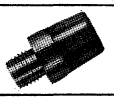
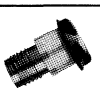
IMPRINTING

Lenses may be hot stamped, engraved, or opaqued and engraved so that the character only is displayed.

The chart below designates type size available for hot stamping. Size of lens determines size of type that can be used.

TYPE	ACTUAL SIZE	
	WIDTH	HEIGHT
2 Pt	.050	.060
6 Pt	.060	.080
8 Pt	.080	.110
10 Pt	.090	.120
12 Pt	.110	.160
NOTE: For other size type, contact factory.		

LENS STYLE

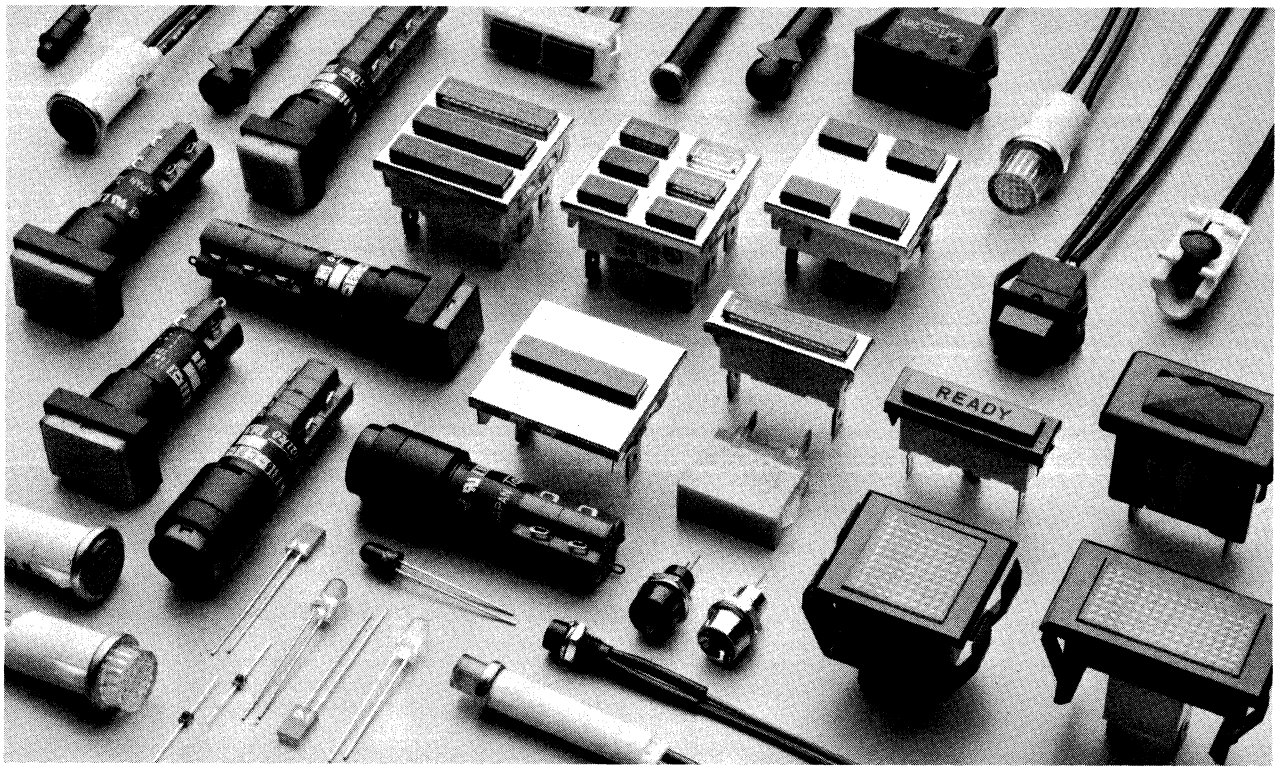
STYLE		DESCRIPTION
Q		Clear anodized bezel allows 180° visibility.
QB		Same as Q lens except with black anodized bezel.
DSC		Clear anodized bezel prevents sidelight emission.
DS		Same as DSC lens except with black anodized bezel.
STD		Full 180° visibility. Maximum illumination.
M		Large lens for maximum visibility from all angles. Engineered to offer the most uniform light distribution. Full 180° visibility.
MB		Same as M lens except with black anodized bezel.
D		Skirted lens covers metal parts for neat panel appearance. Large lighted surface assures positive indication.
SE		Edgelight for plastic panels. Small diameter light gasket minimizes wasted panel space.
DDS		DIMMER: Rotating outer collar changes light output from full to minimum. Rotation to dim can be clockwise or counter-clockwise. Easy adjustment with gloved hand.
U		UNLIMITED: Has no lens to diminish light output. Specifically suited to T-1¾ flanged based LED for maximum light output.

120 SERIES

STB		Full 180° visibility. Maximum illumination. Black bezel.
STC		Full 180° visibility. Maximum illumination. Clear bezel.
QB		Black anodized bezel allows 180° visibility.
Q		Same as QB lens except with clear anodized bezel.

STYLES

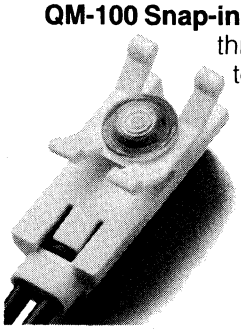
FLAT		NOTE: Lens style may be flat or domed, plain or lensed, meaning that the lens is provided with internal concentric rings on the inner face and flutes on the sides, thus giving better light distribution.
DOMED		



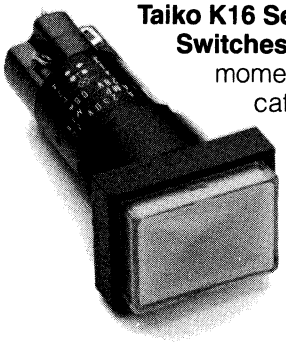
Ask us for solutions to your product lighting needs.

SoLiCo pilot lights, indicator lights and lighted pushbuttons come in a wide variety of styles and sizes for a broad range of products and applications. Give us your panel depth, required hole size, mounting method, lens size and style, material, and termination. Chances are, we'll have an inexpensive standard part for your needs. We'll even send you a free sample on request.

Series 8000 Snap-in Indicator Lights. Real time savers. Snap into .375" hole from front of panel. Pre-wired leads. Red, green, yellow or amber LED's. Red or green neon. Lens bodies domed or flat, translucent or transparent. Bright, quick, easy.



QM-100 Snap-in Indicator Lights. Lens fits through panel front. Lamp snaps to it from back. Pre-wired 6" leads. Standard, blue or green neon lamp. 4 lens shapes, 6 colors. Rated at 125-250V.



Taiko K16 Series Lighted Pushbutton Switches. Incandescent or LED. In momentary, maintained, and indicator styles. Solder lug terminals, independent lamp terminals, and T1 BiPins for durability. Round, square, or rectangular. Lenses clear or in 5 colors. 1, 2, 3, or 4-pole double-make/double-break contacts. Fit 5/8" round hole.

Special items and special assistance, too. Contact our factory sales department for quick solutions to unique lighting demands. Technical aid is always available to help you find the light that's best for your application. To find out just how many ways SoLiCo can help you see the light, call for our full-line brochure—**(203) 527-3092**

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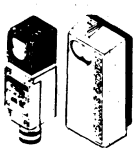
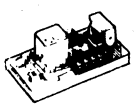
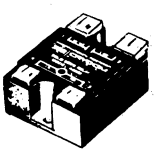
TOGGLE SWITCHES

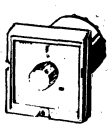

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

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BUD

CIRCUIT BREAKERS
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Heinemann
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Idec
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Amperite
Antex
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Eagle Signal
Guardian
Industrial Timer
Magnecraft
Master Electronics
Midtex
National Controls
Omron
Potter & Brumfield
SSAC
Struthers-Dunn
Syracuse Electronics

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Beckman Ind.

TRIMMERS & POTS
Beckman Ind.

SOLENOID
Dormeyer
Guardian
Line Electric

TERMINAL BLOCKS
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Buchanan
Curtis
Electrovert
Kulka
Magnum
Marco
RDI
Underwriters Safety
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TRANSFORMERS
Dormeyer
Microtran
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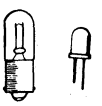
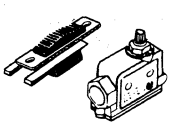
Thordarson
Triad

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

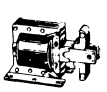
KNOBS


LAMPS & LEDS

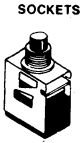

SWITCHES

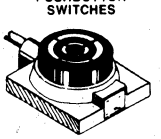
RELAYS

INDICATOR LIGHTS

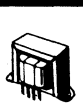

SOLENOIDS

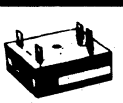
SOCKETS


PUSHBUTTON SWITCHES


PROXIMITY CONTROLS

PADDLE SWITCHES


TRANSFORMERS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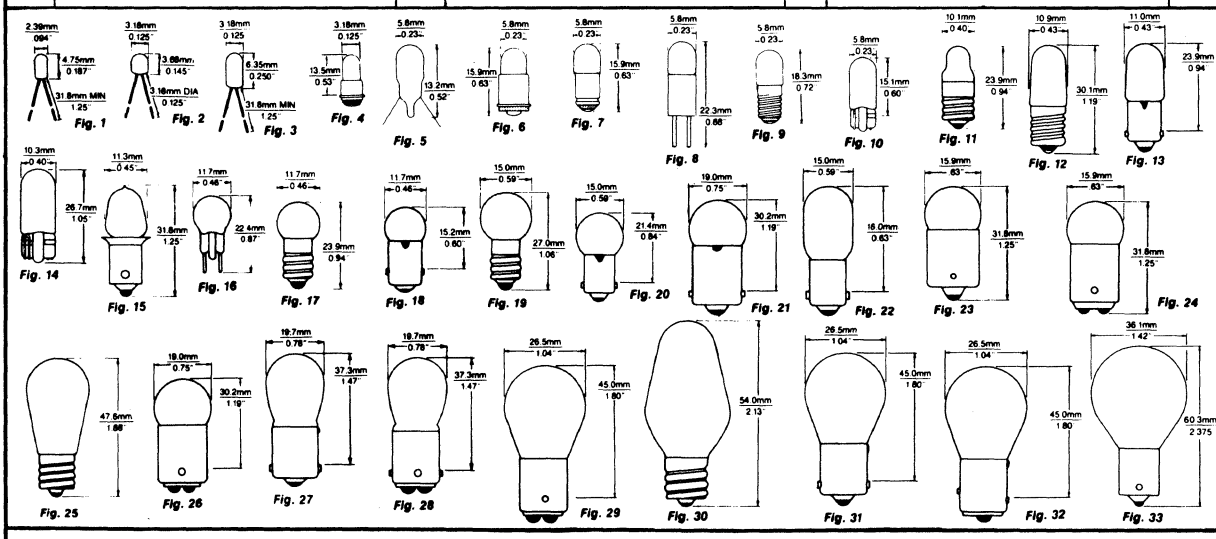
GTE Products Corporation
West Main Street, Dept. EM, Hillsboro, NH 03244

MINIATURE, SUBMINIATURE AND MICROMINIATURE LAMPS

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
PR2	B-3½	2.38	.50	.80	15
PR3	B-3½	3.57	.50	1.50	15
PR4	B-3½	2.33	.27	.40	15
PR6	B-3½	2.47	.30	.45	15
PR7	B-3½	3.7	.30	.90	15
PR12	B-3½	5.95	.50	3.10	15
PR13	B-3½	4.75	.50	2.20	15
PR18	B-3½	7.2	.55	5.5	15
6S6	S-6	120	6W	.....	25
7C7	C-7	115-125	7W	.....	30
12	G-3½	6.3	.15	.35	16
13	G-3½	3.7	.30	.98	17
14	G-3½	2.47	.30	.50	17
19	G-3½	14.4	.10	.90	16
27	G-4½	4.9	.30	1.4	19
31	G-4½	6.15	.30	2.0	19
41	T-3¼	2.5	.50	.50	12
43	T-3¼	2.5	.50	.50	13
44	T-3¼	6.3	.25	.90	13
45	T-3¼	3.2	.35	.50	13
46	T-3¼	6.3	.25	.90	12
47	T-3¼	6.3	.15	.52	13
48	T-3¼	2.0	.06	.04	12
49	T-3¼	2.0	.06	.04	13
51	G-3½	7.5	.22	1.0	18
53	G-3½	14.4	.12	1.0	18
53X	G-3½	14.4	.12	1.0	18
55	G-4½	7.0	.41	2.0	20
57	G-4½	14.0	.24	2.0	20
57X	G-4½	14.0	.24	2.0	20
63	G-6	7.0	.63	3.0	21
67	G-6	13.5	.59	4.0	21
81	G-6	6.5	1.02	6.0	21
82	G-6	6.5	1.02	6.0	26
87	S-8	6.8	1.91	15.0	31
88	S-8	6.8	1.91	15.0	29
89	G-6	13.0	.58	6.0	21
93	S-8	12.8	1.04	15.0	31
112	TL-3	1.2	.22	.....	11
123	G-3½	1.25	.30	.10	17
136	G-4½	1.25	.60	.20	19

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
158	T-3¼	14.0	.24	2.0	14
161	T-3¼	14.0	.19	1.0	14
168	T-3¼	14.0	.35	3.0	14
194	T-3¼	14.0	.27	2.0	14
222	TL-3	2.25	.25	.....	11
301	G-5	28.0	.17	3.0	23
302	G-5	28.0	.17	3.0	24
303	G-6	28.0	.30	6.0	21
305	S-8	28.0	.51	15.0	31
307	S-8	28.0	.67	21.0	31
308	S-8	28.0	.67	21.0	29
309	S-11	28.0	.9	32.0	33
313	T-1¾	28.0	.17	3.5	13
327	T-1¾	28.0	.04	.34	6
328	T-1¾	6.0	.20	.34*	6
330	T-1¾	14.0	.08	.5	6
331	T-1¾	1.35	.06	.006	6
334	T-1¾	28.0	.04	.34	7
344	T-1¾	10.0	.014	.004	6
382	T-1¾	14.0	.08	.30	6
387	T-1¾	28.0	.04	.30	6
388	T-1¾	28.0	.04	.30	6
680	T-1	5.0	.06	.03	3
682	T-1	5.0	.06	.029	4
683	T-1	5.0	.06	.05	3
685	T-1	5.0	.06	.048	4
713	T-1	5.0	.075	.09	3
714	T-1	5.0	.075	.08	4
715	T-1	5.0	.115	.15	3
716	T-1	5.0	.115	.132	4
1003	B-6	12.8	.94	15.0	27
1004	B-6	12.8	.94	15.0	28
1034	S-8	12.8	1.80	32.0	32
		14.0	.59	3.0	
1076	S-8	12.8	1.80	32.0	29
1133	RP-11	6.2	3.91	32.0	34
1156	S-8	12.8	2.10	32.0	31
1157	S-8	12.8	2.10	32.0	32
		14.0	.59	3.0	

Lamp No.	Bulb	Volts	Amps	M.S. C.P.	Fig.
1176	S-8	12.8	1.34	21.0	29
		14.0	.59	6.0	
1183	RP-11	5.5	6.25	50.0	34
1195	RP-11	12.5	3.0	50.0	34
1445	G-3½	14.4	.135	.7	18
1447	G-3½	18.0	.15	1.5	17
1495	T-4½	28.0	.30	6.0	22
1764	T-1¾	28.0	.04	.34	5
1784	T-1¾	6.0	.20	.60	5
1813	T-3¼	14.4	.10	.86	13
1815	T-3¼	14.0	.20	1.4	13
1816	T-3¼	13.0	.33	3.0	13
1819	T-3¼	28.0	.04	.34	13
1828	T-3¼	28.0	.10	1.6	13
1829	T-3¼	28.0	.07	1.0	13
1847	T-3¼	6.3	.15	.38	13
1850	T-3¼	5.0	.09	.25	13
1864	T-3¼	28.0	.17	3.0	13
1869	T-1¾	10.0	.014	.004	5
1888	T-3¼	7.0	.50	2.0	13
1889	T-3¼	14.0	.27	2.0	13
1891	T-3¼	14.0	.24	2.0	13
1893	T-3¼	14.0	.33	2.0	13
1895	G-4½	14.0	.27	2.0	20
2182	T-1¾	14.0	.10	.5	5
2282	T-1¾	14.0	.08	.30	5
2187	T-1¾	28.0	.04	.30	5
6832	T-1	5.0	.06	.05	2
6833	T-¾	5.0	.06	.05	1
6838	T-1	28.0	.024	.15	3
6839	T-1	28.0	.024	.15	4
7152	T-1	5.0	.115	.15	2
7327	T-1¾	28.0	.04	.34	8
7328	T-1¾	6.0	.20	.6	8
7344	T-1¾	10.0	.014	.004	8
7382	T-1¾	14.0	.08	.30	8
7387	T-1¾	28.0	.04	.30	8
7931	T-1¾	1.35	.06	.006	8

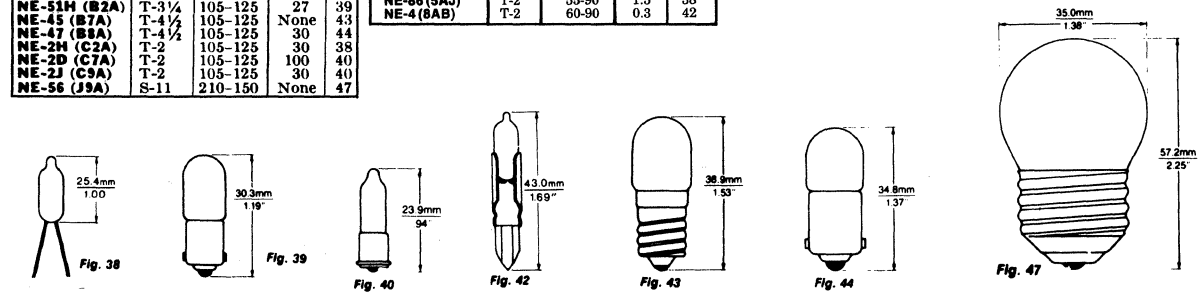


NEON GLOW INDICATOR LAMPS

Lamp No.	Bulb	Circuit Volts	Ext. Res. (K-ohms)	Fig.
NE-2 (A1A)	T-2	105-125	150	38
NE-2A (A2A)	T-2	105-125	220	38
NE-2V (A2B)	T-2	105-125	100	38
NE-2E (A9A)	T-2	105-125	100	38
NE-51 (B1A)	T-3¼	105-125	220	39
NE-51H (B2A)	T-3¼	105-125	27	39
NE-45 (B7A)	T-4½	105-125	None	43
NE-47 (B8A)	T-4½	105-125	30	44
NE-2H (C2A)	T-2	105-125	30	38
NE-2D (C7A)	T-2	105-125	100	40
NE-2J (C9A)	T-2	105-125	30	40
NE-56 (J9A)	S-11	210-150	None	47

NEON GLOW CIRCUIT COMPONENT LAMPS

Lamp No.	Bulb	Start. Volts (DC)	Nom. Cur. (mA)	Fig.
NE-96 (4AB)	T-2	120-150	0.5	38
NE-81 (5AG)	T-2	64-80	0.3	38
NE-76 (5AG-A)	T-2	68-76	0.4	38
NE-83 (5AH)	T-2	60-100	5.0	38
NE-86 (5AJ)	T-2	55-90	1.5	38
NE-4 (8AB)	T-2	60-90	0.3	42



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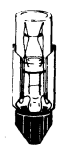
SYLVANIA Miniature Lighting **GTE**

GTE Products Corporation
West Main Street, Dept. EM, Hillsboro, NH 03244

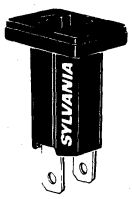
SINGLE SOCKET ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

Available sockets include P N 30153 (round flange) and P N 30151 (rectangular flange). Sockets may be used with or without colored lens cap covering end of bulb which extends 18" beyond .09" flange. Socket P N 30153 (round flange) can also be used with round (.70" dia. × .48" high) or square (.70" ×.48" high) lenses. Both sockets 1.14" M.O.I. Mounting hole, .50" dia. Sockets accept 1-2 lamps rated at 4, 5, 6, 10, 13, 14, 16, 18, 24, 28 or 48 volts.

End Cap



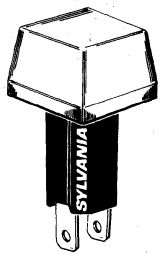
Indicator Lamp



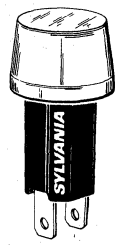
P/N 30151

P/N 30153

With End Cap



With Square Lens



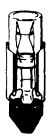
With Round Lens

Part Number	Description
30151	Socket, rectangular flange
30153	Socket, round flange
38001	End cap, (*), red
38002	End cap, (*), yellow
38003	End cap, (*), white
38004	End cap, (*), green
38005	End cap, (*), blue
38006	End cap, (*), pearl white
38007	End cap, (*), orange
38071	End cap, Pyrex, red
38072	End cap, Pyrex, yellow
38073	End cap, Pyrex, white
38074	End cap, Pyrex, green
38075	End cap, Pyrex, blue
30160	Lens, round, red
30161	Lens, round, clear
30162	Lens, round, amber
30163	Lens, round, white
30164	Lens, round, green
30165	Lens, round, blue
30170	Lens, square, red
30171	Lens, square, clear
30172	Lens, square, amber
30173	Lens, square, white
30174	Lens, square, green
30175	Lens, square, blue

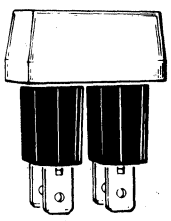
*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

TWIN LIGHT ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

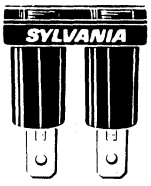
T-2 lamp



Complete Ass'y.

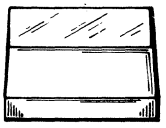


TWIN LIGHT SOCKETS



Ordering Number	Description	No. of Contacts
31351	Both sides common	2
31352	One side common	3
31353	Individual contacts	4

TWIN LIGHT LENSES



Ordering Number	Color
30180	Red
30182	Amber
30183	White
30184	Green
30185	Blue

STRIP SOCKET ASSEMBLIES FOR T-2 SLIDE BASE INDICATOR LAMPS

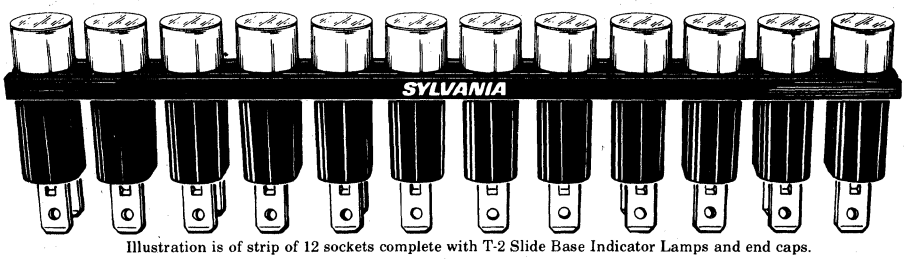


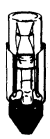
Illustration is of strip of 12 sockets complete with T-2 Slide Base Indicator Lamps and end caps.

Strip socket assemblies may be used with or without end caps listed above. Polycarbonate caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts. Pyrex caps must be cemented to the lamp with a translucent silicone rubber adhesive. Strip socket assemblies are available with 2 thru 12 sockets on 1 2" or 3 4" centers; common ground or individual contacts. Sockets accept T-2 indicator lamps rated at 4, 5, 6, 10, 12, 14, 16, 18, 24, 28 or 48 volts.

INDICATOR LAMP STRIP SOCKETS

Number of Sockets	Ordering Number			
	1/2" Centers		3/4" Centers	
	Common Ground	Individual Contacts	Common Ground	Individual Contacts
2	31301	31311	31321	31337
3	31302	31312	31322	31338
4	31303	31313	31323	31334
5	31304	31314	31324	31339
6	31305	31315	31325	31333
7	31306	31316	31326	31340
8	31307	31317	31327	31341
9	31308	31318	31328	31342
10	31309	31319	31329	31343
11	31310	31320	31330	31344
12	31250	33250	31275	33275

T-2 SLIDE BASE INDICATOR LAMPS FOR ABOVE ASSEMBLIES



Lamp Number	Design			Filament	M.S.C.D.	Average End Foot Candles	Rated Average Life (Hrs.)
	Volts	Amperes	Watts				
4ESB	4.0	.040	.16	C-6	.03	200	10,000
5ESB	5.0	.040	.20	C-6	.04	225	8,000
6ESB	6.0	.040	.24	C-2V	.025	250	10,000
53B	6.0	.240	1.44	C-2V	.24	2,000	5,000
10ASB	10.0	.010	.10	C-2F	.001	.....	50,000
10CSB	10.0	.017	.17	C-2V	.01	60	20,000
10ESB	10.0	.040	.40	C-2V	.07	450	10,000
12ESB	12.0	.040	.48	C-2V	.09	650	10,000
14FSB	14.0	.080	1.12	C-2F	.50	4,000	500
16CSB	16.0	.017	.27	C-2F	.016	80	15,000
16ESB	16.0	.040	.64	C-2F	.17	800	7,500
18ESB	18.0	.040	.72	C-2F	.14	850	5,000
24CSB	24.0	.017	.42	C-2F	.02	100	15,000
24ESB	24.0	.040	.96	C-2F	.12	850	8,000
28ESB	28.0	.040	1.12	C-2F	.25	1,500	6,000
48ESB	48.0	.040	1.92	CC-2F	.44	3,000	5,000

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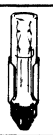
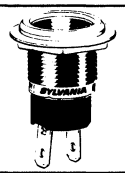
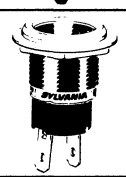
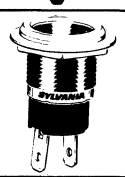
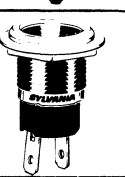
SYLVANIA Miniature Lighting GTE

GTE Products Corporation
West Main Street, Dept. EM, Hillsboro, NH 03244

UNIVERSAL PILOT LAMP HOUSING FOR T-2 SLIDE BASE PILOT LAMPS

A variety of lens styles, each available in a choice of colors, plus a standard socket (P N 30099) provide a wide choice of configurations for virtually every application when used with a T-2 slide base Pilot Lamps rated at 5, 6, 12, 28, 48, 60 or 120 volts. **Dimensions: Lenses** — Height, .38", diameter, .63". **Socket** — Front of panel to end of terminals, .91", mounting hole, .75" dia.

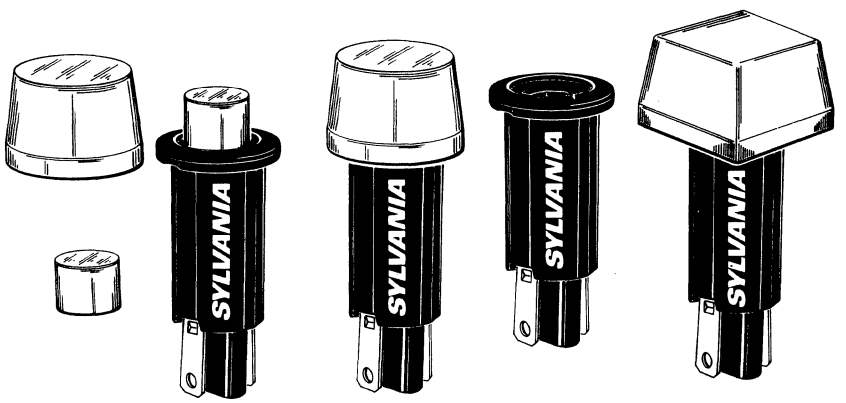
	FLAT TOP	JEWELED	TRANSPARENT	FLUTED	TRANSLUCENT
Choose your lens & color . . .					
add a T-2 Pilot Lamp . . .					
and insert into socket # 30099					

LENSE PART NO'S.	
30200	Flat Top Translucent—Red
30212	Flat Top Translucent—Green
30213	Flat Top Translucent—Blue
30214	Flat Top Translucent—Yellow
30100	Jeweled—Red
30102	Jeweled—Green
30103	Jeweled—Blue
30106	Jeweled—Amber
30110	Transparent—Red
30112	Transparent—Green
30113	Transparent—Blue
30111	Transparent—Amber
30114	Transparent—Yellow
30116	Transparent—Clear
30120	Fluted—Red
30122	Fluted—Green
30124	Fluted—Blue
30126	Fluted—Amber
30125	Fluted—Clear
30130	Dome Translucent—Red
30132	Dome Translucent—Green
30131	Dome Translucent—Yellow
30133	Dome Translucent—White

SOCKET	
30099	Socket

SINGLE SOCKET ASSEMBLIES FOR T-2 SLIDE BASE PILOT LAMPS

Socket P N 30152 plus round (.70" dia. × .48" high) or square (.70" × .70" × .48" high) lens also uses T-2 slide base. Pilot Lamps rated at 5, 6, 12, 24, 28, 48, 60 or 120 volts. Sockets can also be used without lens, with or without colored end cap covering end of bulb which extends .18" beyond .09" socket flange. **Dimensions:** Socket — 1.31" M.O.L.: mounting hole .50" dia.



*Polycarbonate end caps are press fit to the lamp; cannot be used with lamps rated over 1.1 watts.

#Pyrex end caps must be cemented to the lamp with a translucent silicone rubber adhesive.

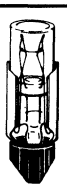
LENSES	Ordering Number	
Color	Round Lens	Square Lens
Red	30160	30170
Clear	30161	30171
Amber	30162	30172
White	30163	30173
Green	30164	30174
Blue	30165	30175

POLYCARBONATE END CAPS*	
Color	Ordering Number
Red	38001
Yellow	38002
White	38003
Green	38004
Blue	38005
Pearl White	38006
Orange	38007

PYREX END CAPS#	
Color	Ordering Number
Red	38071
Yellow	38072
White	38073
Green	38074
Blue	38075

SOCKET	
30152	Socket

T-2 SLIDE BASE PILOT LAMPS FOR ABOVE HOUSING AND ASSEMBLIES



Lamp No.	Design Volts	Amps	Watts	Filament	M.S. C.D.	Average End Foot Candles	Rated Average Life (Hours)
5SLB	5	.12	.6	C-2V	. . .	1,600	2,500
6PSB	6	.14	.8	C-2F	.12	500	20,000
6SLB	6	.144	.6	C-2V	. . .	1,700	2,500
12PSB	12	.17	2.0	C-2F	.35	2,000	12,000
24PSB	24	.073	1.7	C-2F	.50	3,000	10,000
28PSB	28	.04	1.1	C-2F	.29	1,600	5,000
48PSB	48	.053	2.5	C-7A	.7	1,800	7,500
60PSB	60	.05	3.0	C-7A	.73	2,600	7,500
120PSB	120	.025	3.0	CC-7A	.36	1,200	10,000

WIRE LEAD INDICATOR LAMPS

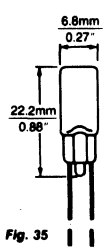


Fig. 35

Lamp No.	Volts	Amps.	M.S. C.P.
4ES	4	.04	.03
5ES	5	.04	.04
6ES	6	.04	.025
10AS	10	.01	.001
10CS	10	.017	.01
10ES	10	.04	.07
12ES	12	.04	.09
16CS	16	.017	.016
16ES	16	.04	.17
18ES	18	.04	.14
24CS	24	.017	.02
24ES	24	.04	.12
28ES	28	.04	.25
48ES	28	.04	.44

WIRE LEAD PILOT LAMPS

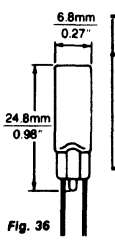


Fig. 36

Lamp No.	Volts	Amps	M.S. C.P.
6PS	6	.14	.12
12PS	12	.17	.35
24PS	24	.073	.5
28PS	28	.04	.29
48PS	48	.053	.7
60PS	60	.05	.73
120PS	120	.025	.36
120PS/6	120	.052	1.43

MINIATURE BAYONET BASE PILOT LAMPS

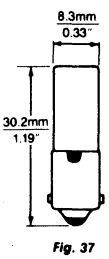


Fig. 37

Lamp No.	Volts	Amps	M.S. C.P.
6MB	6	.140	.12
12MB	12	.170	.35
24MB	24	.073	.50
28MB	28	.040	.29
48MB	48	.053	.70
60MB	60	.050	.73
90MB	90	.033	.37
120MB	120	.025	.36
120MB/6	120	.052	1.43

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OPTICAL ISOLATORS

For fiber-optics communications, especially for analog or high bit-rate digital transmissions, on application of laser diodes (LD) as the light source, the affect of the reflective light from optical circuit devices to LD has existed. That is, by the reflective light, noises and inferiorization of LD are caused. The optical isolators, therefore, are indispensable to defend against the LD. FDK has succeeded in industrialization of a new growing method of YIG single crystal, called the TSFZ method (Traveling Solvent Floating Zone) and this is very suitable for high quality and low cost garnet type single crystal.
Accordingly, FDK has developed a compact and low cost YIG optical isolator, in which FDK YIG single crystal is applied, as a non-reciprocal circuit device for fiber-optics communications of 1.3 and 1.55μm wavelength ranges. This FDK YIG optical isolator has high reliabilities, i.e. high isolation, low insertion loss and better temperature dependence.

Features

- High isolation
- Low insertion loss
- Small and light
- Low cost

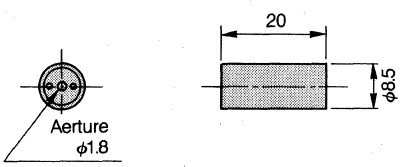
Specifications

Items \ Type	YD-101	YD-103	YD-104
Isolation	≧40dB	≧30dB	≧35dB
Insertion loss	<1.5dB	<1.5dB	<1.5dB
Wavelength	1.3, 1.55μm	1.3, 1.55μm	1.3, 1.55μm
Practical beam size	φ1.8mm	φ1.8mm	φ1.8mm
Faraday rotator	YIG	YIG	YIG
Polarizer, Analyzer	*GT prism	**PBS	**PBS

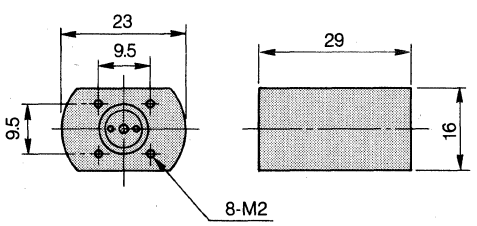
*GT prism (Glan-Thompson prism)
**PBS (Polarizing Beam Splitter)

Shapes and dimensions

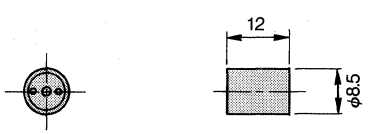
YD-101 A type



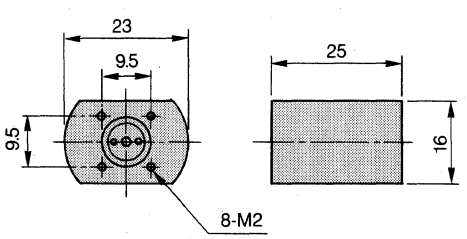
YD-103 A type
YD-104 A type



YD-101 B type



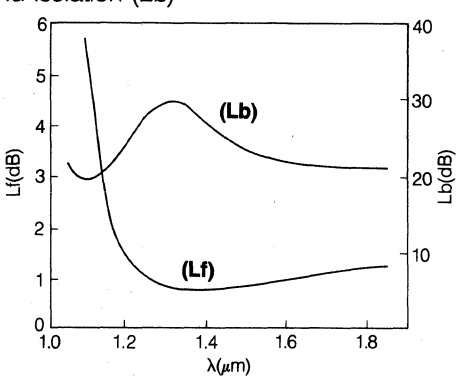
YD-103 B type
YD-104 B type



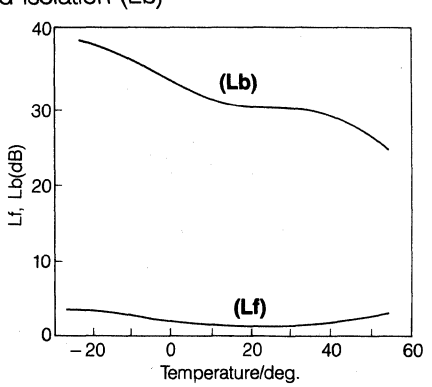
Dimensions in millimeters

Characteristics (YD-103)

- Wavelength dependence of insertion loss (Lf) and isolation (Lb)



- Temperature dependence of insertion loss (Lf) and isolation (Lb)



All specifications are subject to change without notice.

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Tokyo, Japan

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90701, U.S.A.
Phone 213-404-1770 Telex 18-1998 (FEC CALIF LA)
Fax. 213-404-2850

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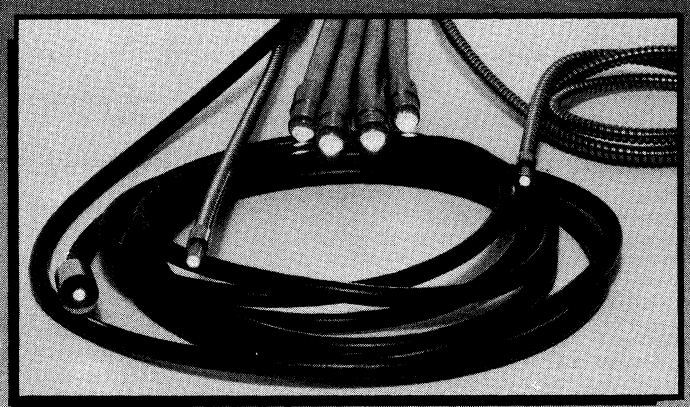

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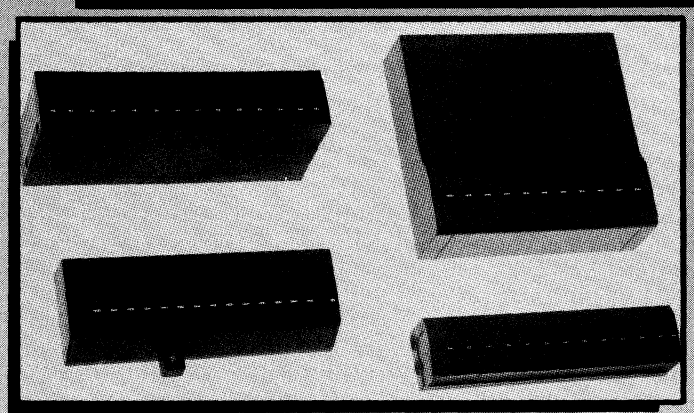

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- Signalization
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- Optical curing (UV light)
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- Automatic inspection
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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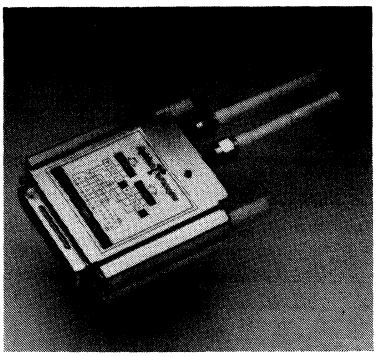
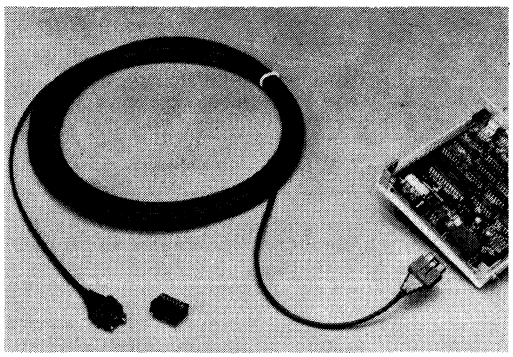
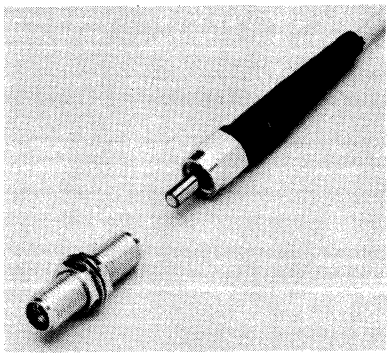

OPTO/LINK Fiber Optic Data Links

Data Links

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Receivers	DC-20M b/s
Transmission Distance in Meters	5 — 2000

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WE SPEAK THE LANGUAGE OF LIGHT

The following pages were designed to give a brief overview of our fiber optic expertise. Our primary emphasis is to create systems for military and hazardous-environment applications, using our standard components or custom-building components as required. We've listed a sampling of our current product line and have made more designs not shown. We can reconfigure or redesign based on your application.

Let us put our fiber optic experience to work for you. Call us toll-free at 800-336-5917 (in Virginia, call 703-953-4751) for more information.

PASSIVE COMPONENTS

Wavelength Division Multiplexers:

As their name implies, WDM's enable multiple channels of analog and/or digital data to be multiplexed, transmitted over a single fiber and demultiplexed at the other end of the data link. Our standard WDM configurations will perform either as multiplexers or demultiplexers.

Part No.	Type	Fiber Size	Pigtail Length	Channel Capacity	Wavelength Range	Typical Insertion Loss	Crosstalk Isolation	Operating Temperature Range	Package Size (inches)		
									L	W	H
3650	Diffraction Grating	100/140 standard; others available	1 meter standard	6	400–1600nm	4dB	-30dB	-40° to 80°C	3.01	0.75	0.75
3652	Diffraction Grating	100/140 standard; others available	1 meter standard	15	400–1600nm	4.5dB	-30dB	-40° to 80°C	3.3	1.5	1.5
3655	Dichroic Mirror	100/140 standard; others available	1 meter standard	2	800–1300nm	2.5dB	-30dB	-40° to 80°C	2.2	0.5	0.5

Low Loss Couplers:

Our couplers can be used "stand-alone" or in linear data buses, and are designed for use in harsh environments. Performance is determined by fiber sizes and split ratios. Two basic examples are shown.

Part No.	Type	Fiber Type	Pigtail Length	Excess Loss	Operating Temperature Range	Package Size (inches)	
						L	Diameter
3666	Symmetric	Multi-mode Fibers	0.5 meter standard	≤ 1 dB	-55° to 200°C	4.0	.375
3662	Asymmetric	Multi-mode Fibers	0.5 meter standard	≤ 0.2 dB	-55° to 200°C	4.0	.375

Optical Sensors:

Other environmental sensors (pressure, temperature, etc.) are available or can be designed and manufactured for your specific application.

Part No.	Type	Max Insertion Loss	Min I/O Ratio	Wavelength Output Range	Channel Pitch Nominal	Channel Width Nominal	Fiber Type	Coding Type	Coding Format	Bits	Resolution/ Travel	Package Size (Inches)
3571	Linear Position Transducer	11dB	10dB	720–950nm	19nm	9.8nm	100/140 step index NA .22	absolute	Gray Code	11	.00075″ / 1.519″	2 × 4 × .87
3567	Rotary Position Transducer	11dB	10dB	720–950nm	19nm	9.8nm	100/140 step index NA .22	absolute	Gray Code	11	0.176° / 360°	1.645 × 1.86 (OD)

Optical Switches:

Our switches are completely passive in that they require no electrical input and offer all the system advantages of fiber optics. The design is rugged and environmentally sealed to allow use in field applications. Various options and customizations are available depending on the wavelength spectrum available, fiber size, pigtail length, connectorization, mounting requirements, etc.

Part No.	Type	Insertion Loss for 100/140 G.I. .29NA	I/O ratio	Wavelength Optimization Availability	Temperature Range	Package Size (Inches)	Notes
3693	Rotary	3dB max	40dB min	800–900nm 1060–1560nm 600–700nm	-55° to 75°C	L – 2.20 OD – 1.24	Up to 10 channels
3692	Pushbutton	2dB max	25dB min	800–900nm 1060–1560nm 600–700nm	-55° to 75°C	L – 1.20 W – 0.96 H – 3.10	Options: normally open or closed, momentary or alternate action.

On-Axis Fiber Optic Rotary Joint (FORJ):

Our fiber optic rotary joints (FORJ's) are components that provide the same unlimited rotational freedom for electro-optical systems that the slip ring has long provided for electrical systems. We manufacture passive on-axis FORJ's with a wide variety of fiber types, including single mode optical fibers. The off-axis FORJ is designed for applications where the centerline cannot be allocated as the fiber optic signal path. It is an active device that is supplied with its own transmitter and receiver.

	Part No.	Outside Diameter (Inches)	Length (Inches)	Fiber Size (μm)	Wavelength (nm)	Pigtail Length Each End (m)	Connection
MULTI-MODE	3585-1	.75	2.16	50/125	800–900	1	None
	-2	.75	2.16	100/140	800–900	1	None
	-23	.75	2.16	50/125	800–900	1	906 SMA
	-24	.75	2.16	100/140	800–900	1	906 SMA
	-22	.75	2.16	200/230	800–900	1	906 SMA
SINGLE-MODE	3581	1.26	3.45	10/125	1300	10	None
	3588	1.26	3.68	10/125	1180-1580	10	None

NOTE: No special features such as flanges or derotation adaptors are included on these configurations.

Call us toll-free at **800-336-5917** (in Virginia, call 703-953-4751) for more information.

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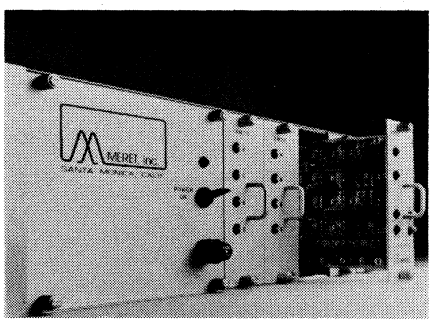
TRANSMITTERS AND RECEIVERS

Many of our transmitters and receivers are custom-built according to the special needs of our customers. Listed below are representative examples of our current products. A variety of packaging configurations are available, including rack mount and stand-alone versions. In addition, discrete-component, surface-mount and thick/thin film hybrid versions of these products are available.

TYPE	DATA RATE	PART NO.	ELECTRICAL INTERFACES	DYNAMIC RANGE	PEAK LAUNCH POWER INTO 100μ FIBER	PEAK Rx SENSITIVITY	WAVELENGTH	SUPPLY VOLTAGE REQUIREMENTS	POWER SUPPLY REQUIREMENTS	MOUNTING METHOD	PACKAGE TYPE	PACKAGE SIZE H x L x W	SPECIAL FEATURES
Hybrid Digital Tx	DC-20 Mb/s Manchester	EO 3519-1	TTL	N/A	−7 dBm	N/A	850nm	+/−5	+5@625mW −5@775mW	PCB	DIP	.2×1.3×.8	available with dual fiber pigtail for linear data bus applications
Hybrid Digital Tx	DC-50 Mb/s Manchester	EO 3519-3	ECL	N/A	−10 dBm	N/A	850nm	+/−5	+5@625mW −5@775mW	PCB	DIP	.2×1.3×.8	same as EO 3519-1 above
Hybrid Digital Rx, AC coupled	50 Mb/s Manchester	EO 3546-1	ECL	20 dB	N/A	−36 dBm, 10^{-9} BER	850nm	+15 +/−5	+15@300mW +5@500mW −5@575mW	PCB	DIP	.5×2×1	- optional dual fiber for linear data bus - 16 BIT capture - Fanout 10 LS loads
Hybrid, Digital Rx, AC coupled	20 Mb/s Manchester	EO 3546-2	ECL	20 dB	N/A	−30 dBm 10^{-9} BER	850nm	+/−5 +/−15	+5@200mW −5@400mW +15@300mW −15@300mW	PCB	DIP	.5×2×1	same as EO 3546-1 above
Hybrid, Digital Rx	DC-2 Mb/s Manchester	EO 3553-1	TTL	20 dB	N/A	−45 dBm 10^{-9} BER	850nm	+/−5 +/−15	+15@150mW −15@375mW +5@725mW −5@250mW	PCB	DIP	.5×2×1	- Dual 100μ fiber, 1M pigtail - Fanout 10 LS loads - DATAC Compatible for linear data bus
Hybrid Digital Rx	DC-1 Mb/s NRZ	EO 3553-2	TTL	20 dB	N/A	−45dBm 10^{-9} BER	850nm	+/−15 +/−5	+15@150mW −15@375mW +5@725mW −5@250mW	PCB	DIP	.5×2×1	- Fan out 10 LS loads - optional dual fiber pigtail
Hybrid, Digital Rx	DC-4 Mb/s NRZ	EO 3553-3	TTL	20 dB	N/A	−45 dBm 10^{-9} BER	850nm	+/−5 +/−15	+15@600mW −15@900mW +5@600mW −5@700mW	PCB	DIP	.5×2×1	- 1M pigtail/100μ - Fanout 10LS loads
Hybrid, Digital Rx	DC-20 Mb/s NRZ	EO 3553-4	ECL	20 dB	N/A	−35 dBm 10^{-9} BER	850nm	+/−5 +/−15	+15@600mW −15@900mW +5@600mW −5@700mW	PCB	DIP	.5×2×1	- same as EO 3553-3 above
Hybrid, Digital Rx	DC-100 Mb/s NRZ	EO 3553-5	ECL	20 dB	N/A	−28 dBm 10^{-9} BER	850nm	+/−5 +/−15	+15@225mW −5@1W	PCB	DIP	.5×2×1	- same as EO 3553-3 above
Video Tx	5 Hz-9.5 MHz Bandwidth	EO 3501-1	RS-170	N/A	−10 dBm	N/A	850nm	Integral 110VDC power supply	N/A	Mounting Flange	Stand alone	1×5×3	- available in rack mount version
Digital Tx	DC-50 Mb/s NRZ	EO 3520	TTL, 50 ohm terminated 3V max	N/A	−9 dBm	N/A	850nm	+/−5	+5@725mW −5@150mW	Mounting Flange	Stand alone	1×3×2	- available in rack mount version
Video Rx	5 Hz-9.5 MHz Bandwidth	EO 3541-1	RS-170	16 dB	N/A	−32 dBm	850nm	integral 110VDC power supply	N/A	Mounting Flange	Stand alone	1×5×3	- AGC Range 8 dB - available in rack mount version
Digital Rx	DC-12 Mb/s NRZ	EO 3548-1	TTL	23 dB	N/A	−35 dBm 10^{-9} BER	850nm	integral 110VDC power supply	N/A	Mounting Flange	Stand alone	1×5×3	
Digital Rx	DC-12 Mb/s	EO 3548-2	TTL	10 dB	N/A	−45dBm 10^{-9} BER	850nm	integral 110VDC power supply	N/A	Mounting Flange	Stand alone	1×5×3	- APD detector
Digital Rx	100 Kb/s-50 Mb/s NRZ	EO 3560	TTL	22 dB	N/A	−32 dBm 10^{-9} BER	850nm	+/−5	.5W	Mounting Flange	Stand alone	1×3×2	- available in rack mount version
RS-232 Modem Tx/Rx	DC-56 Kb/s Asynch DC-29 Kb/s NRZ	EO 3671	RS-232	21 dB	−14 dBm	−44 dBm 10^{-9} BER	850nm	110VDC power supply included	N/A	N/A	Stand alone	1.4×4.7×3.7	- 1 pair constitutes a set - simplex or duplex - synchronous/asynchronous switchable
RS-232 Tx/Rx	DC-100 Kb/s NRZ	EO 3672	RS-232	25 dB	−10 dBm	−34 dBm 10^{-9} BER	850nm	110VDC power supply included	N/A	Plug into RS-232 port	Stand alone	.7×4.3×1.7	- Functions as DTE or DCE - 1 pair constitutes a set - available in rack mount version
RS-422 Tx/Rx	DC-100 Kb/s NRZ	EO 3674	RS-422	25 dB	−10 dBm	−34 dBm 10^{-9} BER	850nm	110VDC power supply included	N/A	Mounting Flange	Stand alone	1.3×3×3	- 1 pair constitutes a set - available in rack mount version
RS-232 Tx/Rx	DC-100 Kb/s NRZ	EO 3675	RS-232	25 dB	−10 dBm	−34dBm 10^{-9} BER	850nm	110VDC power supply included	N/A	Mounting Flange	Stand alone	1×3×3	- suitable for star coupler (LAN) - Functions as DTE or DCE - 1 pair constitutes a set - available in rack mount version
Video Tx/Rx	5 Hz-9.5 MHz Bandwidth	EO 3601-1	RS-170	16 dB	−10 dBm	−32 dBm	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- AGC adjust on front panel - use with EO 3600 rack and EO 3617 double-bay power supply
Dual Channel RS-232	DC-100 Kb/s NRZ	EO 3604-1	RS-232	24 dB	−10 dBm	−34 dBm 10^{-9} BER	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- 2 independent RS-232 channels - Each functions as DTE or DCE - Use with EO 3600 rack and EO 3617 power supply
Dual Channel Video Tx	5 Hz-9.5 MHz Bandwidth	EO 3605-1	RS-170	N/A	−10 dBm	N/A	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- use with EO 3600 rack and EO 3617 power supply
Dual Channel Video Rx	5 Hz-9.5 MHz Bandwidth	EO 3607-1	RS-170	16 dB	N/A	−32 dBm	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- AGC adjustment on front panel/ range 8dB - use with EO 3600 rack and EO 3617 power supply
Dual Channel Digital Tx	DC-50 Mb/s NRZ	EO 3612-1	RS-422	N/A	−10 dBm	N/A	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- use with EO 3600 rack and EO 3617 power supply
Dual Channel Digital Rx	DC-12 Mb/s	EO 3613-1	RS-422	23 dB	N/A	−35 dBm 10−9BER	850nm	+/−12	N/A	rack mount	19" rack	4.6×6.7×1.6	- use with EO 3600 rack and EO 3617 power supply



FIBER OPTIC COMMUNICATIONS

FROM OPTO-HYBRIDS TO COMPLETE SYSTEMS

MERET, Inc., a leader in optical communications since 1975 offers a wide range of components, subsystem assemblies and complete turnkey systems for fiber optic communications

CCTV

FEATURES:
Small Hybrid Package
Simple Operation
High Density Packaging
Stand Alone AC Packaging

APPLICATIONS:
Surveillance
Security Networking
Robotics
Tele-Conferencing

Model	BW	Wavelength	Loss budget	Distance	SNR
284TV	6Hz-5MHz	820 nm	17 dB	4 km	46 dB
285TV	6Hz-10MHz	820 nm	13 dB	3 km	46 dB
28511TV	6Hz-10MHz	820 nm	20 dB	6 km	46 dB
213511TV	6Hz-10MHz	1300 nm	12 dB	10 km	46 dB
214511TV	6Hz-10MHz	1300 nm	21 dB	<20 km	46 dB

HI-RESOLUTION VIDEO

FEATURES:
Up to 120MHz Bandwidth
RGB on One Card
Automatic Gain Option
820nm or 1300nm Systems

APPLICATIONS:
Computer Graphics
Medical Imaging
Flight Simulation
Tempest Networks

Model	BW	Wavelength	Loss budget	Distance	SNR
288TV	6Hz-35MHz	820 nm	4 dB	1 km	46dB
28811TV	6Hz-35MHz	820 nm	14 dB	4 km	46dB
26811TV	6Hz-50MHz	820 nm	12 dB	3 km	46dB
26911TV	6Hz-120MHz	820 nm	7 dB	0.5km	46dB
213911TV	6Hz-120MHz	1300 nm	9 dB	5 km	46dB

ANALOG SYSTEMS

FEATURES:
Bandwidth to 1 GHz
LED or LASER Sources
Simple Operation
820 or 1300 nm
Rack Mount or Stand Alone Packaging

APPLICATIONS:
IF / RF Communications
Ultra-Hi Resolution Graphics
Instrumentation
EMP Testing
Satellite Entrance / Exit link

Model	BW	Wavelength	Loss budget	Distance	SNR
27020	10Hz-40kHz	820 nm	18 dB	4 km	60 dB
24802	DC-400kHz	820 nm	18 dB	6 km	60 dB
259-20	20Hz-140MHz	820 nm	1 dB	0.5 km	46 dB
2139-20	20Hz-140MHz	1300 nm	5 dB	5 km	44 dB
2149-400	20Hz-400MHz	1300 nm	9 † dB	10 km	48 dB
2149-1000	1kHz-1GHz	1300 nm	5 † dB	5 km	46 dB

DIGITAL SYSTEMS

FEATURES:
Data Rates to 150 MB / s
LED or LASER Sources
RZ or NRZ Capability
820 or 1300 nm
Easy Installation and Operation

APPLICATIONS:
Data Buses
Point to Point Links
Tactical Communications
Peripheral Remoting

Model	Data Rate	Wavelength	Loss Budget	Distance	BER
RS232-LS	DC-19.2 kB/s	820 nm	4 dB	1 km	10E -9
481	DC- 5 MB/s	820 nm	8 dB	2 km	10E -9
4811	DC-5 MB/s	820 nm	20 dB	5 km	10E -9
485	DC-10 MB/s	820 nm	4 dB	1 km	10E -9
4145-11	DC-20 MB/s	1300 nm†	50 dB	20 km	10E -9
4595	DC-150 MB/s	820nm	3 dB	0.5 km	10E -9

Military and Specialty Systems

- Ruggedized / Field Deployable / Hardened Systems
- Multi-Media - Digital & Analog Systems
- Battery Powered Transmitters
- Wavelength Division Multiplexing for Multiple Signals on One Fiber
- High Quality Video Plus Audio or Data on One Fiber (Model FM +1)

† on single mode fiber

all loss budgets are given for 50 μ fiber unless single mode (†) is specified

Turnkey Fiber Optic Systems

MERET can supply complete multi-channel systems in cage rack mount configurations. Using MERET hybrid modules, up to 24 channels of analog, video or digital data can be housed in a single standard 19- inch cage, together with all the necessary decoupling, power supplies, fuses, switches, indicators and alarms. Applications include multi-channel remote surveillance video systems with digital data links for camera control, data communications systems, RGB video with sync for computer graphics and CAD / CAM. MERET turnkey systems are supplied with ruggedized multi-channel cable. Field installation service and customer training are also available.

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FIBER OPTIC COMPONENTS

Active Devices

Avalanche Photo Diodes and Avalanche Photo Diode Modules

Device	Description	Wavelength (nm)	Quantum Efficiency (%) (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Dark Current (nA) (Max.)
NDL1102	Silicon Avalanche Photo Diode	850	65	10.0/10.0	1.0
NDL1202	Silicon Avalanche Photo Diode	850	70	1.0/1.0	1.0
NDL1202P	Silicon Avalanche Photo Diode with Fiber Pigtail	850	70	1.0/1.0	1.0
NDL5100	Germanium Avalanche Photo Diode	1300	75	0.2/0.4	500
NDL5100P	Germanium Avalanche Photo Diode with Fiber Pigtail	1300	75	0.2/0.4	500
NDL5102	Germanium Avalanche Photo Diode	1300	75	0.3/0.3	200
NDL5102P	Germanium Avalanche Photo Diode with Fiber Pigtail	1300	75	0.5/0.5	200
NDL5500	InGaAs Avalanche Photo Diode	1300/1550	80/70	0.3	100
OD8406	Silicon Avalanche Photo Diode Module	850	75	1.5/1.5	1.0
OD8409	Germanium Avalanche Photo Diode Module	1300	75	0.5/0.5	500
OD8412	Germanium Avalanche Photo Diode Module with Fiber Pigtail	850	75	1.5/1.5	1.0
OD8413	Germanium Avalanche Photo Diode Module with Fiber Pigtail	1300	75	0.5/0.5	500

PIN Photo Diode Modules

NDL2102	Silicon PIN Photo Diode	850	70	1.0/1.0	1.0
NDL2104	Silicon PIN Photo Diode	850	70	4.0/4.0	1.0
NDL2208	Silicon PIN Photo Diode	850	85	10.0/10.0	1.0
NDL5200	Germanium PIN Photo Diode	1300	75	1.5/1.5	1.0 μA
NDL5405	InGaAs PIN Photo Diode	1300/1550	80/70	0.3	3
OD8454	Silicon PIN Module	850	65	1.5/1.5	1.0
OD8456	Silicon PIN Module—Plastic	850	85	10.0/10.0	1.0
OD8457	Silicon PIN Module with Fiber Pigtail	850	65	1.5/1.5	1.0

Light Emitting Diodes and LED Modules

Device	Description	Wavelength (nm) (Typ.)	Optical Power Output (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Spectral Half Width (nm) (Max.)
NDL4103A	AlGaAs LED	850	2.0 mW	10.0/10.0	50
NDL4103P	AlGaAs LED with Fiber Pigtail	850	50μW	10.0/10.0	50
NDL4105A	AlGaAs LED	850	3.5 mW		50
NDL4105B	AlGaAs LED	850	55μW		50
NDL4105-78	AlGaAs LED	780	3.5 mW		50
NDL4105-88	AlGaAs LED	880	3.5 mW		50
NDL4201A	AlGaAs LED	850	1.0 mW		50
NDL5201B	AlGaAs LED with Ball Lens	850	15 μW	10/10	50
NDL5300	InGaAsP LED	1300	0.6 mW	12.0/12.0	140
NDL5300P	InGaAsP LED with Fiber Pigtail	1300	30 μW	12.0/12.0	140
NDL5302	InGaAsP LED	1300	25 μW	3.0/4.0	150
NDL5302P	InGaAsP LED with Fiber Pigtail	1300	25 μW	3.0/4.0	150
NDL5303P	InGaAsP LED Module with Fiber Pigtail	1300	25 μW	2.0/3.0	150
OD8358	InGaAsP LED Module	770–890	80 μW	15.0/15.0	50
OD8363	InGaAsP LED Module	1300	25 μW	12.0/12.0	140
OD8364	AlGaAs LED Module—Plastic	865	30 μW	15.0/15.0	50
OD8365	AlGaAs LED Module with Fiber Pigtail	770-890	100 μW	15.0/15.0	50
OD8366	InGaAsP LED Module with Fiber Pigtail	1300	25 μW	12.0/12.0	140

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FIBER OPTIC COMPONENTS

Active Devices

Laser Diodes and Laser Diode Modules

Device	Description	Wavelength (nm) (Typ.)	Output Power (mW) (Typ.)	Threshold Current (mA) (Typ.)	Rise Time/ Fall Time (ns) (Typ.)	Operating Temperature
NDL5003	InGaAsP Laser Diode	1300	8.0	20	1.0/1.0	-40 to +70°C
NDL5003C	InGaAsP Laser Diode	1300	8.0	20	1.0/1.0	-40 to +70°C
NDL5004	InGaAsP Laser Diode	1300	5.0	20	1.0/1.0	-40 to +70°C
NDL5004P	InGaAsP Laser Module with Fiber Pigtail	1300	2.5	20	1.0/1.0	-20 to +65°C
NDL5005P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	-20 to +65°C
NDL5006P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	-20 to +65°C
NDL5007P	InGaAsP Laser Diode with Fiber Pigtail	1300	3.0	20	1.0/1.0	-20 to +65°C
NDL5008	InGaAsP Laser Diode	1200	7.0	25	1.0/1.0	-40 to +70°C
NDL5011P	In GaAsP Laser Diode with Fiber Pigtail	1200	2.5	25	1.0/1.0	-20 to +60°C
NDL5017P	InGaAsP Laser Diode with Single Mode Fiber Pigtail	1300	1.5	20	1.0/1.0	-20 to +65°C
NDL5018P	InGaAsP Laser Diode with Single Mode Fiber Pigtail	1300	1.5	20	0.2/0.3	-5 to +65°C
NDL5019P	InGaAsP Laser Diode with Single Mode Fiber Pigtail	1300	1.5	20	0.2/0.3	-5 to +65°C
NDL5050A	InGaAsP Laser Diode	1550	5.0	35	0.5/0.5	-40 to +70°C
OD8325	AlGaAs LD Module with Fiber Pigtail	*	1.0	20	0.5/0.5	-10 to +60°C
OD8326	InGaAs LD Module with Fiber Pigtail	*	1.5	20	0.5/0.5	-10 to +50°C
OD8328	InGaAsP LD Module with Single Mode Fiber Pigtail	1300	1.3	20	0.5/0.5	-10 to +50°C

*Contact Manufacturer

Passive Devices

Optical Isolators

Device	Description	Center Wavelength (nm)	Isolation (dB) (Typ.)	Attenuation (dB) (Typ.)	Insertion Loss (dB) (Typ.)	Splitting Ratio
OD8312	Optical Isolator	850	>25		<1.5	
OD8313B	Optical Isolator	1300	>20		<1.5	
OD8313C	Optical Isolator	1550	>20		<1.5	

Attenuators

OD8501	Stop Optical Attenuator	850, 1300		3.0-5.0	3.0	
OD8511	Continuous Optical Attenuator, Multimode Fiber	850, 1300		0-65	<3.0	
OD8511DSB	Continuous Optical Attenuator, Single Mode Fiber	1300		0-60	<5.5	
OD8530	Optical Attenuator, Programmable	850, 1300, 1550		0-59	<2.0	
OD8550	Fixed Optical Attenuator	850, 1300		3.0-40	Included	
OD9701	Fixed Optical Attenuator	850, 1300		3.0-30	Included	
OD9704	SM Fixed Optical Attenuator	1300		5.0-20	Included	

Couplers

OD8601	Optical Directional Coupler 3-port	850, 1300	15 @ 1:1 30 @ 10:1 30 @ 100:1		<2	1:1 10:1 100:1
OD8605	Optical Directional Coupler with Fiber Pigtails, 3-port	1300	>35		<1.5	1:1 10:1

Line Monitor/Band Pass Filter

OD8650	Line Monitor	850			<5	1:1, 10:1, 100:1
OD8670	Optical Band Pass Filter	850/1300			<3.5	

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FIBER OPTIC COMPONENTS

Passive Devices

Switches

Devices	Description	Center Wavelength (nm)	Repeatability (Typ.)	Rise/Fall Time (Typ.)	Insertion Loss (dB) (Typ.)
OD8752	1-2 Optical Switch	850, 1300	0.03	2	1.2
OD8764	1-2 Optical Switch	850, 1300	0.04	4	1.6

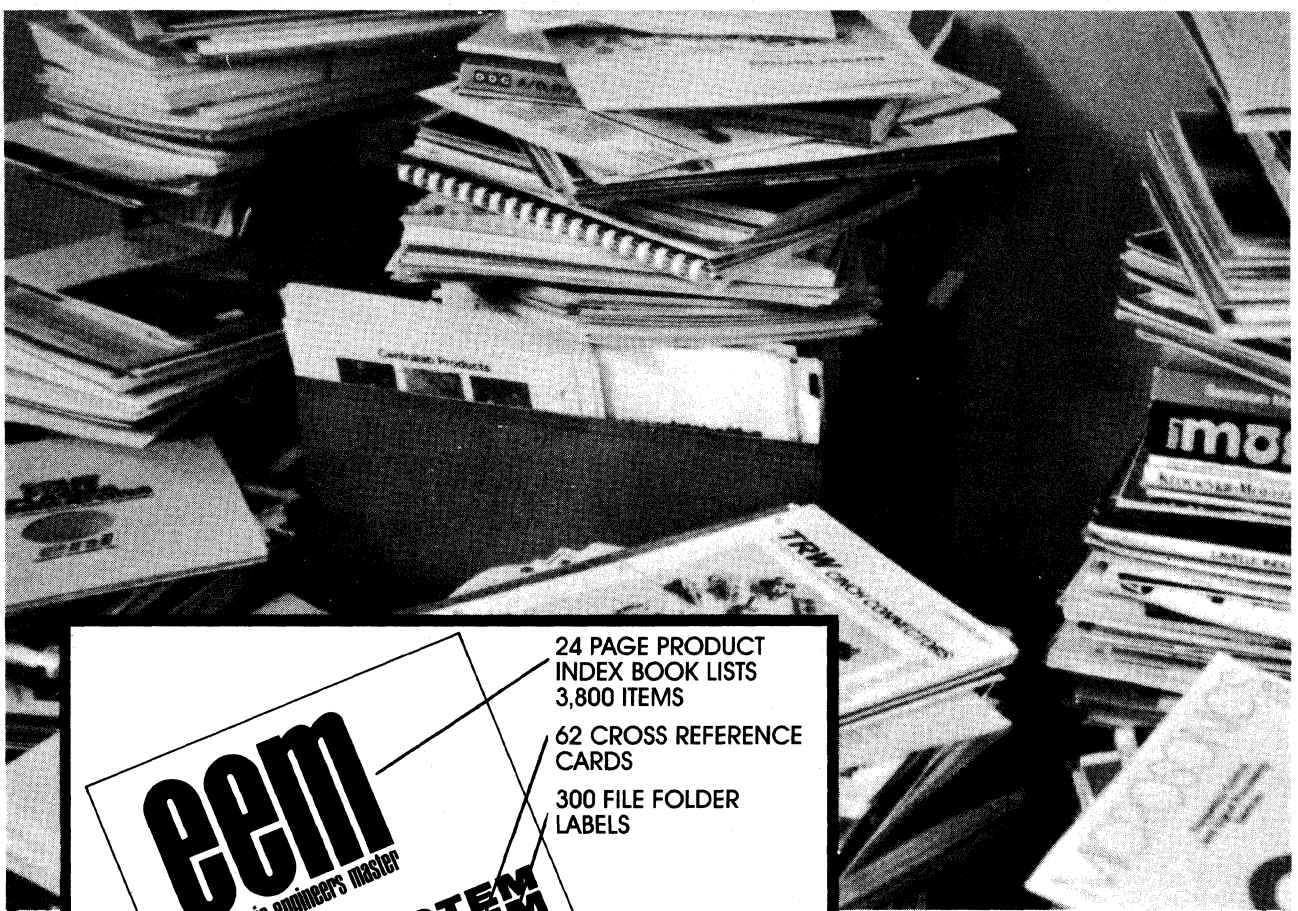
Connectors

Device*	Description	Mode Single Mode—SM Multi-Mode—MM	Inner Diameter Range	Connecting Loss (dB)	Application	
					Field Assy	Factory Assy
OD9311	FC Ferrule	MM	0.123 to 0.129 mm		X	
OD9312	D3 Ferrule and Housing	SM	0.123 to 0.129 mm		X	
OD9313	D3 Ferrule and Housing	MM	0.123 to 0.129 mm		X	
OD9314	FC Ferrule	SM	0.123 to 0.129 mm		X	
OD9321	FC Ferrule Housing	MM			X	
OD9324	FC Ferrule Housing	SM			X	
OD9370	FC Fiber Pigtail or Patchcord	MM		<0.7		X
OD9371	FC Fiber Pigtail or Patchcord	SM		<0.7		X
OD9373	D3 Fiber Pigtail or Patchcord	MM		<0.7		X
OD9374	D3 Fiber Pigtail or Patchcord	SM		<1.0		X
OD9380	D3 or FC Through Adapter	MM				X
OD9384	D3 or FC Through Adapter	SM				X
OD9390	D3 or FC Receptacle	MM				X
OD9411	D4 Ferrule	MM	0.125 to 0.150 nom.	<0.7	X	
OD9414	D4 Ferrule	SM	0.123 to 0.129 mm	<1.0	X	
OD9506	Plastic FOC Terminating Kit (D4)	MM			X	
OD9508	Plastic FOC Terminating Kit (Snap-On)	MM			X	
OD9416	Plastic Ferrule and Housing	MM	0.125, 0.140, 0.250		X	
OD9418	Plastic Snap-On Terminal and Housing	MM	0.125, 0.140, 0.250		X	
OD9420	D4 Ferrule Housing	MM			X	
OD9424	D4 Ferrule Housing	SM			X	
OD9470	D4 Fiber Pigtail or Patchcord	MM		<0.7		X
OD9474	D4 Fiber Pigtail or Patchcord	SM		<1.0		X
OD9476	Fiber Pigtail or Patchcord—Plastic Snap-on Conn.	MM		<1.0	X	
OD9478	Fiber Pigtail or Patchcord—Plastic Snap-on Conn.	MM		<1.0	X	
OD9480	D4 Through Adapter	MM				
OD9484	D4 Through Adapter	SM				
OD9488	Through Adapter—Plastic Snap-on	MM				
OD9490	D4 Receptacle	MM				
OD9498	Receptacle—Plastic Snap-on	MM				
OD9500	FOC Terminating Kit D4 Conn.	MM			X	
OD9506	Plastic FOC Terminating Kit (D4)	MM			X	
OD9508	Plastic FOC Terminating Kit (Snap-on)	MM			X	
OD9610	Portable Polishing Equipment				X	X
OD9620	Resin Curing Instrument				X	X

*See product data sheets for ordering information. Complete P/N for cable assembly may include up to 6 extra digits for specifying pigtail or patchcord, length of fiber, size of fiber and source for fiber (NEC a customer). Complete P/N for separate connectors for field assembly may include extra digits for specifying inner diameter of ferrule to match customer's fiber size.

Data Links

Device	Description	Light Source	Bit Rate (NRZ)	Rise Time/ Fall Time (ns) (Typ.)	Operating Temperature
ODN0101T&R	Neolink	LED	DC-1 Mb/s	200/100	0 to +50°C
ODN0201T&R	Neolink	LED	DC-2 Mb/s	40	0 to +50°C
ODN0301T&R	Neolink	LED	DC-3 Mb/s	10	0 to +50°C
ODN3501T&R	Neolink	LED	DC-35 Mb/s	10	0 to +70°C
ODN2011T&R	Neolink	LED	50-200 Mb/s	2/3	+10 to +50°C
ODN02B1	RS232C/Neolink	LED	DC-20 Kb/s		0 to +50°C



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MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

SHARP®
Optoelectronics

Laser Diodes

Laser Diodes

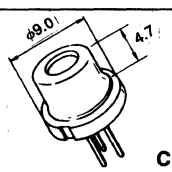
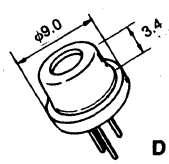
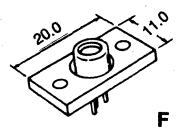
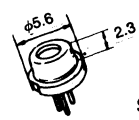
Sharp's laser diodes use a double hetero junction of gallium, aluminum and arsenide compound (GaAlAs). Long life and high reliability are realized by use of our original VSIS structure (V-channeled Substrate Inner Stripe).

Features

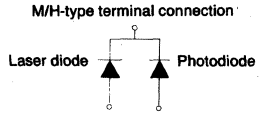
- High power type, low noise type, wide temperature ranges and short wavelength type are included in the scope of products.
- High precision package. PIN photodiodes are built in, and optical power output control is easy.
- The line-up is full, from the ultra compact (ϕ5.6 mm packages) type to the single positive power supply p/w type.
- Long life, high reliability.
- Stable single transverse mode, low threshold current.

	Model No.	Wavelength (nm)	Optical power output (mW) TYP.	Optical power output (mW) MAX.	Features	Main applications
	LT030 Series	750	3	5	Short wavelength	High-speed laser printers, Bar code readers
NEW	LT031 Series		7	10	Short wavelength	High-speed laser printers
	LT020MC	780	3	5	General use	Measuring instruments, Bar code readers
	LT021 Series		10	15	High power	High-speed laser printers, Medical apparatus
	LT022 Series		3	5	Low noise	CD-ROMs, Fiber Optic Communication
	LT023 Series		3	5	Low noise (Multi-mode)	VD players, Analog devices, Fiber Optic Communication
NEW	LT022/023 WIDE TEMP. Series		3	5	Low noise Wide Temperature (−30 to 85°C)	Fiber Optic Communication Factory Automation Equipment
	LT024 Series		20	30	High power	Optical disk memories, Magneto-optical disk systems
	LT026 Series		3	5	Small astigmatism	General use laser printers
	LT027 Series		7	10	General use	Medium-speed laser printers
NEW	LT080MD		3	5	Stabilized wavelength	Measuring instruments, Laser printers, Bar code readers
NEW	LT091MD		14	20	2 channels*	High speed laser printers
	LT010 Series	810	3	5	General use	Measuring instruments, Fiber Optic Communications
NEW	LT016 Series		30	40	High power	YAG laser excitation, Optical disk memories, Magneto-optical disk systems
	LT015 Series	830	30	40	High power	Optical disk memories, Optical memory cards, Medical Apparatus
	LT090 Series		80	100	High power (3 channels)	Medical apparatus, Optical range finders
NEW	LT011MS	840	3	5	Long wavelength	Fiber Optic communications

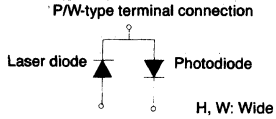
*Independent channel control

Package (mm) Wavelength (nm)	Maximum optical power output (mW)	 C	 D	 F	 S
750	5	—	LT030MD	LT030MF	—
	10	—	LT031MD	LT031MF	—
780	5	LT020MC	—	—	—
	15	LT021MC	LT021MD	LT021MF	—
	5	LT022HC/MC	LT022MD/PD/WD	LT022MF	LT022HS/MS/WS/PS
		LT023MC	LT023MD	LT023MF	LT023HS/MS/WS/PS
	30	—	LT024MD/PD	LT024MF	—
	5	—	LT026MD	LT026MF	LT026MS/PS
	10	—	LT027MD	LT027MF	—
	5	—	LT080MD	—	—
	20	—	LT091MD	—	—
810	5	LT010MC	LT010MD	LT010MF	—
	40	—	LT016MD	LT016MF	—
830	40	—	LT015MD/PD	LT015MF	—
	100	—	LT090MD	LT090MF	—
840	5	—	—	—	LT011MS

M/H-type terminal connection



P/W-type terminal connection



H, W: Wide Temperature Version

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SHARP Optoelectronics

Fiber Optic Data Link/ Laser Receptacle/Photodiode Receptacle

Fiber optic data link

	Model No.	GP0F200
Description	Transmitter	LT022PS (780nm, MAX5mW)
	Receiver	PIN photodiode
	Fiber	Plastic fiber (1mmϕ)
	Feature	Bidirectional type High-speed 32Mb/s transmission Single 5V power supply

Laser diodes with high frequency modulator*

	Model No.	LT015R10	LT024R10
Description	Laser diode	LT015MD (830nm, MAX 40mW)	LT024MD (780nm, MAX 30mW)
	S/N	MIN. 65dB, TYP. 80dB	
	Oscillation frequency	TYP. 250MHz	
	Supply voltage	+ 5V (High frequency modulator)	
	Power consumption	MAX 50mA (High frequency modulator)	

*For laser noise reduction in optical memory application.

Laser receptacle

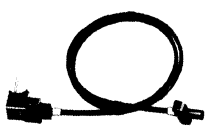
	Model No.	GP0F50T
Description	Laser diode	LT022MS (780nm)
	Connector	FC type
	Light output	MAX. 0.25mW (*)

* Initial value. From the end of fiber (GI 50/125, length = 1m, the other end is conneted to this receptacle)

Photodiode receptacle

	Model No.	GP0F50R
Description	Photodiode	PIN photodiode
	Connector	FC type
	Sensitivity	TYP. 0.3mA/mW (*)

* Initial value. V_R = 5V, P_{IN} = 0.1mW, λ = 780nm.


GP2FD01

GP1F100

GP1F200

GP1F110

Fiber Optic Sensor

(Ta = 25°C)

Model No.	Type	Fiber length (m)	Absolute maximum ratings: Forward current I_F (mA)	Power dissipation P (mW)	Operating temperature Topr (°C)	Electro-optical characteristics: Current transfer ratio: Collector current I_C(μA)	I_F (mA)	V_{CE} (V)	Response Time: t_r (μs) TYP.	t_f (μs) TYP.	I_C (μA)	R_L (Ω)	V_{CE} (V)
GP2FD01	Reflective Uni-directional	0.5MAX	50	75	0 ~ +50	14MIU	20	10	130	120	30	1,000	2

Fiber Optic Data Links

(Ta = 25°C)

Model No.	Type	Fiber length (m)	Absolute maximum ratings: Forward current I_F (mA)	Low level output current I_{OL} (mA)	Operating temperature Topr (°C)	Electro-optical characteristics: Low level output voltage: V_{OL} (V) MAX.	I_{OL} (mA)	V_{CC} (V)	I_F (mA)	Transmission speed (Rz symbol): f_D (kb/s) MIN.	I_F (mA)	V_{CC} (V)	Transmission time: t_{PLH} (μs) TYP.	t_{PLH} (μs) TYP.	I_F (mA)	V_{CC} (V)	R_L (Ω)
GP1F100	Uni-directional	1.5	50	50	−20 ~ +70	0.4	16	5	0	20	7	5	3	4	7	5	280
GP1F200	Bi-directional	1.5	50	50	−20 ~ +70	0.4	16	5	0	20	7	5	3	4	7	5	280

High Speed Transmission Fiber Optic Data Link

(Ta = 25°C)

Model No.	Type	Fiber length (m)	Absolute maximum ratings: Transmitter: Forward current I_F (mA)	Receiver: Reverse voltage V_R (V)	Operating temperature Topr (°C)	Electro-optical characteristics: Transmitter: I_F (mA)	Receiver: Peak sensitivity wavelength λ_P (mm) TYP.	Short circuit current I_{SC} (μA) MIN.	Fiber: Trans. rate T (Op) MIN.	I_F (mA) MIN.	Transmission speed f_D (Mb/s) MAX.
GP1F110	Uni-directional	1.0	50	20	−10 ~ +70	24	20	920	6.8	20	20	4

This list below shows the combination of standard models with component parts (transmitter module, receiver module fiber optic cable) of Fiber Optic Data Links.

(Uni-directional type)

Kit No.	Fiber Optic Cable: Cable No.	Length of cable (m)	Q'ty. (pcs)	Transmitter module: Model No.	Q'ty. (pcs)	Receiver module: Model No.	Q'ty. (pcs)
GP1F100A	GP1C100A	0.5	1	GP1F01T	1	GP1F01R	1
GP1F100B	GP1C101	1.0	1	GP1F01T	1	GP1F01R	1
GP1F100	GP1C101A	1.5	1	GP1F01T	1	GP1F01R	1
GP1F100D	GP1C102	2.0	1	GP1F01T	1	GP1F01R	1
GP1F100E	GP1C102A	2.5	1	GP1F01T	1	GP1F01R	1
GP1F100F	GP1C103	3.0	1	GP1F01T	1	GP1F01R	1
GP1F100G	GP1C103A	3.5	1	GP1F01T	1	GP1F01R	1
GP1F100H	GP1C104	4.0	1	GP1F01T	1	GP1F01R	1
GP1F100I	GP1C104A	4.5	1	GP1F01T	1	GP1F01R	1
GP1F100J	GP1C105	5.0	1	GP1F01T	1	GP1F01R	1
GP1F110	GP1C111	1.0	1	GP1F10T	1	GP1F10R	1

(Bi-directional type)

Kit No.	Fiber Optic Cable: Cable No.	Length of cable (m)	Q'ty. (pcs)	Transmitter-receiver module: Model No.	Q'ty. (pcs)
GP1F200A	GP1C200A	0.5	1	GP1F01D	2
GP1F200B	GP1C201	1.0	1	GP1F01D	2
GP1F200	GP1C201A	1.5	1	GP1F01D	2
GP1F200D	GP1C202	2.0	1	GP1F01D	2
GP1F200E	GP1C202A	2.5	1	GP1F01D	2
GP1F200F	GP1C203	3.0	1	GP1F01D	2
GP1F200G	GP1C203A	3.5	1	GP1F01D	2
GP1F200H	GP1C204	4.0	1	GP1F01D	2
GP1F200I	GP1C204A	4.5	1	GP1F01D	2
GP1F200J	GP1C205	5.0	1	GP1F01D	2

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- Patented and Licensed the World Over.

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  - .1-30 W continuous output power
  - .01-7.09 oz -in. max. continuous torque
  - Speeds up to 16,000 RPM.
- **PMDC motors:**
  - 4-430 W continuous output power
  - .91-415 oz-in. max. continuous torque
  - Custom windings available up to 180 VDC.
  - Speeds up to 6,000 RPM.
- **Precision gearheads:**
  - Diameters from 10mm-120mm (.39-4.72 in.)
  - Continuous output torque to 96 ft-lb.
  - Bidirectional operation in ratios up to 1,000,000:1

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- Tacho-Generators ..... See **D**•4900 p. **D**•2174
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- Magnetic Encoders ..... See **B**•5500 p. **B**•1898
- Precision Gearheads ..... See **B**•3500 p. **B**•1236, 1237
- Motor-Tachometers ..... See page **D**•4900 p. **D**•2174
- Shaft Couplings ..... See **D**•4900 p. **D**•2174
- Zero Back Lash Gearing ..... See **B**•3500 p. **B**•1236
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DC ROTARY CONTINUOUS

Manufacturer	Starting EEM Page No.	Volts, DC		Reduction X:1		Torque, Oz. In.		Speed, RPM		Output, HP		Output, Watts	
		Min	Max	Min	Max	Min	Max	Min	Max	Min	Max	Min.	Max
BRUSHLESS, DIRECT DRIVE													
Aeroflex	B•1184	5	280			.2	1,000	.200	1000,000	.0002	5	.15	3730
Airpax	B•1192	12	30										
Axial Magnetics	B•1195	6	50			1.0	400.0	25	4000				
Clifton Precision/Litton	B•1200					90	3500						
Eastern Air Devices	B•1202	4.4	350			.1	3200	100	100K	.01	3.0	5	2500
Hathaway Motors	B•1213												
Industrial Drives	B•1218								7500	7.5	30		
Maxon Precision	B•1232												
Micro Mo	B•1234					51	284		7000				
MFM	B•1233												
Motor Technology	B•1239									.001	.75		
Novatronics	B•1243												
Pittman	B•1247												
SAIA.Inc.	B•1252												
Shinano Kenshi	B•1255												
Sierracin/Magnedyne	B•1256												
Stock Drive Products	B•1259	1.2	36				25.5						
Synektron	B•1264	9	20			2.3	292		6200			6.5	132
Vernitron	B•1268	0	60			1	4000					101	500
BRUSHLESS, REDUCTION DRIVE													
Airpax	B•1192	6	24					8.2	330				
Bodine Electric	B•1197												
Canon, U.S.A.	B•1199	6	24	5	3000			1.3	830				
Eastern Air Devices	B•1202	4.4	350	3	3600	.4	640	.1	600	.001	.007	.1	4.8
Maxon Precision	B•1232												
MFM	B•1233												
Micro Mo	B•1234			8.3:1	242.9:1								
Motor Technology	B•1239									.oo1	.75		
Pittman	B•1247												
Stock Drive	B•1259	2	4	3.67	2430		0.072		7200				
BRUSH TYPE, DIRECT DRIVE													
Barber Colman	B•1196	6	42			2	120	1000	10000	1mHp	33mHp	1	25
Crouzet Controls	B•1201	12	48			5	43	2000	3000	1/64	1/3	10	25
Hathaway Motors	B•1213												
Industrial Drives	B•1218								6000				
Mabuchi	B•1231	1	24			0.089	6.76						
Maxon	B•1232												
Micro Mo	B•1234	1.5	180				415	1500	20.3K	.00015	4.62	.11	3442
BRUSH TYPE, REDUCTION DRIVE													
Barber-Coleman	B•1196	6	42	2.5	2800	10	3200	1	5000	1mHp	33mHp	1	25
Bodine	B•1197	10	30										
Brevel	B•1198		12	16.5	762			4.5	183.0				
Crouzet Controls	B•1201	12	48	25	626	125	5000	3	120	1/64	1/16	10	46
Maxon	B•1232												
Micro Mo	B•1234	1.5	180		1000K	0.71	45.3K	.006	4710				
Pittman	B•1247			4.2	31104:2								
TORQUE, DIRECT DRIVE													
Aeroflex	B•1184	4	60			1	6720					20	580
Barber-Coleman	B•1196	6	42	2.5	2800	2	120	1000	10000	1mHp	33mHp	1	25
Bodine Electric	B•1197												
Clifton Precision	B•1200					6.00	2700						
MFM	B•1233												
Sierracin/Magnedyne	B•1256												

AC ROTARY, CONTINUOUS ROTATION

Manufacturer	Starting EEM Page No.	Phase 1	2	3	Volts, AC Min.	Max.	Freq. Hz. Min.	Max.	Input, Watts Min.	Max.	Torque, Oz. In. Min.	Max.	Output, RPM Min.	Max	Ratio, X:1 Min.	Max,	Rated HP Min.	Max.
INDUCTION																		
Aeroflex	B•1184	¤	¤	¤	24	208	50	400	5	498	.65	100	1250	10,500				1/3
Axial Magnetics	B•1195	¤			115	230	50	60	25	300	1.0	50.0		3600				
Barber-Colman	B•1196	¤	¤		3	240	50	60	.1	220	.2	50	2400	3200			4mHp	33mHp
Eastern Air Devices	B•1202	¤	¤	¤		440	50	400					450	20,000			.001	3
Industrial Drives	B•1218			¤										6000				
Oriental Motors	B•1245					115		60			.46	53	1200	1550	3	180		
Shinano Kenshi	B•1255	¤			120	220	50	60										
Stock Drive Products	B•1259						50	60										
Vernitech	B•1267	¤	¤	¤	18	220	60	1800	.5	100	.03	50	1400	20,000			1/1000	1/50
SYNCHRONOUS																		
Aeroflex	B•1184	¤	¤	¤	26	220	50	400	3.5	900	.07	200	600	24,000			1/2500	2/3
Airpax	B•1192				24	230	50	60			.75	1.1	1	720				
Bodine	B•1197																	
Crouzet	B•1201	¤			12	240	50	60	2.5	8	1	15	300	720	4.7	1,036,800		
Eastern Air Dvcs.	B•1202	¤	¤	¤		440	50	400					600	12000			.001	1.0'
Industrial Drives	B•1218													60,000				
Novatronics of Canada	B•1243						60	400										
Oriental Motors	B•1245														3	180		
SAIA Inc.	B•1252				6	240	50	60	1.3	3.5			250	600				
Stock Drive Products	B•1259						50	60										
Superior	B•1260	¤		¤	100	240	10	400			25.00	1800	72	200	3:1	125:1	Frctl	Frctl
Vernitech	B•1267	¤	¤	¤	18	220	60	1800	,5	100	,03	50	1400	20,000			1/1000	1/50
TORQUE																		
Barber-Colman	B•1196	¤	¤		3	240	50	60	.1	220	.2	50	1	1600	2.5	2800	4mhp	33mhp
Bodine Electric	B•1197																	
Eastern Air Devices	B•1202	¤	¤	¤		440	50	400			.5	200	0	6000				
Oriental Motors	B•1245														3	180		

DC STEPPER

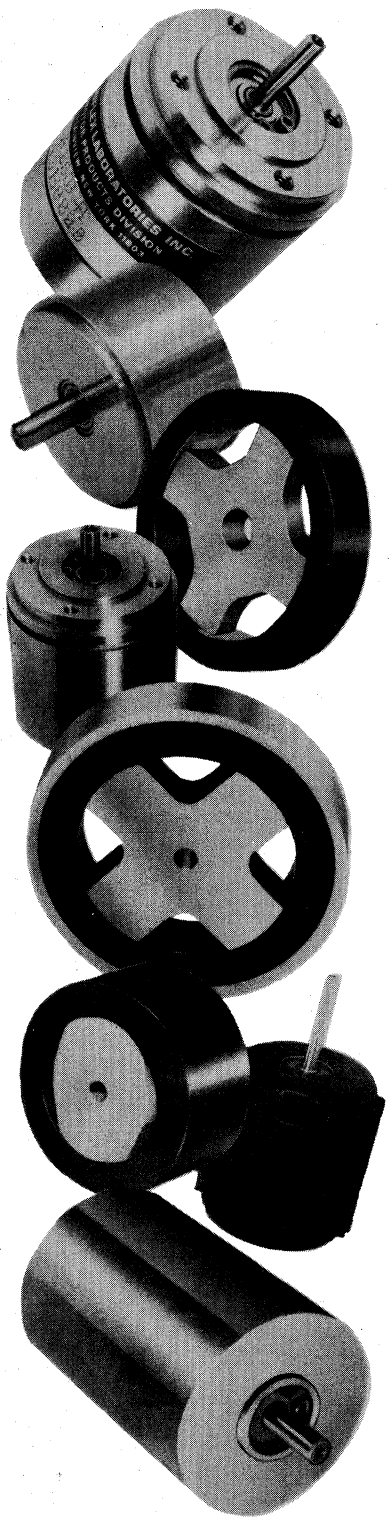
Manufacturer	Starting EEM Page No.	Volts, DC Min.	Mx.	Holding Torque Oz. In. Min.	Mx.	Dynamic Torque Oz. In. Min	Max	Degrees/Step Min	Mx.	Response Steps/Sec. Min.	Max
ROTARY											
Airpax	B•1192	5	12	1	46			7.5	18		
Bodine	B•1197										
Canon	B•1199							0.9	15		
Clifton Precision	B•1200							1.8°	120°		
Crouzet	B•1201	5	42	2.8	42.5	.25	22	7.5	15	1/2	2000
Eastern Air Devices.	B•1202	1.3	120	1	1150	1	900	1.80	90	0	20,000
Hathaway Motors	B•1213										
Inland Motor	B•1214	2	24	1.1	140			1.8	15	0	10K
Industrial Drives	B•1218										
Micro Mo	B•1234	5	5	.20	.25			18	18	500	1200
NMB Technologies	B•1242	3	24	10	1,000			0,9	18		
Novatronics	B•1243							15	90		
Oriental Motors	B•1245	1.4	24	15.3	306			0.45	1.8		
SAIA, Inc.	B•1252			1.42	11.644			7.5	15		
Shinano Kenshi	B•1255							0.9	3.75		
Stock Drive Products	B•1259	1.8	24					7.5°	15°		
Superior	B•1260	<.8	15	35	5500	35	5200	1.8	1.8		
SuperVexta	B•1263			25	300			.9	1.8		
Vernitech	B•1267	6	40	.5	5.0	.1	4.0	15	90	100	800

DC, SERVO, ROTARY

Manufacturer	Starting EEM Page	Volts, DC Min	Volts, DC Max	Torque Oz. In. Min	Torque Oz. In. Max.	Speed, RPM Min	Speed, RPM Max.
DIRECT DRIVE							
Barber-Colman	B•1196	6	42	2	120	1000	10,000
Clifton Precision	B•1200			2	50		
Eltrol	B•1203						
Hathaway	B•1213						
Industrial Drives	B•1218						
Maxon Precision	B•1232						
MFM	B•1233					2	12,000
Micro Mo	B•1234	1.5	180	.7	45000	1	8000
Motor Technology	B•1239						
Pittman	B•1247		40	12	286		25,000
REDUCTION DRIVE							
Barber-Colman	B•1196	6	42	10	3200	1	5000
MFM	B•1233						
Micro Mo	B•1234						
Motor Technology	B•1239						
Pittman	B•1247				160		

SLIP RINGS

Manufacturer	Page No	Capsule Slip Rings	Power Capsule Slip Rings	Power Slip Rings	Power Cartridge Type Brushes	General Purpose Slip Rings	Flat Slip Ring Assemblies	Pancake Slip Rings	Separate Rotors & Brush Blocks	Vehicle Slip Rings	Rotary Switches	Encoders	Motorized Potentiometers
Airflyte	B•1186	¤	¤	¤	¤				¤	¤	¤	¤	
Clifton Precision	B•1200											¤	
ETI Systems	B•1205												¤
Fabricast	B•1206	¤		¤			¤	¤	¤				
Graphite Metallizing	B•1212			¤	¤	¤	¤	¤	¤				
Litton Poly-Scientific	B•1221	¤	¤			¤	¤	¤	¤	¤			
Maxon Precision	B•1232											¤	
Servo-Tek	B•1254											¤	
Sierracin/ Magnedyne	B•1256											¤	
Vernitech	B•1267											¤	¤



Aeroflex *brushless dc motors and torquers*

We're more than just a motor company

State-of-the-art design backed by 25 years of engineering and field experience . . . Aeroflex motors and torquers are working, accurately and reliably, in the most difficult military, aerospace and industrial applications. Time and again they have proven how well they can perform in hostile environments on land, sea or in the air . . . in outer space or in the ocean's depths.

Aeroflex fractional and subfractional H.P. brushless D.C. motors offer equal — or better — performance than brush motors, with no compromise in size. They are ideal for those special applications where environment, service life or other brush motor limitations cannot be tolerated. Their high torque-to-inertia ratios, excellent heat transfer characteristics, high efficiencies (75%) and freedom from downtime make them a cost effective choice.

Aeroflex torquers are designed and built for the same demanding kind of use. They're available from 1" O.D. to 24" O.D. in torques from tenths of an oz.-in. to hundreds of ft.-lbs. With designs like this in stock, it's usually a simple matter to meet your application needs.

Should you require a special motor or torquer, we'll work to your specification or help you develop one that meets your need. We can also help you with the electronic drive interface, or even provide the complete electronic/motor assembly.

We're more than just a motor company.

MAGNETIC PRODUCTS DIVISION
AEROFLEX LABORATORIES INC.
SOUTH SERVICE ROAD • PLAINVIEW, LONG ISLAND, N. Y. 11803
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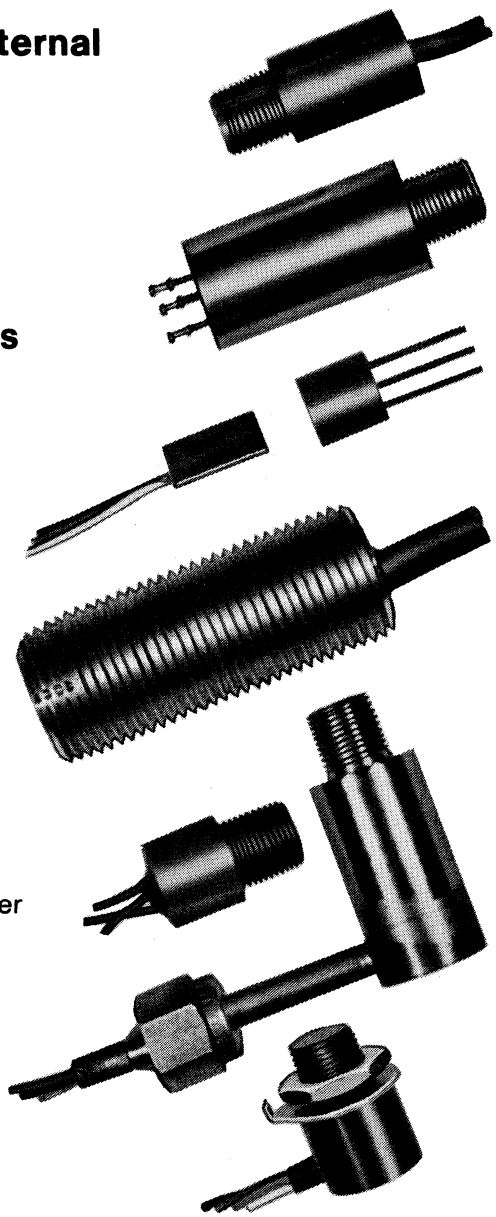
Speed-Independent Magnetic Pick-ups

Their output voltage amplitudes are totally independent of the rate of change to the external magnetic field. They provide

- **True zero speed sensing**
- **Contactless limit switches**
- **Translational and rotational velocity, direction and position sensing**
- **Counting, indexing, and timing functions**



Benefits:

- Simplify designs
- Low power consumption
- Rugged enough for engine environments
- Aerospace reliability
- Operate from logic power bus
- Freedom from EMI (no choppers or oscillators)
- Freedom from actuator mechanisms
- Can replace optical systems

Applications:

Computer peripherals—sensing of indexing marks for drive mechanisms in card readers / magnetic tape memories / paper roll drive, and character selection in printers

Transportation—wheel speed sensing (skid-controlled braking) / ignition system timing / vehicle sensing (traffic control)

Industrial — speed, position and limit sensing

Aerospace — wide applications

Other Products:

Solid state current sensors /
as well as brushless DC Motors, Torques and Drive Electronics.

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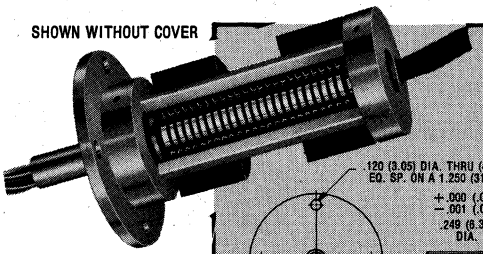
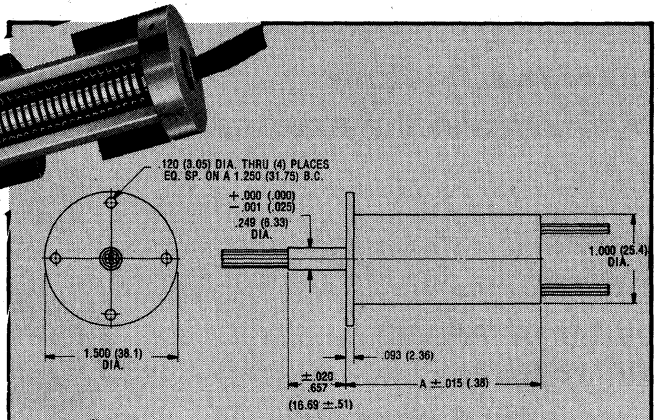
Airflyte ELECTRONICS CO.

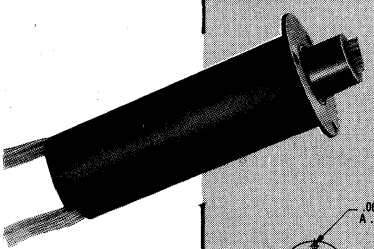
CAPSULE SLIP RING ASSEMBLIES

SHOWN WITHOUT COVER



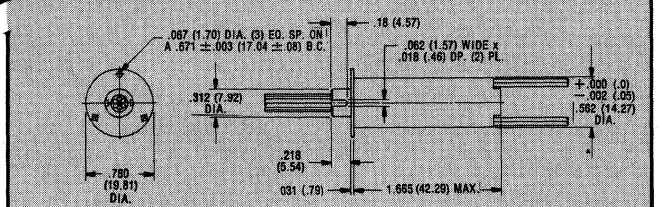
CAY-110
UP TO **30** RINGS

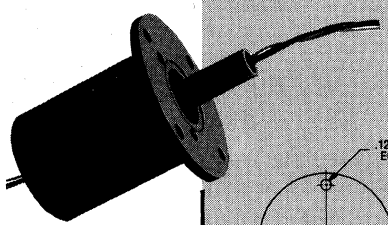




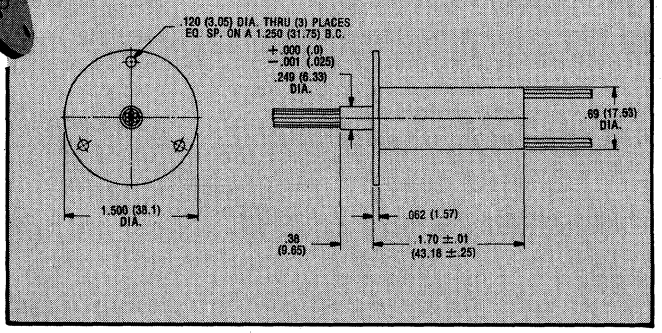
No. of Rings	Inches "A"	Milli-Meters
4-12	1.48	37.6
13-24	2.20	55.9
25-30	2.56	65.0

CAY-604
UP TO **40** RINGS





CAY-245
UP TO **20** RINGS



These Slip Ring Assemblies have found wide use in gyro gimbal and instrument applications. The fully enclosed and tested assemblies feature fine diameter gold alloy brushes mated to compatible gold alloy rings for excellent noise characteristics at low torque levels. Although miniature in size, the assemblies are surprisingly rugged and are able to withstand most military environmental specifications.

Units have been fully tested to the environmental parameters listed below, proving their ruggedness and reliability. All units are factory tested before shipment and a copy of the test data is available with each unit upon request.

The units shown here are only a sample of those available which include a 50 ring capsule of .685 diameter.

SPECIFICATIONS

MECHANICAL

1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Stainless steel
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

ELECTRICAL

1. Current: Signal level to 1 amp maximum
2. Voltage: Micro-volts to 110 volts rms
3. Dielectric Strength: 500 volts rms (all combinations)
4. Leadwire: #30 AWG teflon insulated, 15″ long minimum
5. Noise: ±5 micro-volts per ma

ENVIRONMENTAL

1. Temperature Shock: +85°C for 1 hour and immediately transferred to −55°C for 1 hour
2. Shock: 18 shocks, 20 "g" with duration of 11 ±1 ms (MIL-E-5272C, Procedure V)
3. Vibration: MIL-STD-202B, Method 204, test condition B
4. Altitude: 50,000 ft. and −55°C
5. Humidity: MIL-E-5272C, Procedure III (95% R.H. @ 120°F for 360 hours)

ORDERING INFORMATION

CAY-□□□ □□

No. of Rings

Model

	CAY-110	CAY-604	CAY-245
MECHANICAL			
Torque	1.0 in.-oz. max. (24 rings)	1.0 in.-oz. max.	0.5 in.-oz. max. (20 ring assembly)
Speed	500 rpm max.	200 rpm max.	200 rpm max.
Life	10^8 revs. min.	5 x 10^6 revs. min.	10^7 revs. min.
ELECTRICAL			
Contact Resistance Variation	5 milliohms max. at max. speed	20 milliohms max. at max. speed	5 milliohms max. at max. speed
No. of Rings	30 max.	40 max.	20 max.

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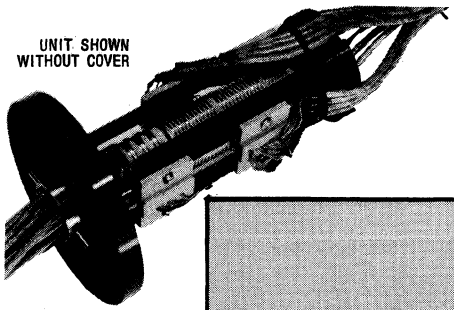
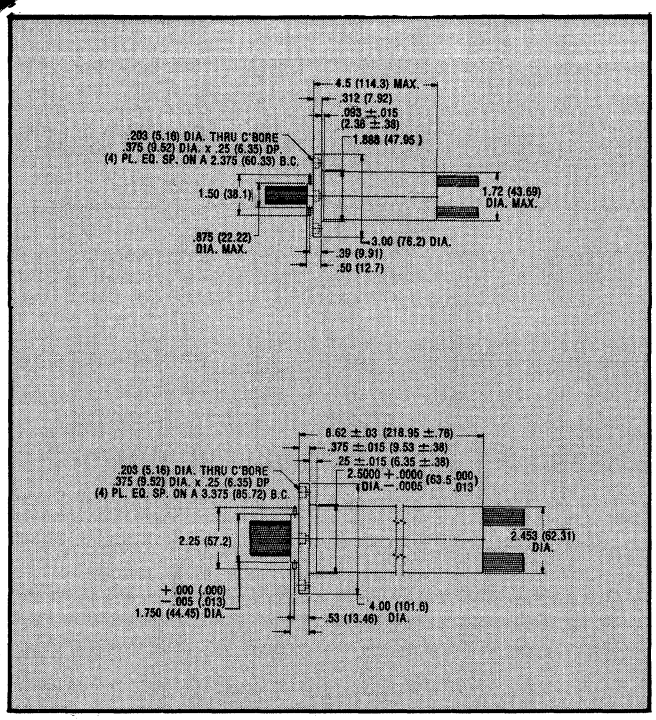
Airflyte ELECTRONICS CO.

CAPSULE SLIP RING ASSEMBLIES



CAY-150
UP TO **48** RINGS



CAY-1120
UP TO **90** RINGS

These assemblies, specially designed for gyro-rate table and centrifuge applications, have found wide use because of their versatility and compact size. The standard assembly, can be supplied (at slight extra cost) with internally shorted rings for double and triple current ratings, and with single, double and triple shielded wire. Featuring gold alloy wire brushes and compatible gold alloy rings, these assemblies are manufactured from proven production tooling at a very nominal cost. Special assemblies with switching circuits and others with non-standard materials for use in severe environments are available.

SPECIFICATIONS

MECHANICAL

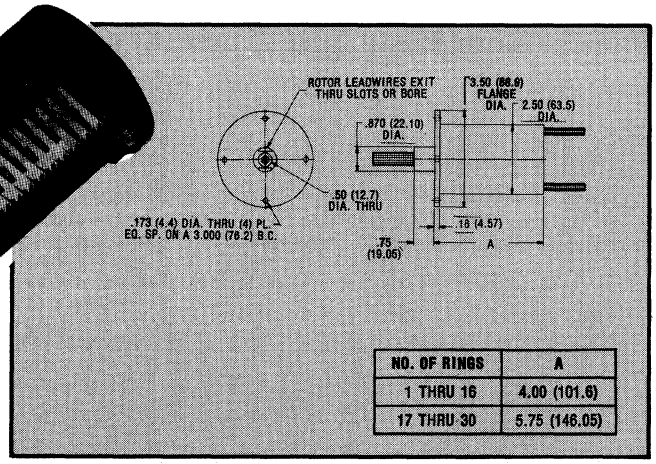
1. Rings: Gold alloy
2. Brushes: Gold alloy wire, spring temper
3. Ball Bearings: Stainless steel
4. Shaft: Stainless steel, type 303
5. Housing: Anodized aluminum
6. Rotation: Bi-directional

ELECTRICAL

1. Current: Signal level to 2.0 amps
2. Voltage: 400 vdc maximum
3. Dielectric Strength: 1000 Volts rms (all combinations)
4. Contact Resistance:
   A. Less than 8 milliohms @ 200 rpm
   B. Less than 2 milliohms @ 10 rpm
5. Leadwire: #28 awg 18″ long

	CAY-150	CAY-1120
Torque	.125 in.-oz. per ring	.18 in.-oz. per ring
Speed	600 rpm max. — intermittent	100 rpm max.
Life	2000 hrs. @ 100 rpm	1000 hrs. @ 100 rpm

CAY-1030
UP TO **30** RINGS



NO. OF RINGS	A
1 THRU 16	4.00 (101.6)
17 THRU 30	5.75 (146.05)

• LONG LIFE • HIGH SPEED

SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite, two per ring
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Torque: .03 in.-lb. per ckt. approx.
7. Speed: Up to 5000 rpm
8. Life: 5000 hrs. at 100 rpm
9. Rotation: Bi-directional
10. Current: 5 amps max. per ring
11. Voltage: 250 Volts DC max.
12. Dielectric Strengths: 500 VRMS (all combinations)
13. Contact Resistance: 10 milliohms max. (excluding wires)
14. Noise: 10 milliohms max.
15. No. of Rings: 30 max.
16. Leadwire: #22 AWG, 24″ lg., both ends

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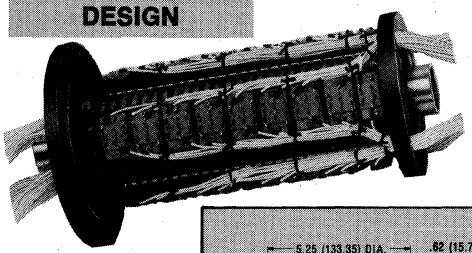
Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES

"THROUGH-BORE" DESIGN

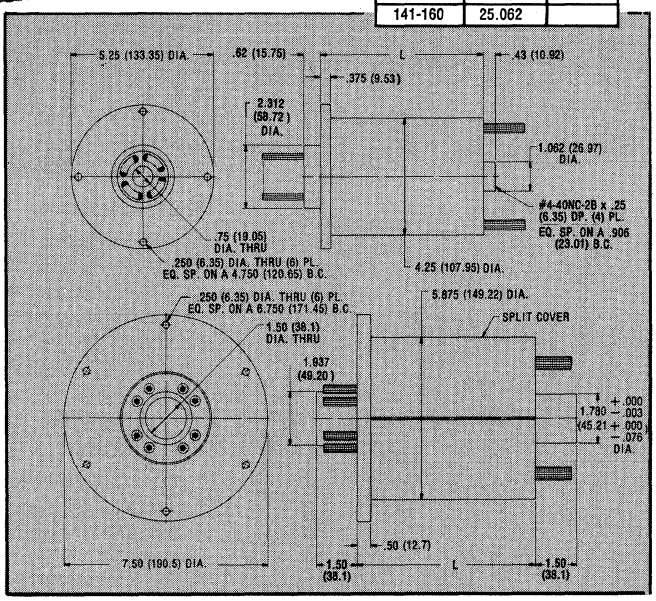


UNIT SHOWN WITHOUT COVER

No. of Rings	DAY-705 "L" ±.025"	DAY-710 "L"
10-20	5.375	4.725
21-40	8.187	6.700
41-60	11.000	8.675
61-80	13.812	10.650
81-100	16.625	12.625
101-120	19.437	14.600
121-140	22.250	
141-160	25.062	

DAY-705
UP TO **160** RINGS

DAY-710
UP TO **120** RINGS



DAY-705

These slip-rings are built to your order using many standard components which have proven themselves over many years of reliable operation. The "platter-type" design includes one coin silver ring on each side of each molded sub-assembly; and, leaf type silver graphite brushes which are molded in an insulating block and perfectly matched to the face of each ring. Inasmuch as the assemblies are the stack-up type, we are able to custom build them to your specifications—using our standard components—with a very minimum lead time required.

DAY-710

Similar in construction to our DAY-705, this platter type unit features two coin silver rings on each side of each platter for greater package density, and a "through bore" design which can be used for the passage of fluid or gas lines.

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Silver graphite
3. Ball Bearings: Stainless steel, shielded
4. Shaft: Anodized aluminum
5. Housing: Anodized aluminum
6. Speed: 500 rpm maximum
7. Rotation: Bi-directional

ELECTRICAL

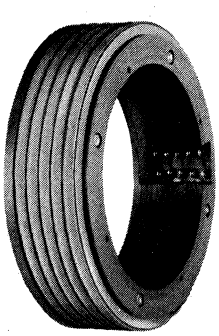
1. Voltage: 0 to 150 Volts AC or DC
2. Dielectric Strength: 500 Volts rms (all combinations)

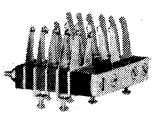
	DAY-705	DAY-710
Torque	½ in.-oz. per circuit	¾ in.-oz. per circuit
Life	3000 hrs. @ 100 rpm	2500 hrs. @ 100 rpm
Current	5 amps max. per circuit	5 amps max. per circuit
Contact Resistance Variation	8 milliohms peak @ max. speed	10 milliohms max.

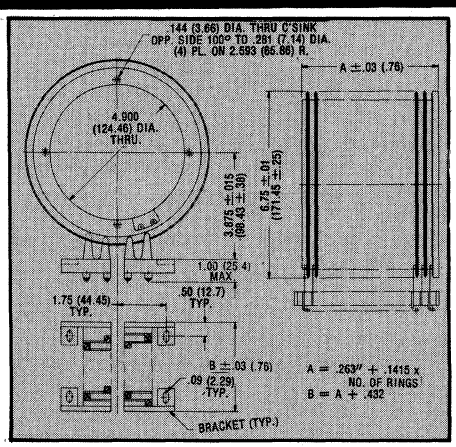
FLAT RING ASSEMBLIES & MATCHING BRUSH BLOCKS

CAY 94

- General purpose
- "Stack-up capability (up to 200 rings or more
- Low noise
- Long life







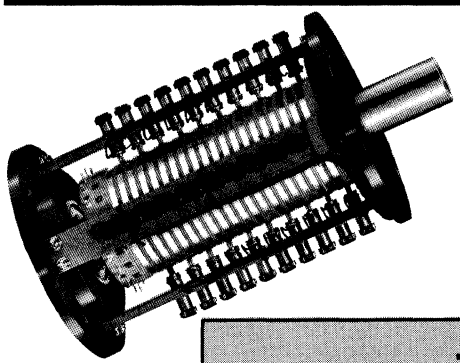
SPECIFICATIONS

1. Rings: Coin silver
2. Brushes: Silver graphite (two per ring)
3. Brush Leafs: Beryllium copper
4. Insulation: Phenolic
5. Leadwire: Available upon request
6. Speed: 750 rpm max.
7. Life: 1000 hours @ 100 rpm
8. Current: 5 amps per rings; 10 amps per ring when 4 brushes are used
9. Voltage: 300 VRMS
10. Dielectric Strength: 500 Volts rms (all combinations)
11. Insulation Resistance: 10 megohms minimum at 500 VDC
12. Noise: The contact resistance change in each circuit shall be less than .005 ohms at maximum speed
13. Units with less than 11 rings have one bracket per brush block

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

POWER CAPSULE SLIP RING ASSEMBLIES



CAY-125

A general purpose, off-the-shelf slip ring assembly especially applicable for strain gage and thermocouple measurements where rotating detector circuits must be brought out to stationary measuring equipment.

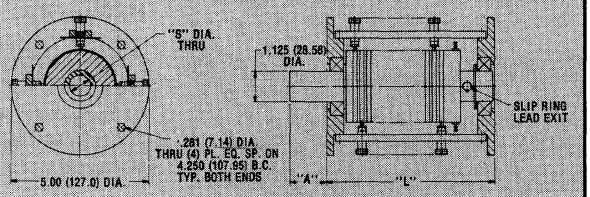
CAY-755

The standard cartridge, (AHW-16), has been used for many years on our CAY-125 assembly and is now available with the CAY-755 which is also drawn, or individually, for use on any ring which is a minimum of ⅛" wide. The silver graphite brushes, coil springs, caps and holders may be purchased individually or as an assembly and are all available from stock.

CAY-125
UP TO **30** RINGS

CAY-755
UP TO **30** RINGS

. . . AS AN ASSEMBLY

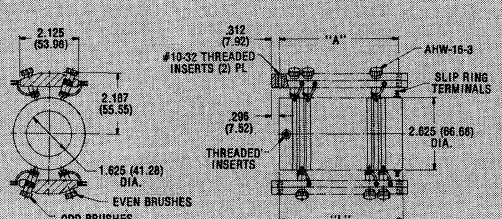


NOTES:
To determine "L" dimension use the following formula:

$$\text{"L"} = 2.62\ (66.55) + \frac{\text{(NO. OF RINGS)}}{4}$$

"S" = .750 (19.05) or 1.000 (25.4)
"A" = .750 (19.05) or 1.000 (25.4)

. . . OR AS SEPARATES



NOTES:
To determine the "L" and "A" dimensions, use the following formulas:

$$\text{"L"} = 1.093\ (27.76) + \frac{\text{(NO. OF CIRCUITS)}}{4}$$

"A" = "L" − .218 (5.54)
†Two identical brush blocks are supplied with each CAY-755 assembly.
†REPLACEMENT PARTS
Cartridge Assembly: AHW-16
Spring: AHW-15
Holder: AHW-14
Cap: AHW-13
Silver Graphite Brush: ABR-12-1

SPECIFICATIONS

MECHANICAL

1. Rings: Coin silver
2. Brushes: Spring loaded silver graphite, two per ring
3. Torque: 0.2 in-lbs. per ring
4. Speed: 5000 rpm maximum
5. Life: 1000 hours minimum @ 500 rpm
6. Rotation: Bi-directional

ELECTRICAL

1. Current: 10 amps per circuit with two brushes per ring
2. Voltage: 0-250 Volts AC or DC
3. Dielectric Strength: 500 Volts rms (all combinations)
4. Contact Resistance Variation: 10 milliohms maximum at maximum speed
5. No. of Rings: 30 maximum

ENVIRONMENTAL

1. Operating Temperature: 0° to 200°F
2. Humidity: 85%

ORDERING INFORMATION

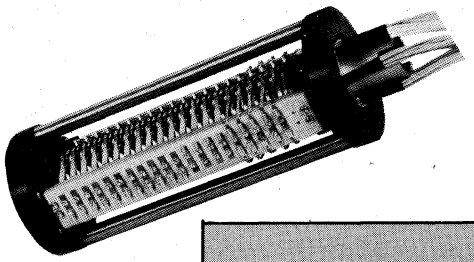
CAY-□□□ □□ □

Model
No. of Rings
Special Variations

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

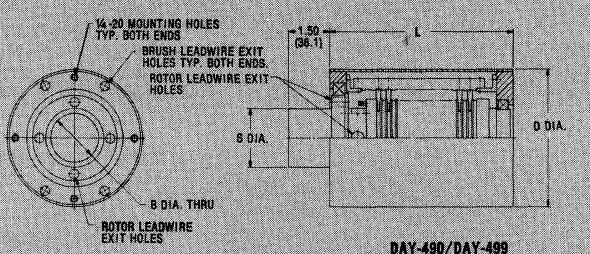
MULTI-PURPOSE SLIP RING ASSEMBLIES



These assemblies, designed for use in commercial equipment, have been used in applications ranging from thermocouples to the transmission of medium power. They feature coin silver rings, silver graphite brushes, convenient terminals on both the slip ring and brush blocks, and a rotor design which allows the leadwires to be exited through the shaft bore, or under the bearing when a shaft clearance hole is required. The wide variety of sizes and configurations available, including "in-between" shaft diameters, allows the designer to select a standard assembly for his application, eliminating time consuming and costly design charges.

DAY-490/499
UP TO **50** RINGS

. . . AS AN ASSEMBLY

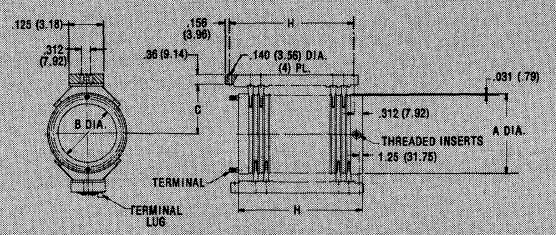


DAY-490/DAY-499

No. of Rings	Inches "L"	Milli-Meters
6-10	4.88	123.95
11-20	6.75	171.45
21-30	8.63	219.2
31-40	10.50	266.7
41-50	12.38	314.45

. . . OR AS SEPARATES

CAY-731/740
UP TO **50** RINGS



To determine "H" dimension use the following formula:
"H" = .750 + .1875 x (No. of Rings)

SPECIFICATIONS

MECHANICAL

1. Frame: Anodized aluminum (DAY-490/DAY-499 only)
2. Rings: Coin silver
3. Brushes: Silver graphite, two per ring
4. Leafs: Beryllium copper
5. Insulation: Epoy or laminated plastic

ELECTRICAL

1. Current: 10 amperes per circuit (20 amperes available at extra cost)
2. Voltage: 250 Volts maximum AC or DC
3. Dielectric Strength: 750 Volts rms (all combinations)
4. Insulation Resistance: 50 megohms minimum at 500 VDC
5. Contact Resistance Variation: 10 milliohms maximum at maximum speed
6. No. of rings: 50 maximum

ENVIRONMENTAL

1. Operating Temperature: 0 to 250°F
2. Humidity: 95% maximum

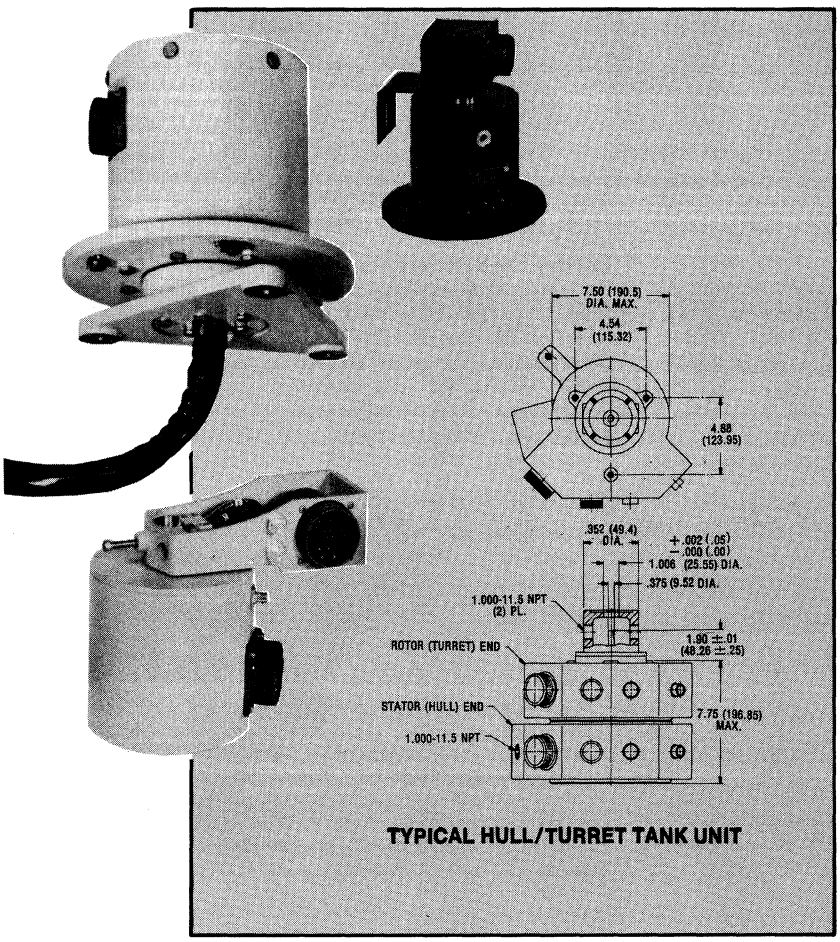
For use when bearing mounted assemblies are not practical, the CAY-731/CAY-740 should be specified.

Part No.	Max. Speed RPM	Min. LIFE 10^4 Rev.	Max. Torque Per Ring lb.-in.	Max. Torque Per Ring gm-cm	DAY-490/DAY-499 "B" Dia. in.	"B" Dia. mm	"D" Dia. in.	"D" Dia. mm	"S" Dia. in.	"S" Dia. mm	CAY-731/CAY-740 "A" Dia. in.	"A" Dia. mm	"B" Dia. in.	"B" Dia. mm	"C" Dia. in.	"C" Dia. mm
DAY-490/CAY-731	5000	50	.21	240	1.00	25.4	4.00	101.6	1.250	31.75	1.875	47.63	1.250	31.75	1.447	36.75
DAY-491/CAY-732	4000	40	.30	350	1.75	44.45	5.00	127.0	2.125	53.98	2.750	69.85	2.125	53.98	1.829	46.46
DAY-492/CAY-733	3000	30	.40	460	2.75	69.85	6.50	165.1	3.125	79.38	3.750	95.25	3.125	79.38	2.281	57.94
DAY-493/CAY-734	2500	25	.50	580	3.75	95.25	7.50	190.5	4.125	104.8	4.875	123.8	4.125	104.8	2.822	71.68
DAY-494/CAY-735	2000	20	.61	700	4.75	120.7	8.50	215.9	5.125	130.2	5.875	149.2	5.250	133.4	3.307	84.00
DAY-495/CAY-736	1500	15	.71	820	5.75	146.1	9.50	241.3	6.125	155.6	7.000	177.8	6.250	158.8	3.857	97.97
DAY-496/CAY-737	1500	15	.82	950	6.75	171.5	10.50	266.7	7.125	181.0	8.000	203.2	7.250	184.2	4.342	110.3
DAY-497/CAY-738	1000	10	.92	1060	7.75	196.9	11.50	292.1	8.125	206.4	9.000	228.6	8.250	209.6	4.837	122.9
DAY-498/CAY-739	1000	10	1.02	1180	8.75	222.3	13.00	330.2	9.125	231.8	10.000	254.0	9.250	235.0	5.332	135.4
DAY-499/CAY-740	750	7.5	1.12	1290	9.75	247.7	14.00	355.6	10.125	257.2	11.000	279.4	10.250	260.4	5.827	148.0

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

Airflyte ELECTRONICS CO.

VEHICLE SLIP RING ASSEMBLIES



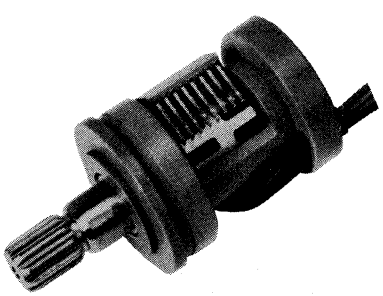
TYPICAL HULL/TURRET TANK UNIT

Airflyte Electronics has experience in the design and manufacture of assemblies for personnel carriers, tanks and other military vehicles. We have built slip rings for periscopes, turrets and commander stations. These assemblies range in size from 6″ or less in outside diameter to slip rings with clearance holes larger than 28″. This type of assembly is characterized by its rugged construction, usually has two high power rings, several low power and up to 50 signal rings. Illustrated are several of the configurations we have built in production quantities.

SPECIFICATIONS

1. Voltage: from 28 VDC to 208 VAC
2. Current: from 1 amp to 600 amps
3. Frequency: DC to 100 MHz
4. Speed: Usually about 20 rpm
5. Noise: Less than 10 mΩ peak to peak
6. Hydraulics: 3000 psi operating
7. Pneumatics: 1500 psi operating
8. Torque: 15 ft.-lb. max. (no hydraulics)
9. Life: 3000 hrs.
10. Environmental: Vibration, shock, etc. per MIL SPEC
11. Terminations: Connectors & fittings customer compatible

ENCODERS & SWITCHES



Airflyte encoders and rotary switches feature drum construction with solid gold alloy conducting segments embedded in epoxy and machined flush. Brushes are multi-strand, spring-temper gold-alloy. As small as ½″ diameter.

ENCODERS

Special encoders with BCD, Gray, True Binary or non-standard codes are available. Units supplied with or without logic circuitry.

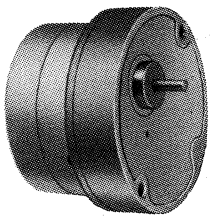
SWITCHES

When close accuracy, repeatability and size are important, specify Airflyte rotary switches for timing and positioning applications. Successfully replaces snap action switches and cams. Pre-set to eliminate installation time. Zero hysteresis.

NEW HOOK ROAD, BAYONNE, NEW JERSEY 07002 201-436-2230 TWX-710-729-4489 FAX 201-436-6024

AC, DC, STEPPER AND GEARED MOTORS

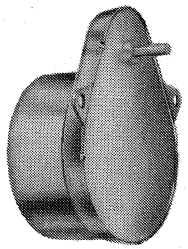
Airpax offers a broad range of high-quality geared AC, DC and stepper motors. Available in standard or custom design to meet the needs of any application. Contact Airpax Company, West Johnson Avenue, Cheshire, CT 06410. (203) 272-0301. A division of North American Philips Corporation.



Instrument Motors

2-phase stator and permanent magnet rotor. Can be furnished as a synchronous motor; 24, 120 or 220 VAC, or as a stepper motor; 5 or 12 VDC. Standard gear reductions will produce high torque outputs, plus speeds to 1 RPM on asynchronous models and step angle to 0.05° on stepper units.

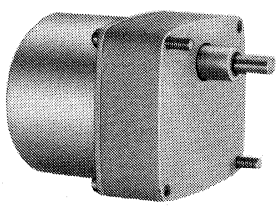
81400 Series	Synchronous operation
82400 Series	Stepper operation



Reversible Synchronous Motors

For commercial/industrial use. 50 or 60 Hz operation; voltages from 12 to 230 VAC. PM rotor, 2-coil windings. Electrically reversible. Rotor speeds 300 RPM at 60 Hz or 720 RPM at 60 Hz. Rotor torque 0.75 oz.-in. and 1.1 oz.-in., respectively. Output speeds from 300 RPM to 1/1000 RPM.

81300 Series	300 RPM rotor
S7100 Series	720 RPM rotor



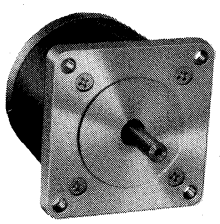
Low-Cost, High-Torque Geared Motors

Ideal as either a synchronous or stepper motor for use in medical and scientific instruments and computer peripherals. Both models are equipped with NEMA-type 2-11 gearbox. Standard output speeds as low as 1/2 RPM or step angle as small as .05°. Rotor bearings and output shaft bearings are permanently lubricated.

86100 Series	Synchronous operation
86200 Series	Stepper operation

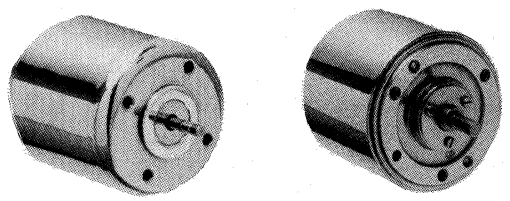
Low-Cost, Iron Rotor DC Motor with Gearbox

39 mmØ – furnished as a self-contained unit with integral gearbox. Operating voltages of 6, 12 or 24 VDC. Torque up to 18 oz.-in. Output speeds from 8.2 to 330 RPM. All units have sleeve bearings and built-in spark suppression.



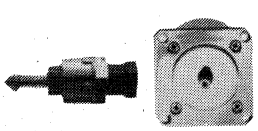
41 to 80 oz.-in. Holding Torque, 1.8° Step Angle – Series 4SH

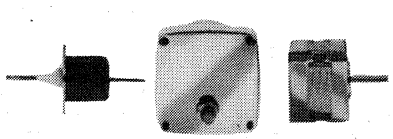
Size 23 unipolar stepper motors have a small step angle of 1.8° to provide fine increments for direct, precise positioning without reduction gears for use in computer peripherals, business machines and control equipment. Hybrid permanent magnet construction.



Ironless Rotor DC Motors

Available in 3 frame sizes: 29, 40 and 65 mmØ. Reversible, low inertia and inductance. High efficiency – as much as 75%. Sleeve bearings – ball bearings available on many models. Available in voltages of 12 to 30 VDC.





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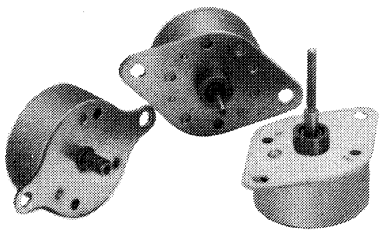
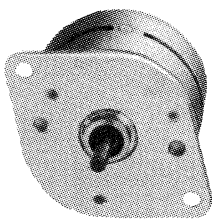
INTERNATIONAL DIVISION

STEPPER MOTORS

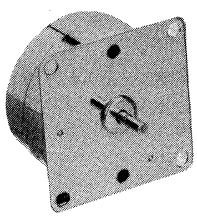
Airpax offers a broad range of high-quality stepper motors in standard or custom design. Ideal for computer peripherals, medical instruments, and other applications where accurate positioning is required. Contact Airpax Company, West Johnson Avenue, Cheshire, CT 06410. (203) 272-0301. A division of North American Philips Corporation.



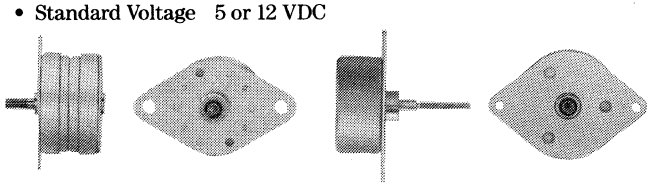
82100
Ideal for battery-driven applications, tape head positioner, portable digital cassettes and similar instruments where space and weight are of a premium.
This motor can be driven over 2500 pps with running torque of .45 oz-in (3.2mNm).
Features:
- 26mm 1″ Dia.
- Holding Torque 1 oz-in
- Step Angle 7.5°, 15°
- Power IN 2.5 Watts
- Standard Voltage 5 or 12 VDC

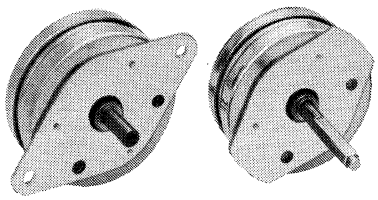


82200
Ideal for application where torque to inertia ratio is critical. Ideal for ribbon drives, ribbon lifts, small printer carriage and paper positioner, tape head positioner, chart recorders, medical applications, etc.
Features:
- 36mm 1.42″ Dia.
- Holding Torque 1.9 to 3.9 oz-in
- Step Angle 7.5° (82200), 15° (83200), 18° (82300)
- Power IN 4 to 4.5 Watts
- Standard Voltage 5 or 12 VDC

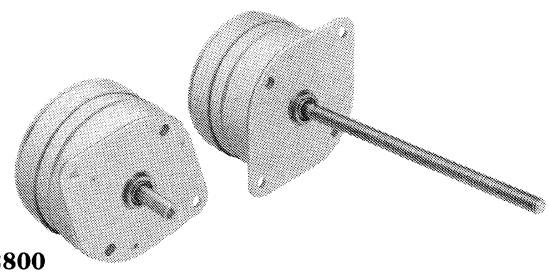


82400
With its efficient running rate and stepping accuracy, the bi-directional motor is an economical answer to a variety of applications.
Features:
- 42mm 1.65″ Dia.
- Holding Torque 12 oz-in
- Step Angle 7.5°
- Power IN 5 Watts
- Standard Voltage 5 or 12 VDC

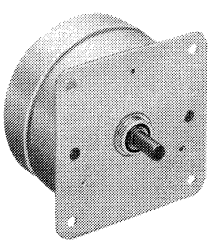




82700
These bi-directional stepping motors offer high efficiency and high running rates in a small package weighing only 8 ounces. Ideal for many applications such as paper advance, carriage drives, medical pumps, HVAC, plotters, etc.
Features:
- 58mm 2.25″ Dia.
- Holding Torque 8 to 17 oz-in
- Step Angle 7.5° (82700), 15° (83700)
- Power IN 8 Watts
- Standard Voltage 5 or 12 VDC



82800
Ideal where more brute force is required and the long life of ball bearings is a critical requirement.
Features:
- 59mm 2.33″ Dia.
- Holding Torque 18 to 28 oz-in
- Step Angle 7.5° (82800), 15° (82600)
- Power IN 8-11 Watts
- Standard Voltage 5 or 12 VDC



82900
This bi-directional permanent magnet stepper is ideal for many applications where high torque is a requirement.
Features:
- 70mm 2.75″ Dia.
- Holding Torque 26 to 46 oz-in
- Step Angle 7.5°, 15°
- Power IN 15 Watts
- Standard Voltage 5 or 12 VDC

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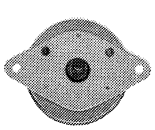
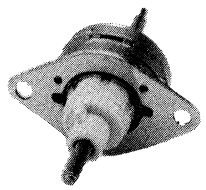
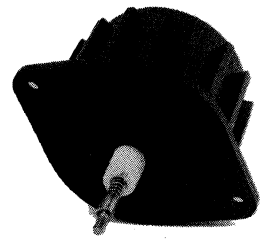


LINEAR ACTUATORS AND BRUSHLESS DC MOTORS

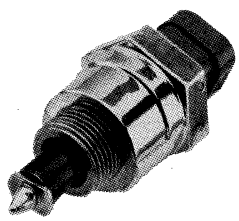
Airpax offers a broad range of high-quality precision linear actuators and brushless DC motors. Available in standard or custom design for any application. Contact Airpax Company, Cheshire Industrial Park, Cheshire, CT 06410. (203) 272-0301. A division of North American Philips Corporation.



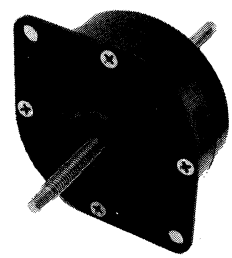
Low Force – Series 92100
Will control devices requiring a "pushed" or "pulled" force of up to 21 ounces. 5 or 12 VDC operation. Shaft moves in increments of 0.001″, 0.002″ or 0.004″ per pulse.



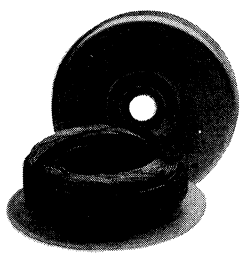
Medium Force – Series 92200
Will control force requirements between 3 and 4 lbs. Accurate incremental movement of 0.001″, 0.002″ or 0.003″ per pulse. Available for 5 or 12 VDC operation.



Automotive Actuators
Shown is one of many digitally controlled linear actuators designed for underhood fuel management systems. Operating voltages from 7.5 to 14.5 VDC. Linear force to 90 oz.

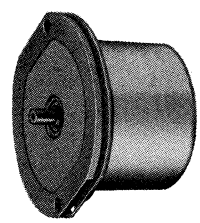


High Force – Series 92400
For applications requiring force of approximately 19 lbs. Rugged 0.250″ diameter shaft extends in 0.001″ or 0.002″ increments to a maximum 3″ from either side of the actuator. Longer shafts available upon review of the application.



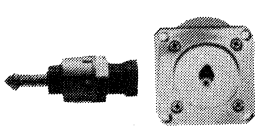
Three-phase Brushless DC Motors
Consist of 4-pole permanent magnet field rotors and 3-phase wye-connected stator windings. Electronically commutated servo; hall cells provided. Shipped as assembly kits. User provides logic, drivers and spindles. Assembled motors with spindles available. Efficiency up to 85%. Stall torques from 30 oz.-in. to 700 oz.-in. Optimum power output. Excellent speed control. No major EMI. Minimum maintenance, long life. Particularly well-suited for rigid and floppy disk drives, phase-locked servo spindle controls and high-reliability tape recorders.

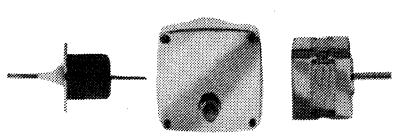
L85101 Series	24 VDC
K85401 Series	24 VDC
K85601 Series	48 VDC



Size 15 Brushless DC Motor
Bi-directional, 2-pole permanent magnet motor with external rotor and 3-phase wye-connected stator winding. Includes integral 8-pole tachometer with a range of 3000 to 6000 RPM. Output pulses 8 per revolution. Output voltage (Sq. Wave) 5V, TTL. Ideal for 1/4-inch streamer applications, floppy disks and small fans. Low EMI and high acceleration characteristics.

K85915 Series	12 VDC





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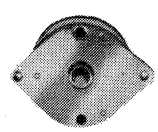
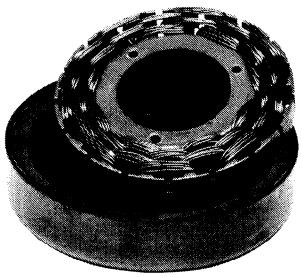


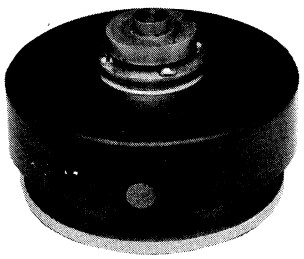
BRUSHLESS DC MOTORS FROM AXIAL MAGNETICS



ROTOR AND STATOR SET, Brushless DC

Dia: 3.00 inches
Length: .63 inches
Max ID: 1.40 inches
Torque Sensitivity: 10.0 oz-in/amp
Resistance: 5.0 ohms

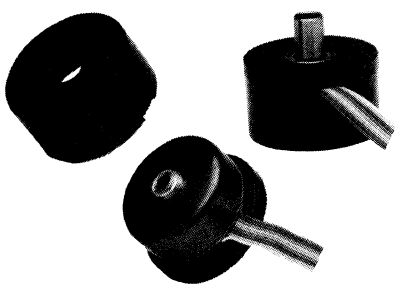
This shows the middle size of a family of 6.50, 4.00, 3.00, and 2.00 inch diameter ceramic magnet motor sets available in various lengths and ratings. Available with mounted Hall Effect Sensors.



SPINDLE MOTOR, Brushless DC

Dia: 4.00 inches
Length: 1.5 inches
Shaft Runout: .0005 inches
Torque Sensitivity: 5.0 oz-in/amp
Resistance: .5 ohms

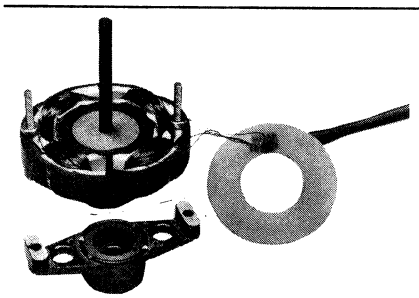
Example of complete motor sold in prototype and quantities made by Axial Magnetics for 6, 12, and 24 volt systems. Torque Sensitivites of up to 50 oz-in/amp have been supplied in this 4.00 inch diameter with Delta connected 3 phase windings.



HOLLOWSHAFT MOTOR, Brushless DC

Dia: 2.25 inches
Length: 1.25 inches
Shaft ID: .25 inches
Shaft Runout: .0005 inches
Torque Sensitivity: 4.2 oz-in/amp
Resistance: 22.0 ohms

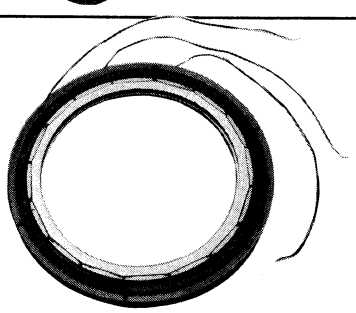
Custom design for slow speed rotation of laser prism for etching electronic circuits.



LOW COST MOTOR, Brushless DC

Dia: 3.30 inches
Length: 2.50 inches
Torque Sensitivity: 6.0 oz-in/amp
Resistance: 1.0 ohms
Construction: Sleeve Bearings

This is a motor designed and built for a high volume requirement to a low cost custom application.



TORQUE MOTOR ROTOR AND STATOR SET, Brushless DC

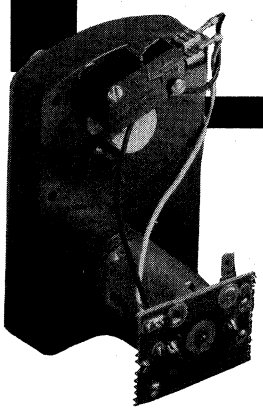
Dia: 6.50 inches
Length: .45 inches
Max ID: 4.75 inches
Torque Sensitivity: 24 oz-in/amp
Resistance: 2.4 ohms

This is the largest of a family of inner member rotate Rare Earth Magnet designs having maximum diameters of 6.50, 5.50, 4.50, 3.50 and 2.50 inch diameters.

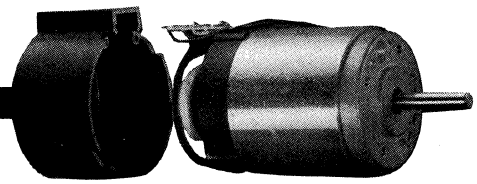
AXIAL MAGNETICS DIV.
TENCAL INC.
450 West Los Angeles St., Simi Valley, CA 93065 • 805-527-0900

BARBER COLMAN COMPANY
a Siebe company

BARBER-COLMAN
subfractional motion control



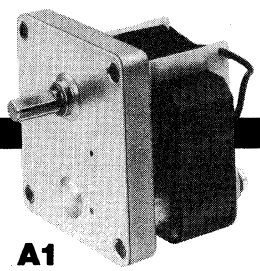
NEW PRODUCTS



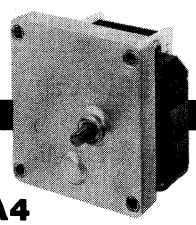
D26
DC gearmotor
6–24 Volts
Low cost plastic gearbox
Torque to 7 lb-in.
Optional features:
- Control circuits
- Limit switches
- Many shaft configurations

MYMM
Long life high torque DC motor
Stall torque to 125 oz-in.
EMI filtering
Optional features:
- Optical encoders
- Gear boxes

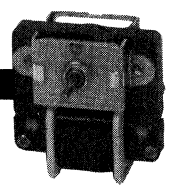
AC MOTORS



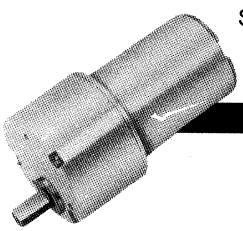
A1
Torque to 60 lb-in.
Speed 11–800 RPM



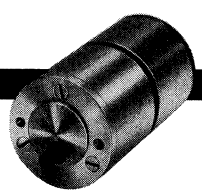
A4
Torque to 60 lb-in.
Speed 1–800 RPM



YAA
Rated HP to .005
Small and compact

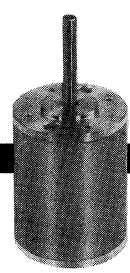


EYQE
Torque to 11 lb-in.
1.5″ max. dia.



CYHC
Torque to 15 lb-in.
2.0″ max. dia.

EYQM
6–32 VDC
1.18″ dia.
2.16″ max. length



DC MOTORS

CYHM
6–36 VDC
2.0″ dia.

Our manufacturing experience and engineering content assure consistent quality — from simple drive motors to sophisticated "motion control packages." Our motors are available with multiple types of companion gearheads and may be combined with options like magnetic tachs, optical encoders, ball bearings and electrical filtering for exact start-stop and speed control. *For detail application assistance and pricing, contact our office at the address below.*

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MOTOR DIVISION

P.O. Box 2940
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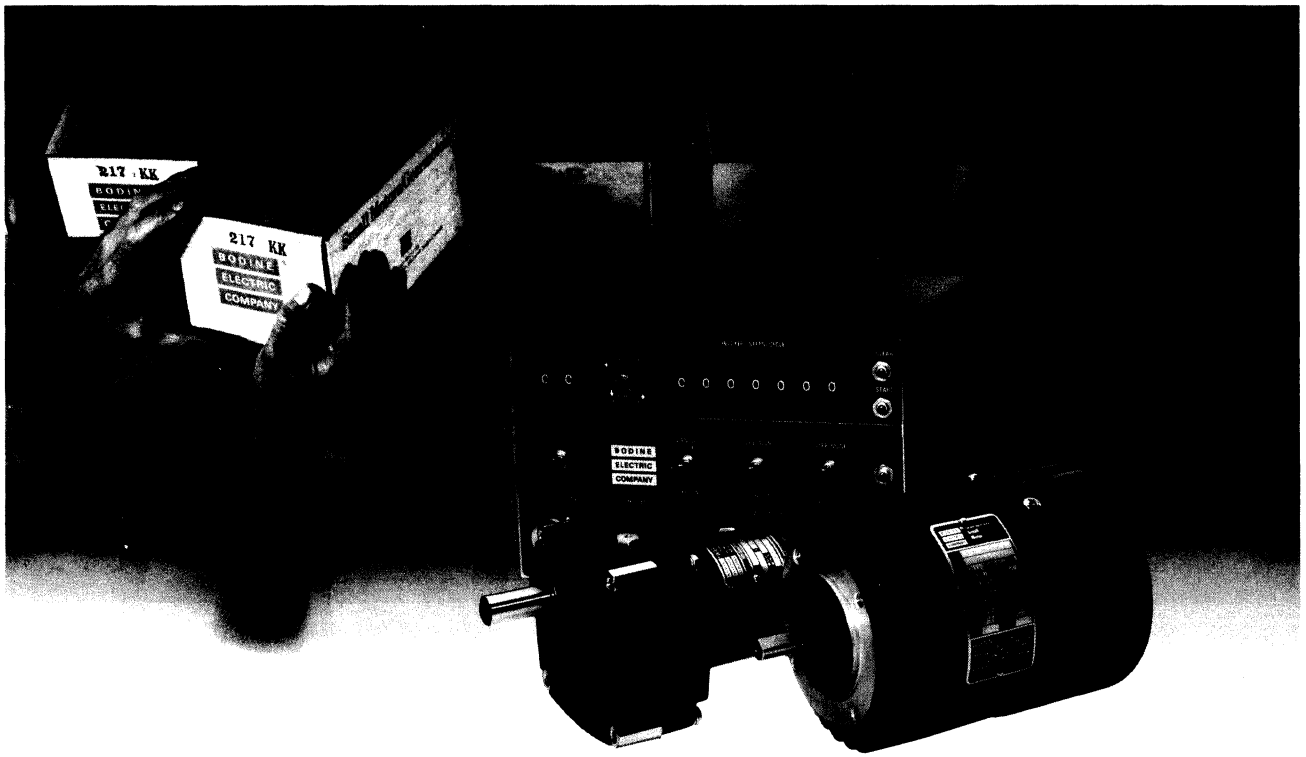
Phone: (815) 968-0660

Toll Free: 1-800-237-2537
FAX: (815) 962-0070
Telex: 4330367

M-104 LITHO IN U.S.A



To the best in small gearmotors, motors and electronic motion controls Bodine adds the best in availability

500 models available from local distributor stocks

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COMPANY

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Chicago, IL 60618 U.S.A.
Tel: (312) 478-3515
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Quality in Motion®

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For many motion control applications, even those that are relatively complex, standard product is the best, quickest, and most cost-effective solution . . . and in such situations, your Authorized Bodine Distributor is your best, quickest, and most cost-effective source.

Bodine offers you the industry's widest selection of off-the-shelf small gearmotors, motors and electronic motion control . . . available factory-direct in OEM quantities or through 103 stocking Authorized Distributors and Service Centers in the USA, Canada and Europe. And Bodine Distributors can help you in the selection, application and use of gearmotors, motors and motion controls.

The broad and varied Bodine product line is characterized by performance that is not only exceptionally reliable, but also exceptionally consistent, motor-to-motor and lot-to-lot. Bodine motors don't last forever, it's true, but it takes them longer to wear out—and if they do, we're there to recondition them. It's reassuring to have this help nearby, and to know that our network of Authorized Service Centers is a critical part of the Bodine "insurance policy."

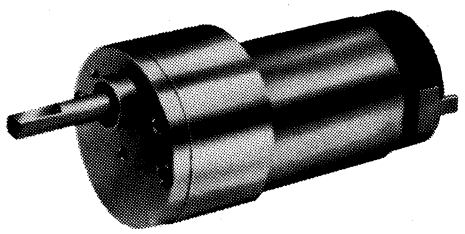
In addition to broad inventory and excellent customer service capabilities, Bodine also provides comprehensive technical and product application literature. In particular, our standard off-the-shelf line is fully described in Stock Catalog S and European Voltage Stock Catalog SME . . . the motor specifier's basic references, available free on request. Ask for your copy of either, or both.

Mini-guide to Bodine stock products

- 400 USA/Canadian models, plus 100 European voltage models
- Motors: 10 and 30 AC, DC, universal; HP 1/2000 to 1/2; dia. 2.27" to 6.00"
- 24 VDC gearmotors and motors
- Parallel shaft gearmotors: AC, DC; up to 341 Lb.-in. torque
- Right-angle shaft gearmotors: AC, DC; up to 340 Lb.-in. torque
- New state-of-the-art DC Stepper controls
- 72 RPM HY-Sync™; instrument, torque, floppy disc motors
- Matched SCR and Thyristor DC speed/torque controls for PM and shunt wound drives
- Synchronous and non-synchronous, split phase, permanent split capacitor, shunt wound, PM, series wound
- Most stock products U.L. construction recognized, many CSA-certified and VDE-approved
- Other models and modifications available built-to-order in small or large quantities

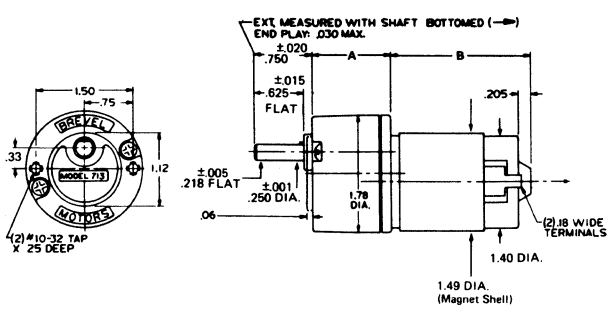
BREVEL MOTORS

Model 713 (12 VOLT) Stock D.C. Gearmotor



The Model 713 D.C. Gearmotor was designed for low torque applications. The extremely compact gearmotor is ideal for robots, instrumentation, and other uses where space is at a minimum, but quality and reliability is of maximum concern.

Several models of each design are available as stock items from over 100 Brevel Distributors nationwide. . .or Brevel will custom design to fit your applications.

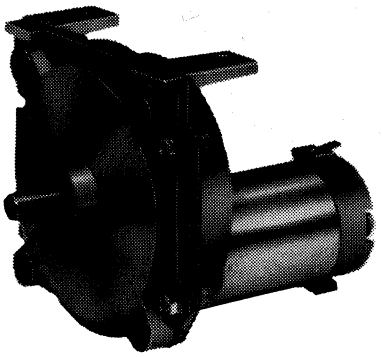


ALL SPECIFICATIONS @ 12V DC

Stock Model No.	No-Load RPM	Starting Torque Lbs.-In.	Nominal Running AMPS	Running Torque @ RPM Lbs.-In.	Dimension A	Dimension B	Gear Train Ratio
713-982922	5.8	*103.0	.75	20.0 – 4.6	1.20	2.31	604.0:1
713-982923	9.4	* 63.0	.75	20.0 – 5.9	1.20	2.31	374.0:1
713-982924	16.4	* 36.0	.75	12.0 – 10.0	1.20	2.31	213.0:1
713-982925	26.0	* 22.0	.75	7.5 – 16.0	1.20	2.31	132.0:1
713-982926	39.8	* 32.0	1.25	10.8 – 25.0	.93	3.06	75.3:1
713-982927	46.0	14.4	.75	4.8 – 29.0	.93	2.31	75.3:1
713-982928	64.4	20.0	1.25	6.6 – 42.0	.93	3.06	46.6:1
713-982929	112.0	12.7	1.25	4.2 – 73.0	.93	3.06	26.6:1
713-982930	145.6	9.8	1.25	3.2 – 94.5	.93	3.06	20.0:1
713-982931	183.0	7.0	1.25	2.6 – 110.7	.93	3.06	16.5:1

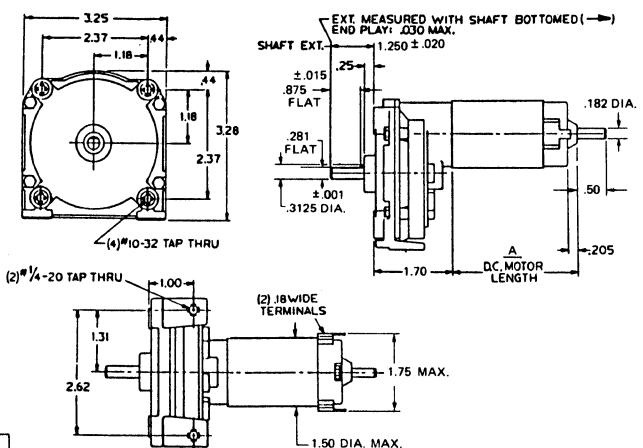
*TORQUE LOAD MUST NOT EXCEED 20 LBS–IN

Model 780 (12 VOLT) Stock D.C. Gearmotor



The Model 780 D.C. Gearmotor was designed for high torque applications. The rugged Model 780 is ideal for pumps, vending machines, lift mechanisms and other uses where tough reliable operation is demanded.

Several models of each design are available as stock items from over 100 Brevel Distributors nationwide. . .or Brevel will custom design to fit your applications.



ALL SPECIFICATIONS @ 12V DC

Stock Model No.	No-Load RPM	Starting Torque Lbs.-In.	Nominal Running AMPS	Running Torque @ RPM Lbs.-In.	Dimension A	Gear Train Ratio
780-982956	4.5	*240	2.0	120.0 – 3.0	2.675	762.6:1
780-982957	7.5	*170	2.0	75.0 – 4.8	2.675	487.8:1
780-982958	12.0	140	2.0	60.0 – 7.5	2.675	272.8:1
780-982959	23.0	70	2.0	30.0 – 16.0	2.675	150.5:1
780-982960	34.0	70	2.5	33.0 – 20.0	3.425	97.2:1
780-982961	62.0	40	2.2	18.0 – 40.0	3.425	53.1:1
780-982962	90.0	27	2.2	13.0 – 60.0	3.425	35.4:1
780-982963	175.0	16	2.0	6.5 – 130.0	3.425	19.0:1

*TORQUE LOAD MUST NOT EXCEED 125 LBS.–IN.

BREVEL MOTORS INC.

a subsidiary of

VERNITRON CORPORATION

BROAD AND 16th STREETS
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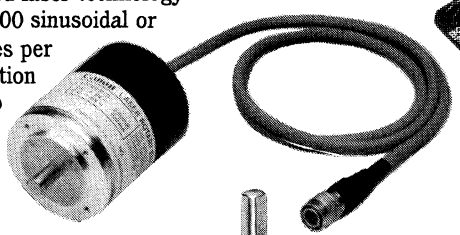
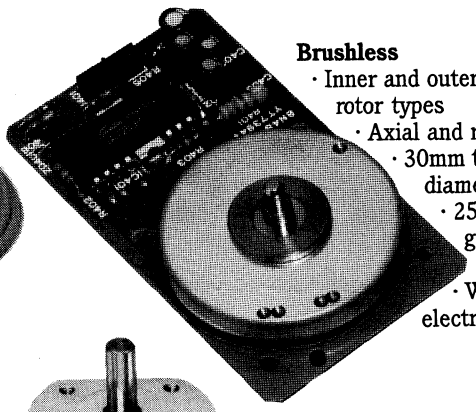
Sub-fractional DC Motors

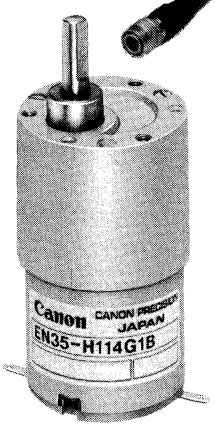
Absolute & incremental laser rotary encoder
- Patented laser technology
- 50,000–81,000 sinusoidal or square pulses per revolution
- Compact 36mm to 56mm diameter





Brushless
- Inner and outer rotor types
- Axial and radial gap types
- 30mm to 90mm diameter
- 25 to 700 g-cm starting torque
- With or without electronics

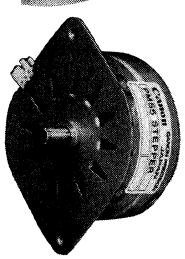
Gearmotors
- Over 100 different combinations
- Ratios from 5:1 to 3000:1
- 25 to 20,000 g-cm rated torque
- 1.3 to 830 rpm
- 6 to 24 VDC
- Concentric or offset shaft
- Gearheads from 20mm to 54mm dia.

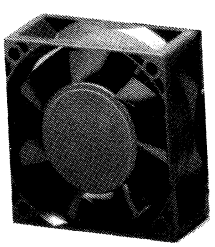


Iron core
- Over 70 models
- 12mm to 52mm dia.
- 12 g-cm to 9000 g-cm starting torque
- Integral AC tach, optical encoder
- Ball or sleeve bearings on some models

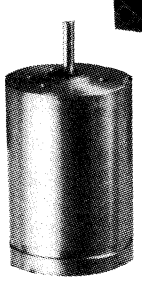
PM Type Steppers
- Low in cost, high in performance
- Step angle 7.5 and 15 degrees
- 35mm, 42mm and 55mm diameters

Hybrid Type Steppers
- Step angle 0.9 and 1.8 degrees
- 39mm, 42mm and 56mm diameters
- Modifications of standard units available in OEM quantities





Brushless DC box fans
- Low cost
- Long life
- Low mechanical noise
- High air flow
- Sizes: 40mm to 120mm



Coreless
- 12mm to 40mm dia.
- 28 to 455 g-cm starting torque
- Ball bearings available on some models

If you are an OEM with a requirement for sub-fractional DC motors call Canon directly or send for our free short form catalog.

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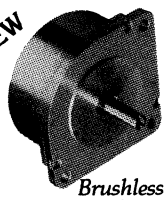
Dependable...fractional horsepower motors by Clifton Precision

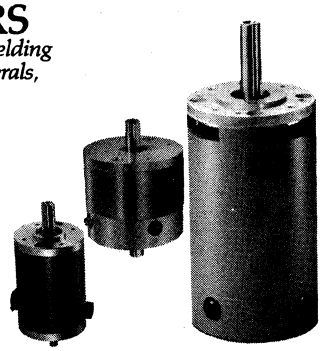
DC PM MOTORS

Wheelchairs, door openers, welding wire feeders, computer peripherals, machine tools

NEW



Brushless — Limited Rotation



. . . with torques from 90 to 3500 oz-in., 2 inch to 4 inch O.D. Advanced magnetic materials . . . cartridge brushes

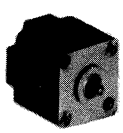
BRUSHLESS DC MOTORS

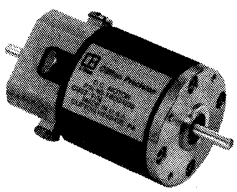
Floppy and Winchester disk drives, machine tool drives, pumps, fans, robotics

. . . with 40 to 150 mm O.D.; 1, 2, or 3 phase. Specializing in rotor/stator parts sets, with housed units also available. Will customize upon request.

MINIATURE HIGH-TORQUE DC SERVOMOTORS

Computer peripheral drives, instrument recorders, laboratory instruments, medical equipment robotics

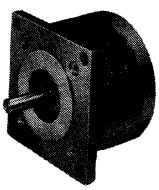


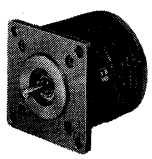


. . . with torques from 2 to 50 oz-in. .75 inch cube to 1.32 inch O.D. Cartridge brushes, Alnico or rare earth magnets

PM, HYBRID, AND VR STEPPER MOTORS

Computer peripheral drives, office equipment, machine tool drives, avionics, & military applications



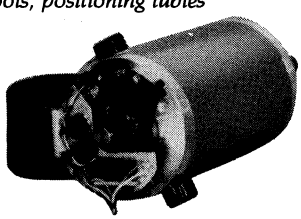


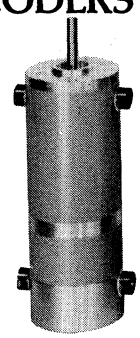
CLIFTON SPECIALIZES IN CUSTOM DESIGNED PRODUCTS

. . . with step angles 1.8°, 1.875°, 15°, 30°, 45°, 90°, 120°; .75 inch to 2.3 inch O.D. Ceramic Alnico or rare earth magnets. Available with integral encoders.

INTEGRAL MOTOR/ENCODERS & TACHOMETERS

Robotics, computer and office equipment, machine tools, positioning tables

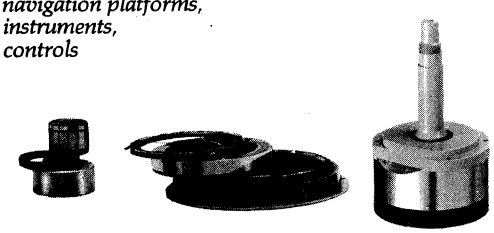




. . . for closed loop feedback: optical encoder resolution to 2500 cycles. Analog tachometers integral to motor. No assembly or alignment necessary.

DC PM HOLLOW SHAFT TORQUE MOTORS

Inertial navigation platforms, aircraft instruments, aircraft controls



. . . with torques from 6 to 2700 oz-in., 1.1 inch to 20 inch O.D. Precision tolerances, gold commutators, high reliability

For information on Stepper Motors and Brushless DC Motors, call Murphy, NC (704) 837-5115; for all other motor information, call Clifton Heights, PA (215) 622-1000.

Litton

Clifton Precision

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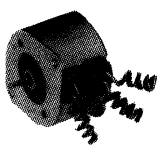
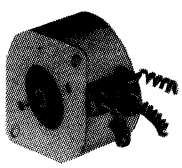
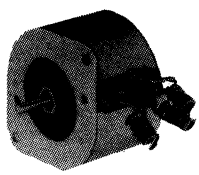
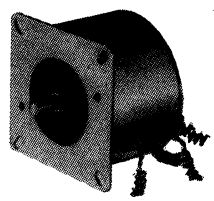
Permanent Magnet Motors

Stepper Motors - 7.5° - 2 Phase and 4 Phase

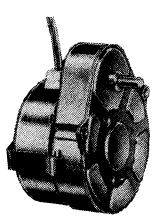
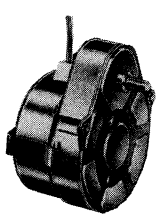
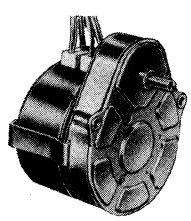
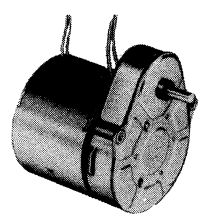
PART NUMBER	82 910.0	82 920.0	82 930.0	82 940.0
Stepper Motors				
Diameter	1.4″ (35.5 mm)	2″ (51 mm)	2.25″ (57.5 mm)	2.55″ (65 mm)
Holding Torque (2 Phase)	3.1 in. oz.	8.5 in. oz.	23 in. oz.	39 in. oz.

Reversible Synchronous Motors

Above Stepper Motor sizes are available as Reversible Synchronous Motors (300 or 450 RPM) 82 500 Series

Synchronous Gear Motors (Pear Shape)

- High Torque, instant stop
- Uni-directional or reversible
- Precision double bushing
- Standard round, flatted or knurled shaft
- UL, CSA and most European standards.
- Optional: Dual Voltage, friction or one way clutch, low temperature lubrication, etc.

Rotation	Uni-Directional		Reversible	
Torque	Standard Torque	High Torque	Standard Torque	High Torque
Part Number	82 344	82 334	82 514	82 524
Synchronous Gear Motors				
Static Torque	300 in. oz.	300 in. oz.	300 in. oz.	300 in. oz.
Dynamic Torque	75 in. oz.	75 in. oz.	75 in. oz.	75 in. oz.
Running Torque @ 1 RPM	155 in. oz.	580 in. oz.	420 in. oz.	1200 in. oz.
Power Input	2.7 w	2.8 w	2.7 w	3.5 w

Also available from Crouzet: ***Shaded Pole Gear Motors***

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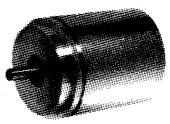
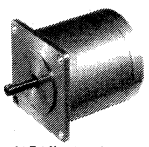
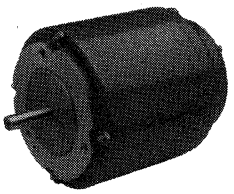
STEPPING MOTORS



Sizes 8 through 20 VR and PM stepping motors, 7.5, 10, 15, 22.5, 30, 45, and 90 degree step angles with a wide range of voltage and torque ratings. Heat sinks and mechanical dampers available.

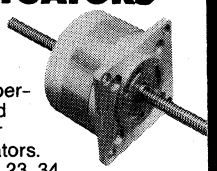


Size 23 (2 7/32″ dia.) and size 34 (3⅜″ dia.) permanent magnet stepping motors with 1.8, 1.875, 2, 2.5, 5, and 7.5 degree step angles. Torque ratings from 50 to 150 oz. in. for size 23, and 150 to 450 oz. in. for size 34.



Size 42 (4 3/16″ dia.) PM stepping motors with 1.8° step angles. High holding torques of 650 and 1150 oz/in. High positioning accuracy of ± 3% noncumulative. Bidirectional. High speed drivers and other options.

LINEAR ACTUATORS



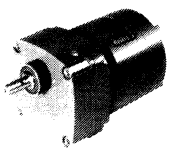
Stepper-based linear actuators. Sizes 23, 34, and 42. Linear force up to 1 ton. Linear resolution down to .000125″ travel per 1.8° step. Long strokes.

INSTRUMENT MOTORS AND GEAR MOTORS

Holtzer Cabot Model M instrument motors with ratings up to 1/20 HP. Available as induction, torque, and synchronous motors in either face or foot mount. Only 2⅞″ sq. Popular for floppy disk drive applications.

Holtzer Cabot Model L & S instrument motors with ratings up to 1/100 HP. Available as servo, polarized synchronous, synchronous, torque, induction, and DC motors. Only 2 5/16″ square.

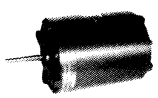
Holtzer Cabot Model L & S instrument gear motors with ratings through 150 oz. in. Available with gear reductions from 3:1 to 3600:1 in either spur or in helical gearing. Only 2 5/16″ square.



Size 34 (3⅜″ dia.) synchronous and nonsynchronous gear motors. Speeds from 2 RPM to 150 RPM. Torque output up to 40 lb. in. For applications that require quiet operation and long life.

Holtzer Cabot right angle gear motors. Up to ⅛ HP in a variety of voltages, either AC or DC. Gear ratios from 6:1 to 1140:1 in either single or double reduction gear reducers.

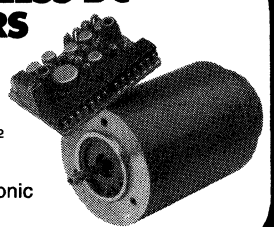
SYNCHRONOUS AND INDUCTION MOTORS



Size 34 (3⅜″ dia.) and 44 (4⅜″ dia.) synchronous and induction motors. 1/300 through ½ HP. 600 to 12,000 RPM. Single or dual speeds, single or dual voltage. 50/60 or 400 Hz.

Size 31 (3⅛″ dia.) and size 39 (3⅞″ dia.) synchronous and induction motors. 1/200 through ½ HP. 600 to 3600 RPM. Single or dual speeds. 50/60 Hz.

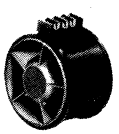
BRUSHLESS DC MOTORS



Motors, fans, blowers. Sub-FHP to ½ HP. To 20,000 rpm. With or without electronic drive circuits.

FANS AND BLOWERS

Propeller and Tubeaxial fans. Up to 12″ dia. up to 1500 CFM. The EAD line of axial fans for cooling application is manufactured for continuous duty and efficient air circulation.



Vaneaxial fans. Available in 1½″, 2″, and 4¾″ dia. from 3 to 500 CFM at high static pressures. EAD V-Line fans are small and powerful air moving devices particularly suited to high-density electronic packages.

Centrifugal blowers. From 3 to 2000 CFM, static pressures up to 5″ of water. These centrifugal squirrel cage blowers have general-purpose performance characteristics for systems with medium back pressures.

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Holtzer Cabot Instrument Motors

Janette Gear Motors, Reducers

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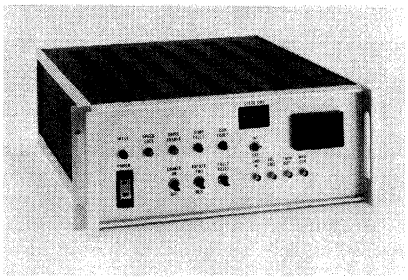
DC SERVO SYSTEMS

For applications requiring closed servo loop performance

MODEL 7-300-030-00
BRUSHLESS D.C. VELOCITY SERVO SYSTEM



The basic system includes the following:
- Brushless DC servo controller
- Brushless DC motor
- Commutation position encoder
- Incremental optical encoder

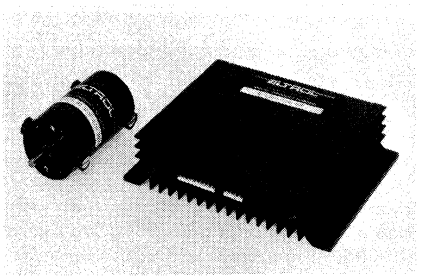
The system provides precise velocity control in a complete package: Internal D.C. power supplies, crystal reference, controls for bidirectional rotation and variable speed, digital speed readout, operating controls and status indicators.
Instantaneous speed regulation to ±.001%
Fault protection: Overtemperature, shorts to ground, shorts across motor
Current loop: High bandwidth with current limiting
Input power: 115/220VAC, 1 0, 50–60 Hz

MODEL 5-480-028-00
BRUSHLESS D.C. SERVO CONTROLLER

Motion control of velocity or torque. Available in three optional configurations:
- Transconductance amplifier: switch mode drive, 22 KHz switching freq., four quadrant operation, three phase delta or wye stators, high bandwidth current control loop with current limiting
- Phase lock servo: digital 5V square wave input command with velocity proportional to frequency, instantaneous speed regulation to ±.001%
- Velocity servo: analog input command, typical speed regulation ±0.5%

Commutation logic: accepts three phase 60 degree logic signals from the motor commutation position encoder
Fault protection: overtemperature, shorts across motor, shorts to ground, external fault indication and reset
Input power bus: 24–60 VDC
Peak output current: 5–30 amps

MODEL 6-120-024-00
BRUSH-TYPE LINEAR D.C. SERVO CONTROLLER



Motion control of position, velocity, or torque.
Simple adjustments for application adaptation
Peak output current: 2–10 amps
Linear operating mode: No switching EMI, high servo stiffness, no torque dead zone
Fault protection: Shorts across motor, shorts to ground, peak and time dependent continuous foldback current limits, external fault indication and reset.

The Eltrol motor-tach shown above is ideally suited to take full advantage of the servo controller's capabilities.

Eltrol Corporation is an engineering oriented firm specializing in D.C. servo systems. We provide standard, modified standard or custom designed systems to your electrical and mechanical specifications.

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Options + Accessories

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Brushless DC Controls
Computer Interfaceable

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Motors & Gearmotors
0.13 to 750 lb-in
Right Angle & Parallel Shaft

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Low Inertia Design
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SUMITOMO
SM Cyclo Speed Reducers
⅛ to 300 Horsepower
Efficiencies to 95%

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Dampers for Steppers/Servos

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ETI SYSTEMS

PRODUCT LINE

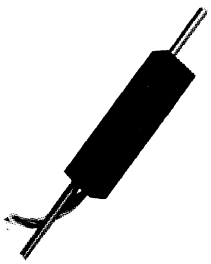
POTENTIOMETERS

SINGLE TURNS

- Conductive Plastic or Wirewound
- ½" diameter to 3" diameter
- Bushing or Servo Mount
- Multi Ganged
- Low Torque
- Oil Filled

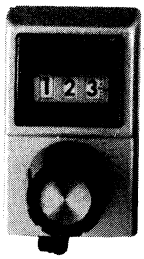
MULTI TURNS

- Wirewound or Hybrid
- ½" diameter to 2" diameter
- Bushing or Servo Mount
- 5 Amp Limit Switches
- Oil Filled or Sealed



LINEAR MOTION

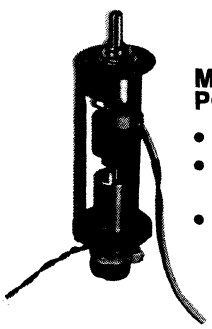
- Wirewound or Conductive Plastic
- 7/16" diameter to 2" square
- Oil Filled or Sealed
- Spring Returns and Threaded Shafts



TURNS COUNTING DIALS

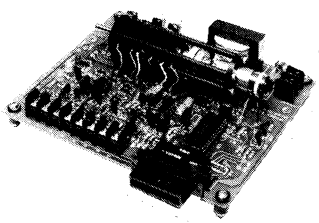
- Concentric or Rectangular
- Up to 100 Turn Counts
- Combination Pots and Dials "Combos"
- Over-Center Locks

POSITION CONTROLS



MOTORIZED POTENTIOMETERS

- 6, 12 or 24 VDC or 24, 115 VAC
- All Single Turn and Multi Turn Pots can be Motorized
- Motorized Variable Transformers and Rheostats



CIRCUITRY

- Circuitry to Drive DC Motor Pots
- Inputs of 4 to 20 Milliamps; 0 to 5 or 10 VDC;8 and 16 Binary Codes
- Power Supply with +15, −15, +5 VDC Output

ROTARY ACTUATORS

- Valve Positioner
- Rotary Mechanisms
- Throttle Controls
- Up to 200 Inch Lbs. or Torque

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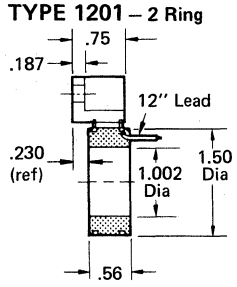
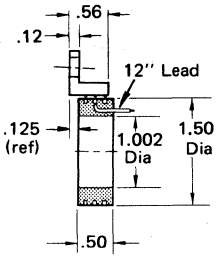
BEST DELIVERY **1**

SEPARATE ROTOR AND BRUSH BLOCK ASSEMBLY — STOCK DELIVERY

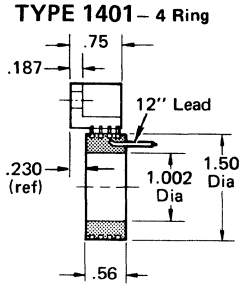
TYPE 1201 – 2 Ring



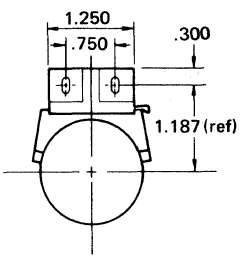
TYPE 1301 – 3 Ring



TYPE 1401 – 4 Ring

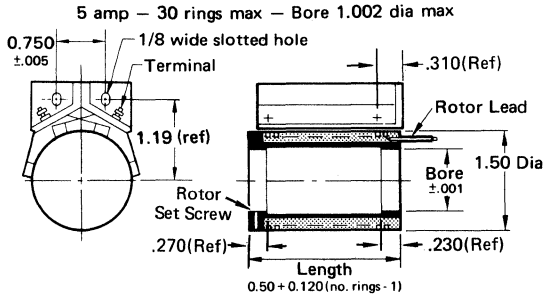


TYPICAL END VIEW



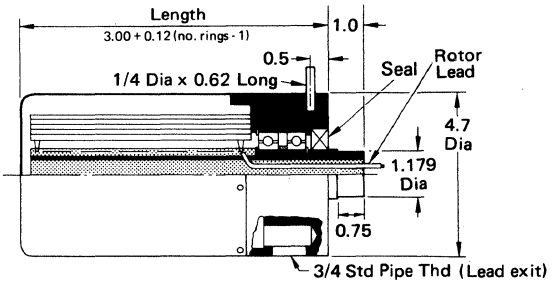
Slip Ring Assembly Type **1057**
Separate Rotor and Brush Block

5 amp – 30 rings max – Bore 1.002 dia max



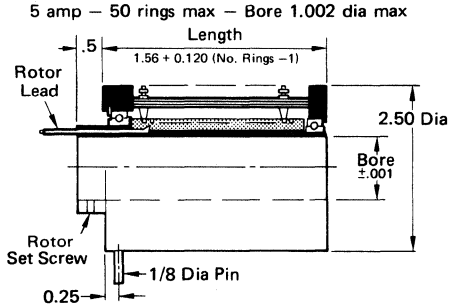
Slip Ring Assembly Type **1302**
Sealed Housing

5 amp – 50 rings max – Solid Bore



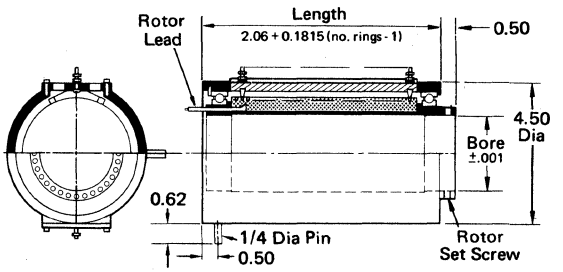
Slip Ring Assembly Type **1186**
Rigid Tube Housing – Exposed Stator Terminals

5 amp – 50 rings max – Bore 1.002 dia max



Slip Ring Assembly Type **1067**
Rigid Tube Housing – Exposed Stator Terminals

5 amp – 100 rings max – Bore 2.252 dia max



CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds.

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

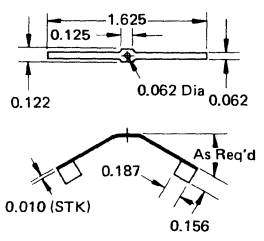
Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

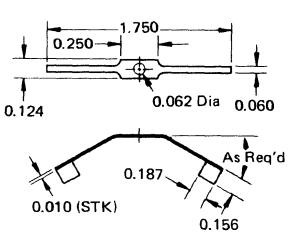
BRUSH ASSEMBLIES 2

LEAF TYPE (BRUSH MATERIAL - FAG 180 LEAF MATERIAL - BeCu) STOCK DELIVERY

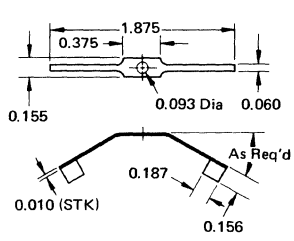
5.0 AMP DOUBLE BRUSH
P/N 1103004 BRUSH .040 WIDE



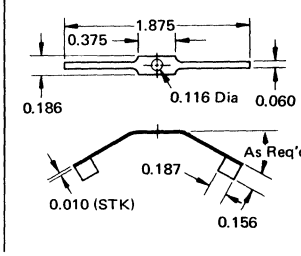
5.0 AMP DOUBLE BRUSH
P/N 1050006-13 BRUSH .040 WIDE



5.0 AMP DOUBLE BRUSH
P/N 1050006-5 BRUSH .040 WIDE

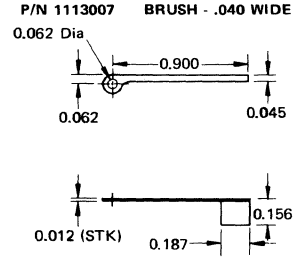


5.0 AMP DOUBLE BRUSH
P/N 1050006-2 BRUSH .040 WIDE

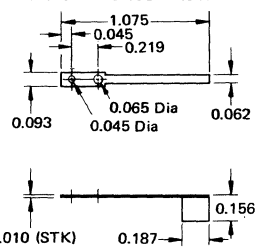


"AS REQ'D" ANGLE IN FREE STATE – LEAF WITHOUT BRUSH WOULD TOUCH RING SURFACE

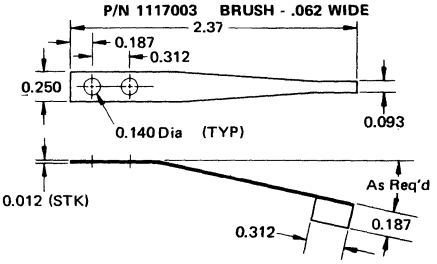
2.0 AMP SINGLE BRUSH
P/N 1113007 BRUSH - .040 WIDE



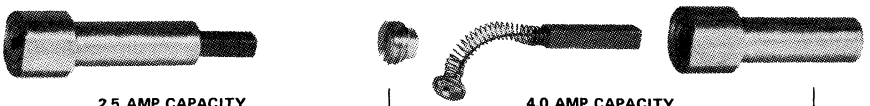
2.0 AMP SINGLE BRUSH
P/N 1120051 BRUSH - .040 WIDE



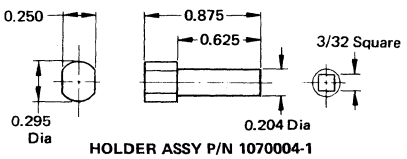
5.0 AMP SINGLE BRUSH
P/N 1117003 BRUSH - .062 WIDE



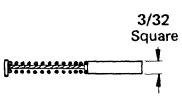
PLUNGER TYPE (BRUSH MATERIAL - FAG 180 HOLDER - BRASS) STOCK DELIVERY



2.5 AMP CAPACITY
3/32" SQUARE BRUSH

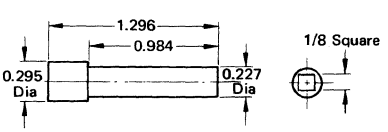


HOLDER ASSY P/N 1070004-1
CAP ASSY P/N 1070004-2

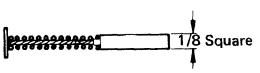


BRUSH ASSY P/N 1072-1

4.0 AMP CAPACITY
1/8" SQUARE BRUSH

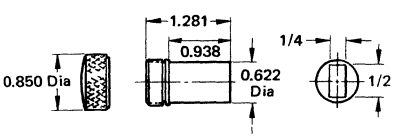


HOLDER ASSY P/N 1051032-1
CAP ASSY P/N 1051032-2

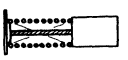


BRUSH ASSY P/N 1072-2

25 AMP CAPACITY
1/4" x 1/2" RECTANGULAR BRUSH



HOLDER ASSY P/N 1092006-1
CAP ASSY P/N 1092006-2



BRUSH ASSY P/N 1092003

BRUSH MATERIAL

- Fabricast grade Fag 180, the universal low noise level grade used for all standard brush assembles.
- Fabricast grade FAG 193, the lowest noise level grade, however, the ring surface speed is limited to 250 SFM.
- Fabricast grade FAG 150, the highest surface speed grade, however, noise levels are compromised.

Grade No.	Composition	Recommended Surface Speed	Carrying Capacity
FAG150	50% silver, 50% graphite	Over 3500 ft. per min.	100 Amps per sq. in.
FAG180	80% silver, 20% graphite	Up to 3500 ft. per min.	250 Amps per sq. in.
FAG193	93% silver, 7% graphite	Up to 250 ft. per min.	300 Amps per sq. in.

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

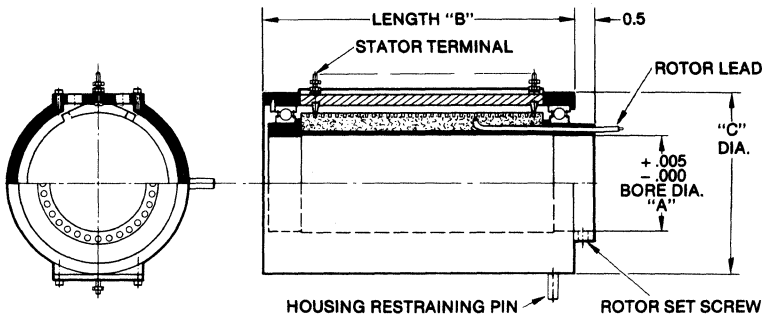
SLIP RING ASSEMBLIES

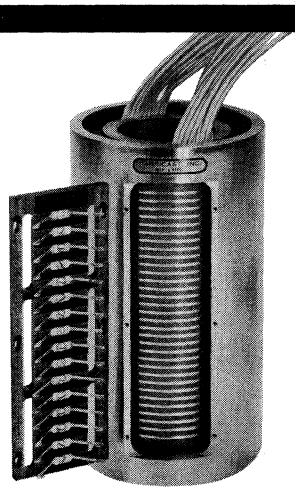
SELF—CONTAINED RIGID TUBE HOUSING

3

DISTINGUISHING CHARACTERISTICS

Rigid one piece housing eliminates bearing alignment problems. Larger section bearings are generally used in these units for a more rugged unit.





TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
1230	Solid	—	100		3.50 + .120 (no. rings -1)	2.50
1186	1.000	0 - 1.002	100	5 amp std 2 brushes per ring	1.56 + .120 (no. rings -1)	2.50
1197	1.250	1.0 - 1.252	70		1.56 + .130 (no. rings -1)	3.50
1289	1.500	1.25 - 1.502	100		1.56 + .150 (no. rings -1)	4.00
1067	2.000	1.5 - 2.252	100	10 amp std or lo noise 4 brushes per ring	2.06 + .181 (no. rings -1)	4.50
1420	3.000	2.25 - 3.002	100		1.38 + .181 (no. rings -1)	4.75
1506	3.500	3.0 - 3.502	100		2.88 + .200 (no. rings -1)	6.50
1390	4.000	3.5 - 4.252	100		2.00 + .187 (no. rings -1)	5.75

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* FOR 50 AMP STANDARD POWER ASSEMBLIES SEE POWER ASSEMBLY SECTION.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Coin Silver 5 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable

NOISE: 10 Milliohms dynamic resistance MAX
5 Milliohms MAX with 4 brushes per CKT

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

HOUSING: One piece tube construction

COVER: Easily removable for brush and ring inspection

BEARINGS: Shielded or sealed ball bearings

PART NUMBER CODING – Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

WRITE OR PHONE FOR THE FABRICAST CATALOG

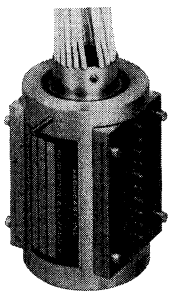
Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

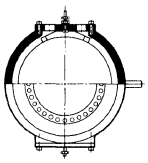
SLIP RING ASSEMBLIES

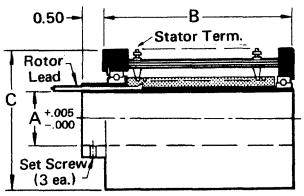
SELF-CONTAINED 4

SELF CONTAINED RIGID HOUSING SLIP RING ASSEMBLIES



DISTINGUISHING CHARACTERISTICS
Rigid one piece housing eliminates bearing alignment problems. Bearings are thin section aircraft torque tube type or Kaydon KA series.





REPLACEABLE BRUSH ASSEMBLIES — 1000 VAC HYPOT

TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
4100	.500	.250 - .502	48		1.19 + .125 (no. rings - 1)	2.00
4150	1.000	.000 - 1.002	64	5 amp std	1.19 + .120 (no. rings - 1)	2.50
4200	1.312	1.000 - 1.312	100	2 brushes	1.19 + .125 (no. rings - 1)	3.00
4237	1.750	1.312 - 1.752	78	per ring	1.19 + .130 (no. rings - 1)	3.37
4268	2.000	1.750 - 2.002	100		1.28 + .150 (no. rings - 1)	3.62
4350	2.750	2.250 - 2.752	100	10 amp std	1.75 + .150 (no. rings - 1)	4.50
4400	3.250	2.750 - 3.252	100	or lo noise	1.75 + .187 (no. rings - 1)	5.00
4462	3.750	3.250 - 3.752	100	4 brushes	1.75 + .160 (no. rings - 1)	5.50
4500	4.250	3.750 - 4.252	100	per ring	1.75 + .187 (no. rings - 1)	6.00
4600	5.250	4.250 - 5.252	79		1.75 + .186 (no. rings - 1)	7.00
4700	6.250	5.250 - 6.252	63		1.75 + .186 (no. rings - 1)	8.00
4800	7.250	6.250 - 7.252	58		1.75 + .187 (no. rings - 1)	9.00
4900	8.750	7.250 - 8.750	58		1.75 + .187 (no. rings - 1)	11.00
1271	1.000	.000 - 2.000	15	50 amp std	3.50 + 1.050 (no. rings - 1)	4.50
1291	3.000	2.000 - 3.252	9	50 amp std	4.50 + 1.120 (no. rings - 1)	6.50

NON-REPLACEABLE BRUSH ASSEMBLIES — 500 VAC HYPOT

4087	.250	.250 - .502	50	3 amp std	.875 + .080 (no. rings - 1)	1.56
4125	.500	.250 - .752	50	2 brushes	.875 + .100 (no. rings - 1)	2.00
4230	2.000	1.500 - 2.002	50	per ring	.875 + .080 (no. rings - 1)	3.50

PART NUMBER CODING — Specify fully when ordering

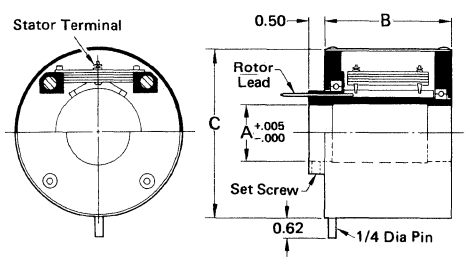
Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS

RPM: **Rigid one piece housing eliminates bearing alignment problems.**
RINGS: Coin Silver 5 amp rings. Copper 50 amp rings.
BRUSHES: Silver Graphite Fabricast Grade FAG 180 (80% AG — 20% C) Two brushes per ring. Brushes individually removable and replaceable.
NOISE: 10 Milliohms dynamic resistance max 5 Milliohms max with 4 brushes per ckt.
CURRENT: Noted in tabulated block. Rating may be doubled with 4 brushes per ckt.
HI-POT: See table on left.
ROTOR: One piece steel sleeve. Ring complement vacuum cast on sleeve as unit with epoxy dielectric.
ROTOR LEADS: 5 amp Leads — 20 ga per MIL-W-16878 type "E" 50 amp Leads — 8 ga — Teflon.
HOUSING: One piece tube construction.
COVER: Easily removable for brush and ring inspection.
BEARINGS: Shielded or sealed ball bearings.

SELF CONTAINED COVERED STATOR TERMINAL SLIP RING ASSEMBLIES

DISTINGUISHING CHARACTERISTICS
Bearing Bell and space bar type units best suited for larger bore assemblies.



TYPE	BORE DIA "A", inches		NO. RINGS MAX	CURRENT	LENGTH "B", inches	Housing Dia "C"
	Nominal	Range				
1296	.250	.250 - .377	48		1.25 + .110 (no. rings -1)	2.25
1297	.500	.378 - .565	100	5 amp std	1.25 + .120 (no. rings -1)	2.75
1298	1.000	.566 - 1.002	100	2 brushes	1.25 + .120 (no. rings -1)	3.00
1272	1.000	1.000 - 1.750	100	per ring	2.00 + .150 (no. rings -1)	5.25
1273	2.000	1.750 - 2.625	100		2.00 + .150 (no. rings -1)	6.25
1274	3.000	2.625 - 3.750	100		2.00 + .160 (no. rings -1)	7.50
1275	4.000	3.750 - 4.750	48	10 amp or	2.00 + .186 (no. rings -1)	9.00
1276	5.000	4.750 - 5.750	63	lo noise	2.00 + .186 (no. rings -1)	10.50
1277	6.000	5.750 - 6.750	58	4 brushes	2.00 + .187 (no. rings -1)	12.00
1278	8.000	6.750 - 8.750	58	per ring	2.00 + .187 (no. rings -1)	15.00
1282	1.000	1.000 - 1.250	16		3.00 + 1.050 (no. rings -1)	8.00
1283	2.000	1.250 - 2.000	16		3.00 + 1.050 (no. rings -1)	9.00
1284	3.000	2.000 - 3.125	9	50 amp std	3.00 + 1.120 (no. rings -1)	10.00
1285	4.000	3.125 - 4.375	8	100 amp	3.00 + 1.116 (no. rings -1)	11.50
1286	5.000	4.375 - 5.375	10	4 brushes	3.00 + 1.116 (no. rings -1)	12.50
1287	6.000	5.375 - 6.375	10	per ring	3.00 + 1.125 (no. rings -1)	13.50
1288	8.000	6.375 - 8.375	10		3.00 + 1.125 (no. rings -1)	16.00

* RING COMPLEMENT MAY BE LIMITED BY ABILITY TO PASS ROTOR LEADS UNDER BEARINGS.
* 10 AMP OR LOW NOISE CKT ON TYPES 1296, 1297, 1298, REQUIRE 2 PARALLEL RINGS PER CIRCUIT.
* INSTRUMENT AND 50 AMP POWER CIRCUITS MAY BE CAST ON COMMON SLEEVE.

PART NUMBER CODING — Specify fully when ordering

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

CHARACTERISTICS **HOUSING:** Bell, Bell Spacer and Cover type construction. All other characteristics same as for Self Contained Rigid Housing Slip Ring Assembly.

WRITE OR PHONE FOR THE FABRICAST CATALOG

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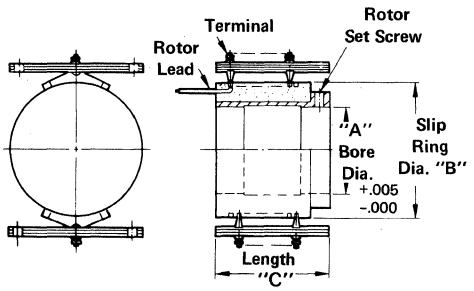
P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

SLIP RING ASSEMBLIES

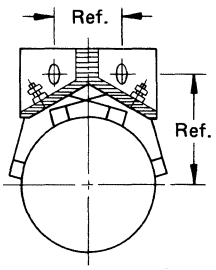
SEPARATE ROTOR & BRUSH BLOCK

5

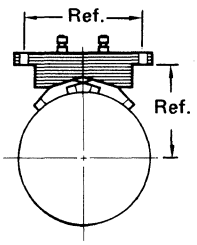
Brush Block Assy
5 AMP STD



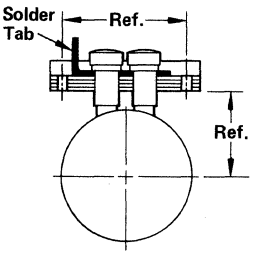
Brush Block Assy
TYPE "A"



Brush Block Assy
TYPE "E"



Brush Block Assy
50 AMP STD



TYPE	BORE DIA "A" INCHES		NO. RINGS MAX.	CURRENT AMPS	SLIP RING DIA "B"	LENGTH "C" INCHES
	NOMINAL	RANGE				
2050	SOLID	000 - .127	18	5 amp std 2 brushes per ring	.500	.625 + .125 (no. rings -1)
2087	SOLID	000 - .377	48		.875	.625 + .110 (no. rings -1)
2112	.375	000 - .627	52		1.125	.625 + .125 (no. rings -1)
2150	.750	.625 - 1.002	52		1.500	.625 + .120 (no. rings -1)
2187	1.000	.750 - 1.250	48		1.875	.625 + .125 (no. rings -1)
2200	1.125	.750 - 1.375	80	10 amp std or lo noise 4 brushes per ring	2.000	.750 + .125 (no. rings -1)
2237	1.250	1.000 - 1.502	78		2.375	.750 + .130 (no. rings -1)
2268	1.500	1.250 - 1.752	107		2.687	1.000 + .150 (no. rings -1)
2350	2.000	1.750 - 2.502	78		3.500	1.000 + .181 (no. rings -1)
2375	2.500	2.370 - 2.875	48		3.750	1.000 + .200 (no. rings -1)
2462	3.000	2.750 - 3.752	100		4.652	1.250 + .160 (no. rings -1)
2500	4.000	3.250 - 4.002	40		5.000	1.250 + .250 (no. rings -1)
2600	5.000	4.000 - 5.002	80		6.000	1.250 + .186 (no. rings -1)
2700	6.000	5.000 - 6.002	63		7.000	1.250 + .186 (no. rings -1)
2800	7.000	6.000 - 7.002	58		8.000	1.250 + .187 (no. rings -1)
2900	8.000	7.000 - 9.002	58		10.000	1.250 + .187 (no. rings -1)
3268	1.000	.750 - 1.187	16	50 amp std 2 brushes per ring	2.687	2.000 + 1.050 (no. rings -1)
3300	1.500	1.187 - 1.500	6		3.000	2.000 + 1.000 (no. rings -1)
3350	2.000	1.500 - 2.000	16		3.500	2.000 + 1.050 (no. rings -1)
3462	3.000	2.000 - 3.125	9		4.625	2.000 + 1.120 (no. rings -1)
3600	4.000	3.125 - 4.500	8		6.000	2.000 + 1.116 (no. rings -1)
3700	5.000	4.500 - 5.500	10		7.000	2.000 + 1.116 (no. rings -1)
3800	6.000	5.500 - 6.500	10		8.000	2.000 + 1.125 (no. rings -1)
3900	7.000	6.500 - 8.500	10		10.000	2.000 + 1.125 (no. rings -1)

CHARACTERISTICS

RINGS: Coin Silver AMP Rings.
Copper 50 AMP Rings.

BRUSHES: Silver Graphite.
Fabricast Grade FAG 180 (80% AG – 20% C)
Two brushes per ring
Brushes individually removable and replaceable.

NOISE: 10 Milliohms dynamic resistance MAX.
5 Milliohms max with 4 brushes per CKT.

CURRENT: Noted in tabulated block.
Rating may be doubled with 4 brushes per ckt.

HI-POT: 1000 VAC 60 cycle for 15 seconds.

ROTOR: One piece steel sleeve.
Ring complement vacuum cast on sleeve as unit with epoxy dielectric.

ROTOR LEADS: 5 AMP Leads – 20 GA per MIL-W-16878 TYPE "E"
50 AMP Leads – 8 GA – Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends.

BRUSH BLOCK: Glass epoxy laminate.
Optional mounting methods shown.

PART NUMBER CODING – Specify fully when ordering.

Type	Bore (inches)	No. Rings	Lead Length (inches)	Lead Type (Shielded - S, Unshielded - U)
X	X	X	X	X

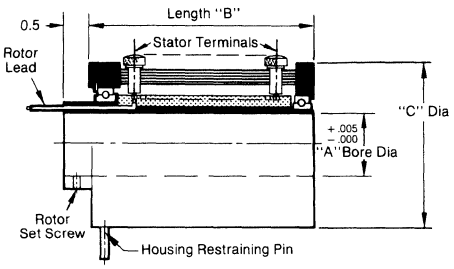
WRITE OR PHONE FOR THE FABRICAST CATALOG

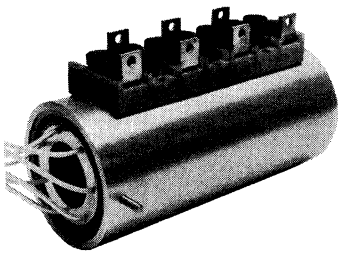
Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

SLIP RING ASSEMBLIES 6

POWER ASSEMBLIES





CHARACTERISTICS

RPM: Rigid one piece housing eliminates bearing alignment problems

RINGS: Copper 50 AMP Rings

BRUSHES: Silver Graphite
Fabricast Grade FAG 180 (80% AG—20% C)
Two brushes per ring
Brushes individually removable and replaceable

CURRENT: Noted in tabulated block
Rating may be doubled with 4 brushes per CKT

HI-POT: 1000 VAC 60 CYCLE for 15 seconds

ROTOR: One piece steel sleeve
Ring complement vacuum cast on sleeve as unit with epoxy dielectric

ROTOR LEADS: 50 AMP Leads — 8 GA — Teflon
Lead exit as shown on most units. Maximum ring complement may require smaller wire or leads to exit both ends

BEARINGS: Shielded or sealed ball bearings

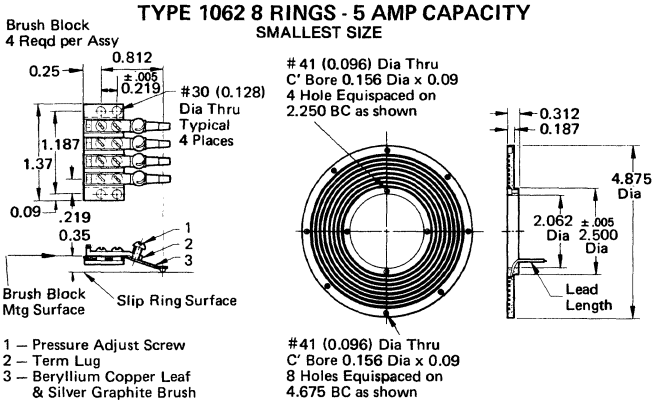
TYPE	BORE DIA "A" INCHES		NO. RINGS MAX	CURRENT	LENGTH "B" INCHES	HOUSING DIA "C"
	NOMINAL	RANGE				
5035	1.625	1.125 - 2.125	15	50 amp std	3.25 + 1.089 (no. rings-1)	4.50
5043	2.625	2.000 - 3.250	8	2 brushes	3.25 + 1.100 (no. rings-1)	5.50
5050	3.375	2.750 - 4.000	10	per	3.25 + 1.125 (no. rings-1)	6.12
5060	4.062	3.125 - 5.000	10	ring	3.25 + 1.116 (no. rings-1)	7.25
5070	5.250	4.500 - 6.000	8	100 amp	3.25 + 1.116 (no. rings-1)	8.00
5080	6.000	5.500 - 6.500	8	4 brushes	3.25 + 1.125 (no. rings-1)	9.00
5100	7.625	6.750 - 8.500	8	per	3.25 + 1.125 (no. rings-1)	11.00
5140	9.500	8.500 - 10.500	6	ring	3.75 + 1.250 (no. rings-1)	15.75

PART NUMBER CODING — Specify fully when ordering

Type	Bore (Inches)	No. Rings	Lead Length (Inches)
X	X	X	X

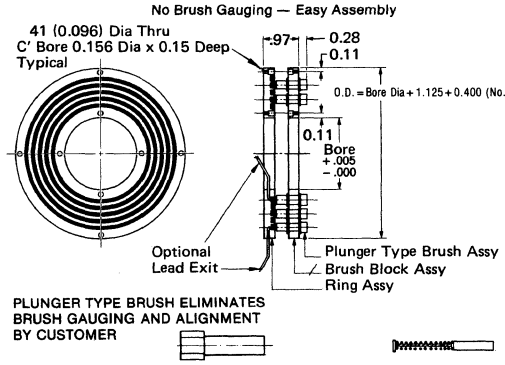
PANCAKE TYPE SLIP RING ASSEMBLIES

TYPE 1062 8 RINGS - 5 AMP CAPACITY
SMALLEST SIZE



1 — Pressure Adjust Screw
2 — Term Lug
3 — Beryllium Copper Leaf & Silver Graphite Brush

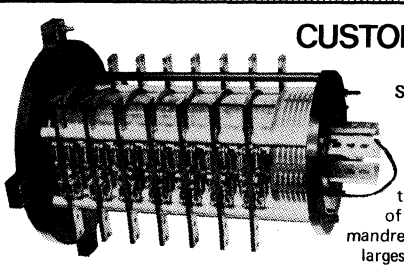
TYPE 1650 - 5 AMP CAPACITY
NO. OF RINGS PER CUSTOMER REQ'TS
No Brush Gauging — Easy Assembly



PLUNGER TYPE BRUSH ELIMINATES BRUSH GAUGING AND ALIGNMENT BY CUSTOMER

HOLDER ASSY P/N 1070004 **BRUSH ASSY P/N 1072-1**

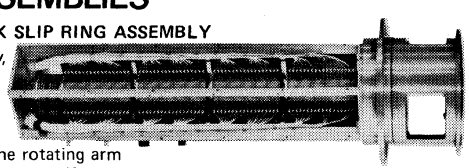
CUSTOM DESIGNED SLIP RING ASSEMBLIES



CUSTOM 7000 AMP SLIP RING ASSEMBLY

This slip ring assembly, as designed and manufactured by Fabricast, Inc., is used to supply 7000 amperes of current to the rotating mandrel of the world's second largest spin forging machine.

CUSTOM 222 TRACK SLIP RING ASSEMBLY



This slip ring assembly, as designed and manufactured by Fabricast, Inc. was used to complete the electrical circuits to the rotating arm of an astronaut carrying centrifuge.

The unit consists of 50 amp. power, 5 amp. instrumentation and 50 megacycle coaxial modules.

FABRICAST WILL ALSO CUSTOM DESIGN SPLIT RING ASSEMBLIES AND SEGMENTED SLIP RING ASSEMBLIES

WRITE OR PHONE FOR THE FABRICAST CATALOG

Fabricast, Inc. *CUSTOM MANUFACTURERS OF SLIP RING ASSEMBLIES*

P.O. BOX 3176, 2517 SEAMAN AVENUE, SOUTH EL MONTE, CALIF. 91733 Phone (818) 443-3247 (S. El Monte/Los Angeles)

GRAPHALLOY®

SILVER GRAPHALLOY BRUSHES and BRUSH & SLIP-RING ASSEMBLIES...

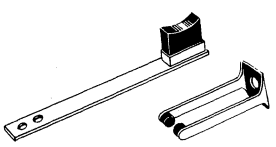
USED IN **MICROWAVE EQUIPMENT • SERVO SYSTEMS • SYNCHROS • INVERTERS • THERMOCOUPLE and STRAIN GAGE CIRCUITS • PULSE SYSTEMS • COMPUTER GROUNDING CONTACTS • TORQUE INDICATORS • MEDICAL EQUIPMENT • PACKING MACHINERY**

GRAPHALLOY® BRUSHES

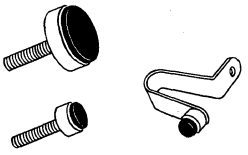
Silver-Graphalloy Brushes have been widely used because of low *and* constant contact drop, extremely low electrical noise, *and* long life. Over 100 grades are now serving in a wide variety of applications. Silver-Graphalloy Brushes on ½-inch-diameter coin silver slip rings have operated successfully in highly critical electrical circuits at speeds up to 100,000 r.p.m.

Standard sizes from ⅛"-square to ¾"-square. Many sizes in stock.

Our Engineering Department will assist you in determining the exact grade of GRAPHALLOY for your needs. *Ask for our Brush Inquiry Form 109.*



LEAF SPRINGS



CUP CONTACTS

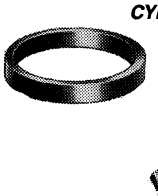
GRAPHALLOY® SLIP RINGS

We supply Coin Silver and Bronze Slip Rings, both *cylindrical* and *flat* types ... and recommend three brushes per ring ... spaced at 120° ... for best contact. The cylindrical type are designed for press fitting over standard steel shafting. The flat type rings are designed for nesting either on an insulated plate or for molding into insulation. Insulated slip rings of either type, or slip-ring assemblies, can be furnished with leads attached.

No. 168 Series FLAT TYPE to 20" O.D.

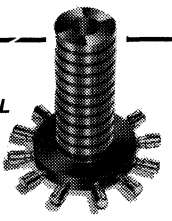
Standard FLAT Rings have ¼" radial contact surface and ⅛" radial spacing between adjacent rings.

No. 116 Series CYLINDRICAL TYPE to 36" O.D.



Typical Layout

Model 319 CYLINDRICAL SLIP-RING Assembly

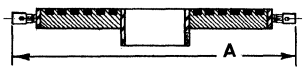


SOLID COIN SILVER RINGS

Model	Rings	Length
319-4	4	2 9/16"
319-6	6	3 5/16"
319-10	10	4 13/16"
319-14	14	6 5/16"

O.D. Slip Ring 1⅝"
Terminal 4"
Assembly I.D. .814/.813"

Model 409 FLAT SLIP-RING Assembly

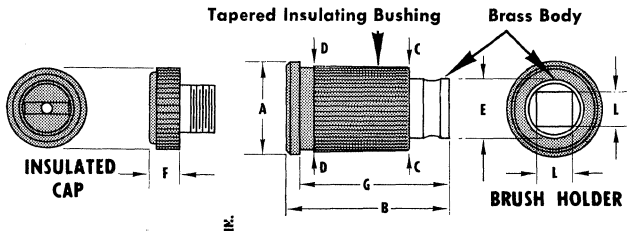


SOLID COIN SILVER RINGS

Model	Rings	O.D. "A"
409-2	2	5½"
409-4	4	7"
409-6	6	8½"
409-10	10	11½"

Hub O.D. 2" I.D. 1.753/1.751"
Length 1⅛" To 5 Amps., 125 V.
More rings on application.

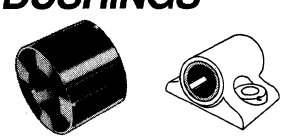
GRAPHALLOY BRUSH HOLDERS



BRUSH HOLDER & CAP NO.	BRUSH SIZE	SUGGESTED MIN. SLIP-RING WIDTH	**MOUNTING HOLE DIAMETER	BRUSH HOLDER TO SLIP RING—MIN.	A	B OVERALL LENGTH	F	C	D	E	G	L BROACHED HOLE
					Other Sizes Available							
14326	⅛" sq.	3/16"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.129"
11509†	5/32" sq.	¼"	13/32"	1/16"	.437"	⅞"	3/16"	.404"	.418"	.281"	25/32"	.160"
11570†	3/16" sq.	¼"	7/16"	1/16"	.484"	⅞"	3/16"	.441"	.451"	.313"	25/32"	.193"
19011†	¼" x 3/16"	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256 x .193"
11527†	¼" sq.	5/16"	9/16"	⅛"	.616"	1 5/16"	3/16"	.561"	.573"	.438"	1 3/16"	.256"
14292†	⅜" x ¼"	7/16"	43/64"	⅛"	.718"	1 7/16"	¼"	.672"	.682"	.533"	1 5/16"	.382 x .256"
12166†	⅜" sq.	7/16"	13/16"	⅛"	.921"	1 13/16"	¼"	.813"	.828"	.628"	1⅝"	.382"
31392†	½" sq.	9/16"	1⅛"	⅛"	1.237"	1 13/16"	¼"	1.126"	1.141"	.878"	1 9/16"	.503"
35439†	¾" x ½"	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"
35440†	¾" sq.	⅞"	1 33/64"	⅛"	1.661"	2 1/32"	5/16"	1.508"	1.528"	1.253"	1 25/32"	.753"

†Shunts are provided. **Mounting hole diameter for brush holder dimension D.

GRAPHALLOY BUSHINGS and PILLOW BLOCKS



Survive unlubricated! Replace oil-lubricated bushings in synchros, instruments, timers and missiles. Advantages:

(1) Lower friction at room temperatures;
(2) No oil to solidify at low temperatures;
(3) No oil to carbonize at prolonged elevated temperatures.
(4) No oil or grease drag.

Ask for Data Sheets 270 and 277 on Miniature Bronze-Graphalloy Bushings.

Ask for the following Data Sheets

GRAPHALLOY BRUSHES, SLIP RINGS & ASSEMBLIES ... DS-218
GRAPHALLOY BUSHINGS, PILLOW BLOCKS ... DS-117 and DS-1001

We can solve your unique electrical or mechanical problems. Phone or write us today!

Standard and Custom-designed GRAPHALLOY® products since 1913

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1036 Nepperhan Ave., P.O. Box 110
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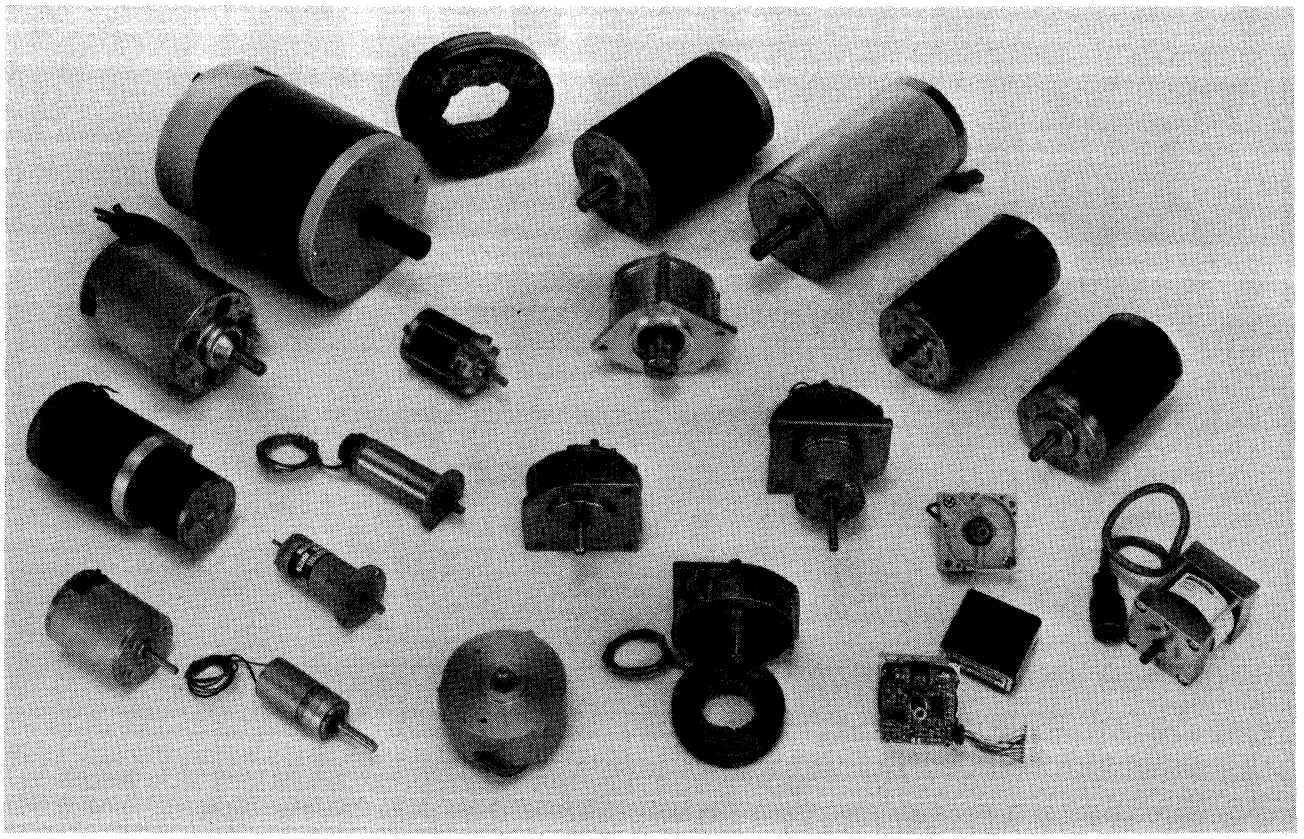
Hathaway MOTORS

BRUSHLESS AND BRUSH TYPE PMDC MOTOR LINE



The value resource in electronic motion control.

HATHAWAY has developed and is currently producing several sizes of BRUSHLESS DC MOTORS. Hathaway's brushless DC motors are priced competitively with offshore manufacturers, even at high volumes. Our engineers can help you with fast turnaround on prototypes for your specific applications.

HATHAWAY offers quality, cost effective PMDC BRUSH TYPE motors to meet your product's critical performance or high volume requirements. HATHAWAY motors are specifically designed for today's technology. If you are currently designing performance, quality or reliability into your product, contact HATHAWAY.

HATHAWAY ADVANTAGES

- Engineering — Hathaway's engineering staff is recognized as an authority in PMDC motor design.
- Manufacturing — Modern automatic equipment and high volume production capability.
- Applications — Hathaway experience and know-how covers a broad spectrum, from military and aerospace hardware, to OEM consumer products and computer peripheral equipment.
- Customer Service — Ask a Hathaway customer.
- Magnets — Neodymium, rare earth cobalt, ceramic, alnico

APPLICATIONS

- Computer peripheral drives
- Military systems
- Servo positioning
- OEM consumer products
- Encoder assemblies
- Fans/Blowers
- Instruments
- Appliances
- Medical products
- Aerospace
- Pumps

CUSTOM DESIGNS

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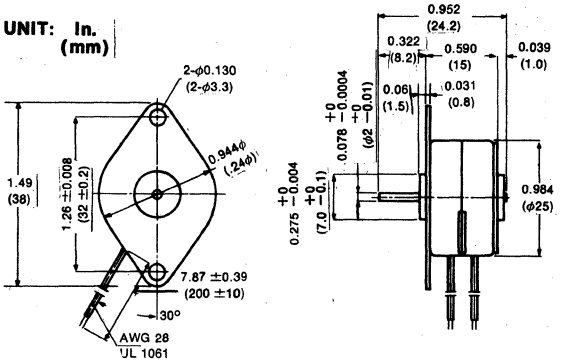
INLAND MOTOR
KOLLMORGEN CORPORATION

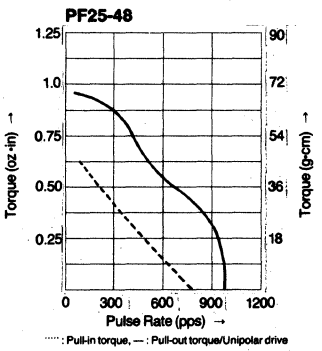
PM TYPE STEPPER MOTORS

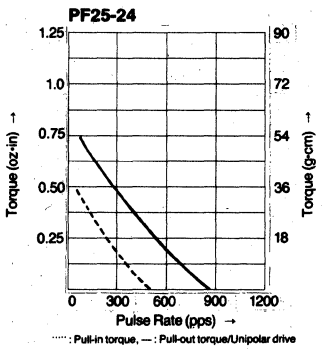
PF25 SERIES

UNIT: In. (mm)



Typical Torque vs. Pulse Rate Characteristics



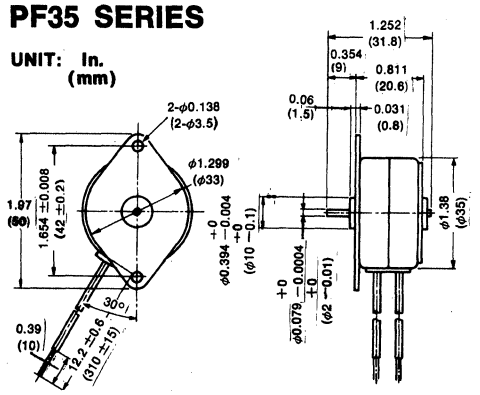


Specifications

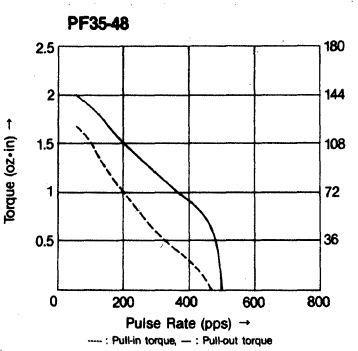
Items \ Models		PF25-48B	PF25-48C	PF25-48D	PF25-24B	PF25-24C	PF25-24D
Excitation Mode		2-2					
Step Angle	(°)	7.5			15		
Step Angle Tolerance	(%)	±5					
Steps per Revolution		48			24		
DC Operating Voltage	(V)	24	12	5	24	12	5
Operating Current	(mA/φ)	48	100	274	48	100	274
Winding Resistance	(Ω/φ)	480	120	16	480	120	16
Winding Inductance	(mH/φ)	137	39	5.5	111	34	4.8
Holding Torque	(oz·in/g·cm)	1.4/100			1.1/80		
Rotor Inertia	(oz·in²/g·cm·s²)	5.3x10⁻³/1.0x10⁻³					
Starting Pulse Rate, Max.	(pps)	790			520		
Slewing Pulse Rate, Max.	(pps)	900			850		
Ambient Temp. Range, Operating	(°C)	−10 ~ +50					
Temperature Rise	(°C)	70					
Weight	(oz/g)	1.23/35					
Driver		PS-ILD-42					

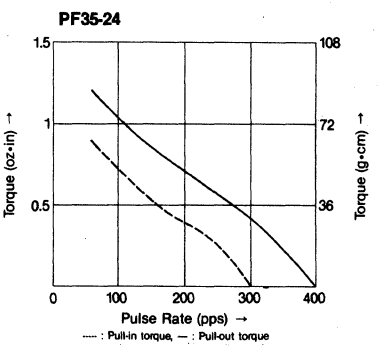
PF35 SERIES

UNIT: In. (mm)



Typical Torque vs. Pulse Rate Characteristics





Specifications

Items \ Models		PF35-48B	PF35-48C	PF35-48D	PF35-24B	PF35-24C	PF35-24D
Excitation Mode		2-2					
Step Angle	(°)	7.5			15		
Step Angle Tolerance	(%)	±5					
Steps per Revolution		48			24		
DC Operating Voltage	(V)	24	12	5	24	12	5
Operating Current	(mA/φ)	67	133	313	67	133	313
Winding Resistance	(Ω/φ)	360	90	16	360	90	16
Winding Inductance	(mH/φ)	202	48	8.9	156	37	6.9
Holding Torque	(oz·in/g·cm)	2.8/200			2/150		
Rotor Inertia	(oz·in²/g·cm·s²)	24x10⁻³/4.5x10⁻³					
Starting Pulse Rate, Max.	(pps)	470			300		
Slewing Pulse Rate, Max.	(pps)	500			400		
Ambient Temp. Range, Operating	(°C)	−10 ~ +50					
Temperature Rise	(°C)	55					
Weight	(oz/g)	2.9/80					

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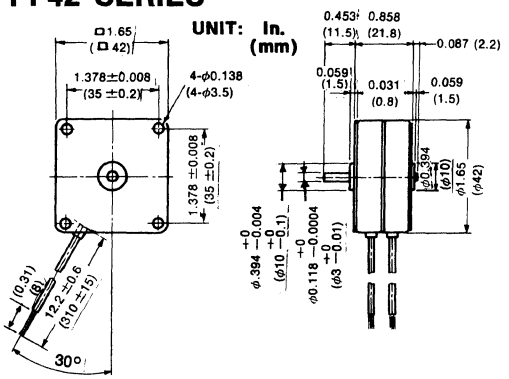
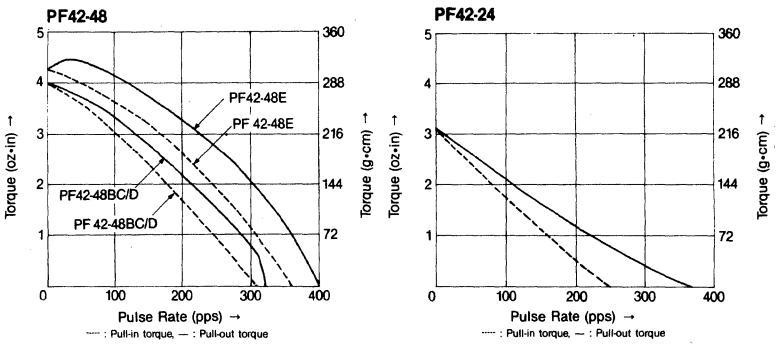
INLAND MOTOR
KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

PF42 SERIES



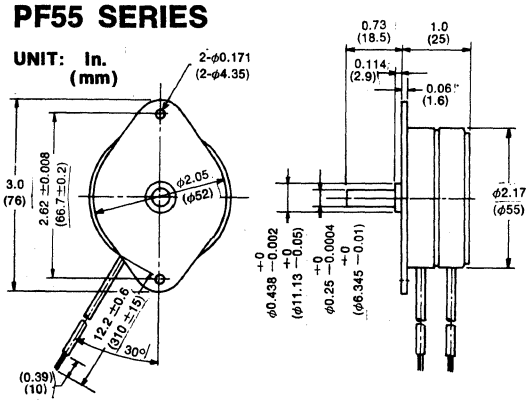
Typical Torque vs. Pulse Rate Characteristics



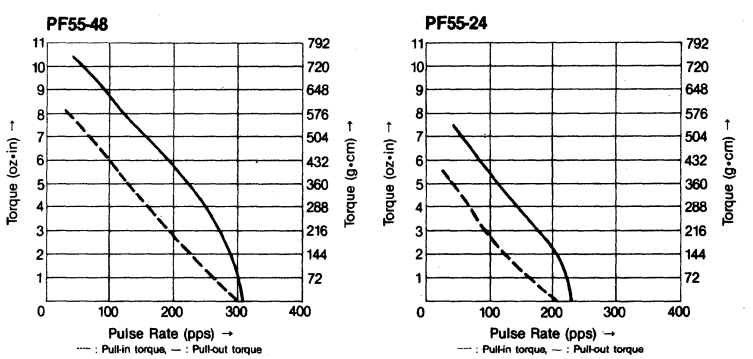
Specifications

Items \ Models	PF42-48B	PF42-48C	PF42-48D	PF42-48E	PF42-24B	PF42-24C	PF42-24D
Excitation Mode	2-2						
Step Angle (°)	7.5			15			
Step Angle Tolerance (%)	±5						
Steps per Revolution	4.8			24			
DC Operating Voltage (V)	24	12	5	12	24	12	5
Operating Current (mA/φ)	86	170	416	240	86	170	416
Winding Resistance (Ω/φ)	280	70	12	50	280	70	12
Winding Inductance (mH/φ)	200	54	9.1	35	160	43	7.2
Holding Torque (oz•in/g•cm)	6/450			6.9/500	4/300		
Rotor Inertia (oz•in²/g•cm•s²)	90x10⁻³/16.8x10⁻³				97x10⁻³/18x10⁻³		
Starting Pulse Rate, Max. (pps)	310			360	250		
Slewing Pulse Rate, Max. (pps)	320			400	350		
Ambient Temp. Range, Operating (°C)	−10 ~ +50						
Temperature Rise (°C)	55			70	55		
Weight (oz/g)	5.7/160						

PF55 SERIES



Typical Torque vs. Pulse Rate Characteristics



Specifications

Items \ Models	PF55-48B	PF55-48C	PF55-48D	PF55-24B	PF55-24C	PF55-24D
Excitation Mode	2-2					
Step Angle (°)	7.5			15		
Step Angle Tolerance (%)	±5					
Steps per Revolution	48			24		
DC Operating Voltage (V)	24	12	5	24	12	5
Operating Current (mA/φ)	166	360	1,000	166	360	1,000
Winding Resistance (Ω/φ)	145	36	5	145	36	5
Winding Inductance (mH/φ)	166	43	5.9	143	37	5.1
Holding Torque (oz•in/g•cm)	15/1150			12/900		
Rotor Inertia (oz•in²/g•cm•s²)	215x10⁻³/40x10⁻³			231x10⁻³/43x10⁻³		
Starting Pulse Rate, Max. (pps)	300			205		
Slewing Pulse Rate, Max. (pps)	310			230		
Ambient Temp. Range, Operating (°C)	−10 ~ +50					
Temperature Rise (°C)	55					
Weight (oz/g)	10.6/300					

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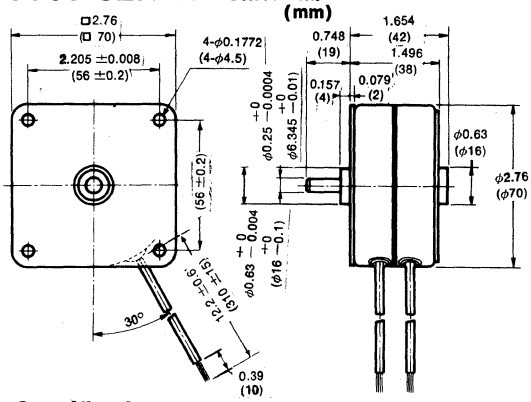
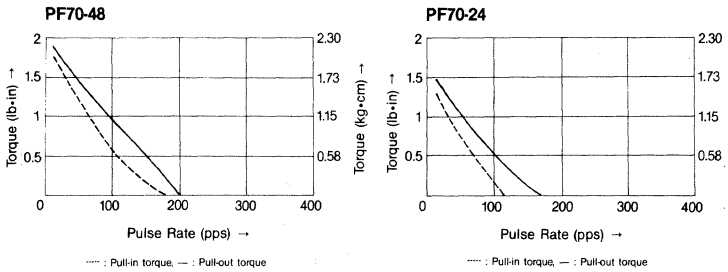
INLAND MOTOR
KOLLMORGEN CORPORATION

PM TYPE STEPPER MOTORS

PF70 SERIES UNIT: In. (mm)



Typical Torque vs. Pulse Rate Characteristics



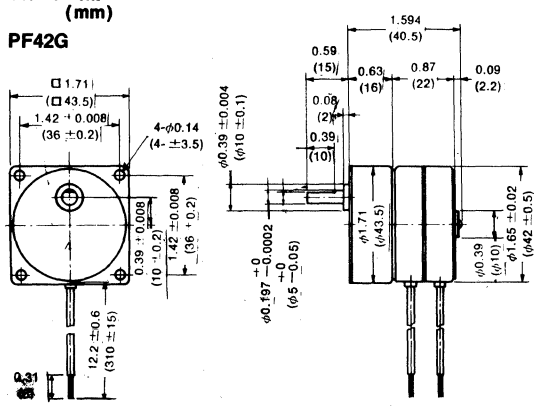
Specifications

Items \ Models	PF70-48B	PF70-48C	PF70-48D	PF70-24B	PF70-24C	PF70-24D
Excitation Mode	2-2					
Step Angle (°)	7.5			15		
Step Angle Tolerance (%)	±5					
Steps per Revolution	48			24		
DC Operating Voltage (V)	24	12	5	24	12	5
Operating Current (mA/φ)	0.3	0.6	1.4	0.3	0.6	1.4
Winding Resistance (Ω/φ)	80	20	3.6	80	20	3.6
Winding Inductance (mH/φ)	120	27	5.4	120	27	5.4
Holding Torque (lb•in/kg•cm)	2.95/3.4			2.17/2.5		
Rotor Inertia ($oz•in^2/g•cm•s^2$)	$80x10^{-2}/15x10^{-2}$					
Starting Pulse Rate, Max. (pps)	180			135		
Slewing Pulse Rate, Max. (pps)	200			155		
Ambient Temp. Range, Operating (°C)	−10 ~ +50					
Temperature Rise (°C)	80					
Weight (oz/g)	25/700					

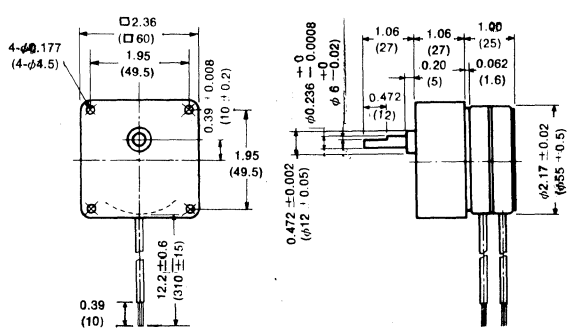
PF42G/PF55G SERIES

UNIT: In. (mm)

PF42G



PF-55G



Specifications PF42G

Speed Reduction Ratio	Maximum Allowable Torque	Speed Reduction Ratio	Maximum Allowable Torque
6/25	0.87 lb•in	1/50	2.60 lb•in
1/5	1 kg•cm	1/60	3 kg•cm
3/25	1.74 lb•in	1/62.5	
1/10	2 kg•cm	1/75	
1/12.5		1/100	3.47 lb•in
1/15		1/120	4 kg•cm
3/50	2.17 lb•in	1/125	
1/20	2.5 kg•cm	1/150	
1/25		1/200	
1/30		1/250	
		1/300	

Specifications PF55G

Speed Reduction Ratio	Maximum Allowable Torque	Speed Reduction Ratio	Maximum Allowable Torque
6/25	3.47 lb•in 4 kg•cm	1/25	6.08 lb•in 7 kg•cm
1/5		1/30	
3/25		1/50	
1/10		1/60	
1/12.5		3/250	8.68 lb•in 10 kg•cm
1/15		1/100	
3/50		1/125	
		1/150	
		1/250	
		1/300	

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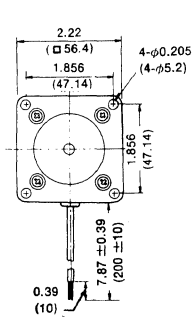
INLAND MOTOR
KOLLMORGEN CORPORATION

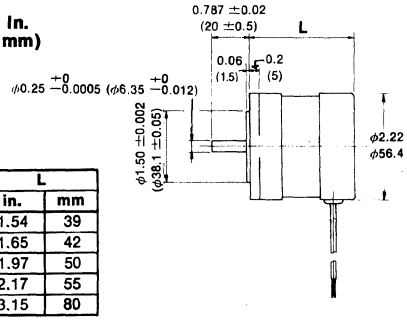
HB TYPE STEPPER MOTORS

PJ SERIES

Typical Performance Curves

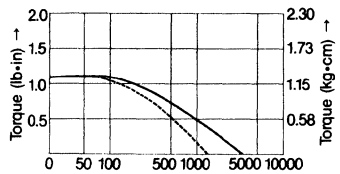
UNIT: In. (mm)





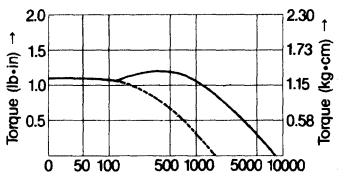
	L	
	in.	mm
PJ39	1.54	39
PJ42	1.65	42
PJ50	1.97	50
PJ55	2.17	55
PJ80	3.15	80

PJ39B1 Torque Characteristics (L/6.0R)



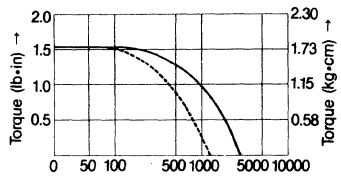
----- : Pull-in torque, — : Pull-out torque

PJ39B1 Torque Characteristics (Unipolar Chopper Drive)



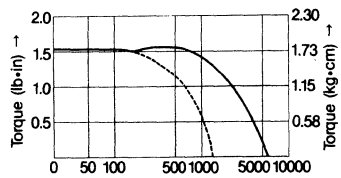
----- : Pull-in torque, — : Pull-out torque

PJ42B1 Torque Characteristics (L/5.2R)



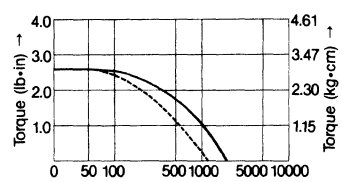
----- : Pull-in torque, — : Pull-out torque

PJ42B1 Torque Characteristics (Unipolar Chopper Drive)



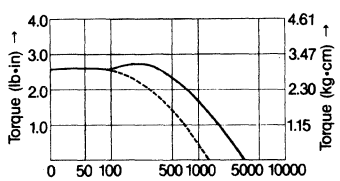
----- : Pull-in torque, — : Pull-out torque

PJ50B1 Torque Characteristics (L/5.0R)



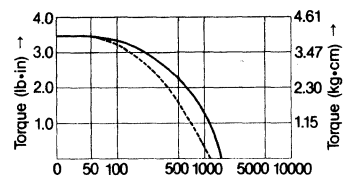
----- : Pull-in torque, — : Pull-out torque

PJ50B1 Torque Characteristics (Unipolar Chopper Drive)



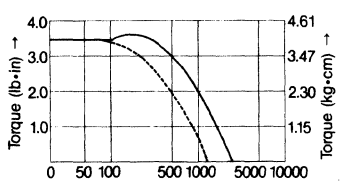
----- : Pull-in torque, — : Pull-out torque

PJ55B1 Torque Characteristics (L/5.3R)



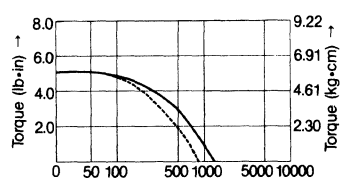
----- : Pull-in torque, — : Pull-out torque

PJ55B1 Torque Characteristics (Unipolar Chopper Drive)



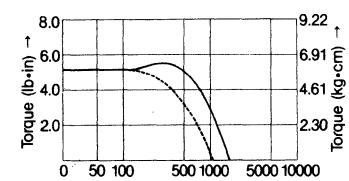
----- : Pull-in torque, — : Pull-out torque

PJ80B1 Torque Characteristics (L/5.2R)



----- : Pull-in torque, — : Pull-out torque

PJ80B1 Torque Characteristics (Unipolar Chopper Drive)



----- : Pull-in torque, — : Pull-out torque

Specifications

Items \ Models	PJ39			PJ42			PJ50			PJ55			PJ80		
	A1	B1	C1	A1	B1	C1	A1	B1	C1	A1	B1	C1	A1	B1	C1
Excitation Mode	2-2														
Step Angle (°)	1.8														
Step Angle Tolerance (%)	±5														
Steps per Revolution	200														
DC Operating Voltage (V)	2	4	8	2.3	4.6	9.2	3	6	12	3.4	6.8	13.6	3.36	6.7	13.4
Operating Current (mAφ)	2	1	0.5	2	1	0.5	2	1	0.5	2	1	0.5	2	1	0.5
Winding Resistance (Ω/φ)	1	4	16	1.15	4.6	18.4	1.5	6	24	1.7	6.8	27.2	1.68	6.7	26.8
Winding Inductance (mH/φ)	0.6	2.4	10.0	0.8	3.0	13.0	1.5	5.7	23	1.9	7.6	31.0	2.5	10.0	36.0
Holding Torque (lb•in/kg•cm)	1.74/2			2.17/2.5			4.34/5			5.21/6			6.95/8		
Rotor Inertia (oz•in²/g•cm•s²)	$29x10^{-2}/5.4x10^{-2}$			$33.3x10^{-2}/6.2x10^{-2}$			$56.4x10^{-2}/10.5x10^{-2}$			$70.3x10^{-2}/13.1x10^{-2}$			$132.6x10^{-2}/24.7x10^{-2}$		
Ambient Temp. Range, Operating (°C)	−10 ~ +60														
Temperature Rise (°C)	70														
Weight (oz/g)	11.3/320			12/340			15.9/450			18.3/520			29.3/830		

"For additional information on modifications available or a complete catalog of all stepper motor and drive electronic products manufactured by Nippon Pulse Motor Company, contact Inland Motor Sierra Vista, Arizona."

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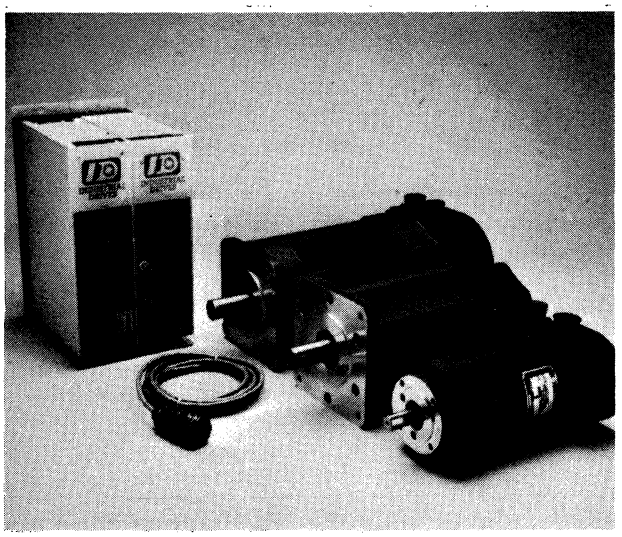
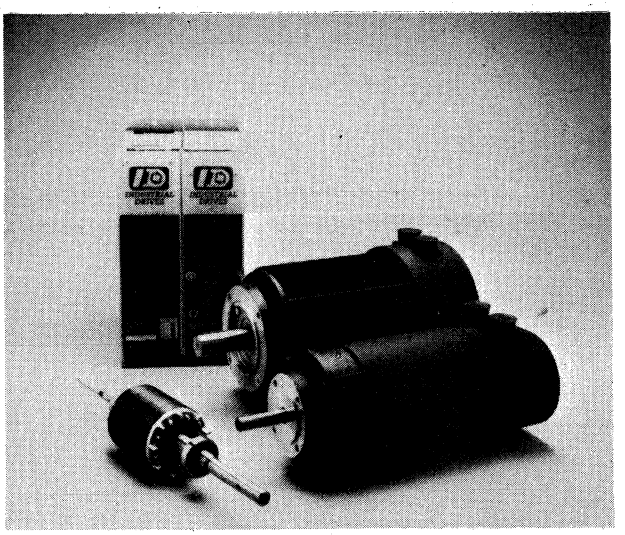
INDUSTRIAL DRIVES
A KOLLMORGEN DIVISION

INNOVATIVE PRODUCTS FOR MOTION CONTROL

BRUSHLESS MOTORS & DRIVES





AC SYNCHRONOUS PERMANENT MAGNET SERVOS

The AC synchronous (DC Brushless) systems from INDUSTRIAL DRIVES offer premium performance from a completely brushless motor. These AC synchronous motors having rare earth permanent magnet rotors yield the highest torque-to-size and torque-to-inertia ratios. Microprocessor-based sine-wave modular drives employ a patented torque angle control algorithm. This provides wider speed range and the optimum torque sensitivity even under transient speed and load conditions. The proprietary design features of the BR-310X motor in combination with these drives provide extremely smooth operation having torque ripple as low as 0.3%. Also, special high speed motor systems, with speeds to 60,000 rpm, and high torque models of 1000 lb-ft (1360 N•m) are available. Standard systems are offered in a range from 2.2 lb-ft (3.0 N•m) to over 55 lb-ft (75 N•m) T.E.N.V., over 150 lb-ft (203 N•m) with cooling, speeds to 7500 rpm to meet the most demanding application.

AC INDUCTION SERVOS

INDUSTRIAL DRIVES' brushless AC induction servos combine advanced designed sine-wave servo drives with proven and inexpensive induction motors. The result is reliable, high performance servo systems without the maintenance problems or commutation limitations associated with brush type servo motors. A microprocessor-based three phase sine-wave modular amplifier uses a proprietary slip control technique to optimize motor performance over a wide range of speed and load conditions. Precise control is maintained down to zero speed. Induction motor servos from INDUSTRIAL DRIVES are available with ratings from 1.5 lb-ft to in excess of 31 lb-ft (2 to 42 N•m) and operate to 6,000 rpm. Competitively priced, these systems are the ideal choice for most applications requiring brushless motors.

INDUSTRIAL DRIVES

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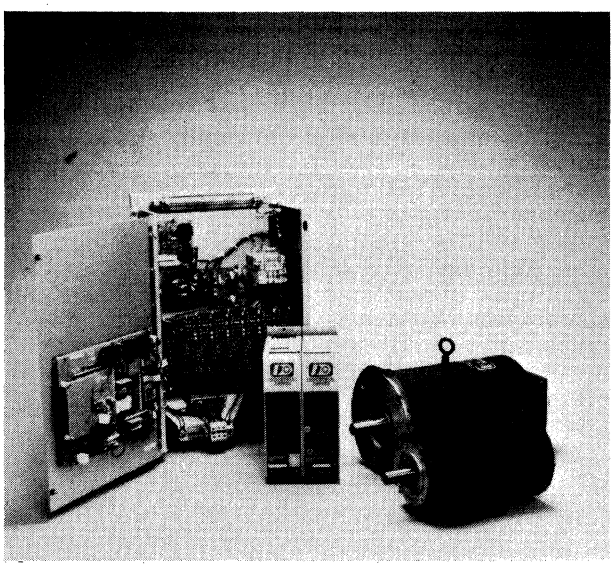
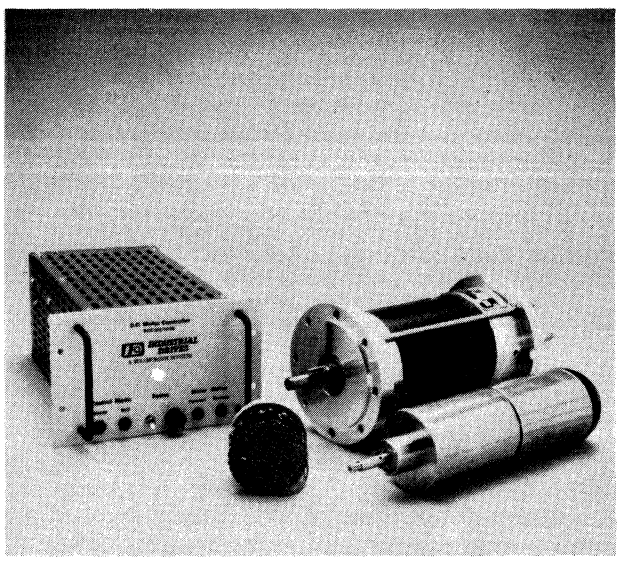
INNOVATIVE PRODUCTS FOR MOTION CONTROL

BRUSHLESS MOTORS & DRIVES



AC INDUCTION SPINDLES

The AC spindle systems from INDUSTRIAL DRIVES deliver high performance from reliable induction motors. High speed operation, wide constant horsepower speed range and smooth operation are among the features of these systems. Microprocessor-controlled sine-wave drive amplifiers provide the optimum slip from a patented control technique. Drive options include spindle orient, up-to-speed and zero-speed indicators. Optimized-design motors are compact, efficient and are offered with various cooling alternatives. Systems with speeds to 7500 rpm and power ratings from 7.5 HP (5.6 kw) to over 30 HP (22.4 kw) continuous are offered to satisfy a diverse range of applications.



SUBMERSIBLE MOTORS

In response to the need for reliable fluid-filled and pressure-compensated submersible motors, INDUSTRIAL DRIVES has developed a wide range of brushless motor systems. Motors incorporating permanent magnet rotors and brushless feedback along with stainless steel frames, provide reliable operation in a salt water environment at depths to 20,000 feet (10,000 PSI). Motors ranging from 0.3 HP (224 watts) with an integral drive package to 20 HP (14.9 kw) models with separate six-step drive amplifiers are available. Whether as a thruster or in a closed servo loop for a manipulator, these brushless motor systems solve the problems normally associated with the demanding requirements of submersible vehicles.

INDUSTRIAL DRIVES

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INDUSTRIAL DRIVES
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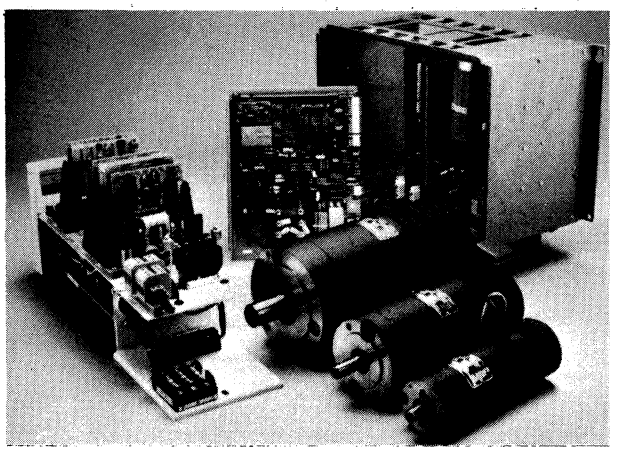
INNOVATIVE PRODUCTS FOR MOTION CONTROL

BRUSH-TYPE SERVO Motors and Drives



BRUSH-TYPE DC SERVOS

Permanent magnet brush-type DC servos from INDUSTRIAL DRIVES offer proven capabilities from advanced designs. A wide selection of motor sizes and features are available with continuous torques from 35 oz-in (0.25 N•m) to over 100 lb-ft (136 N•m), and speeds to 6,000 rpm are offered. Patented technology PWM transistor drives, or the more traditional SCR amplifiers, complement all motor sizes and windings. From 6 amps to 200 amps continuous, these amplifiers are highly reliable and contain features such as high bandwidth, commutation current limits, and overspeed shutdown, to mention a few. INDUSTRIAL DRIVES DC servos provide inexpensive solutions to high performance requirements.

POSITIONING SYSTEMS

FLEXIBLE POSITIONING SYSTEMS

INDUSTRIAL DRIVES' position control systems are microprocessor-based and provide precise control of our servomotor systems. The positioner can serve as a smart link between an industrial control and the servo drive and motor. Motion control capabilities include indexing, profiling, camming, velocity ratio, and digital master/slave.

The FPS-B (Flexible Positioning System-Basic model) is programmed with a simple intuitive language through an RS232 port by an ASCII terminal. A maximum of 32 general purpose inputs and outputs, and executive I/O for program select, system start, etc., allow versatile stand-alone operation.

Our FPS-C is an enhanced version of the FPS-B. A self-contained, remote control module provides user friendly, menu driven programming with a built in four line alphanumeric display. A remote display unit provides a bright readout of up to four real time parameters simultaneously. English language error messages are displayed, providing quick troubleshooting.

Our positioning systems are engineered to provide the versatility necessary to solve your unique application.

All Flexible Positioning Systems feature:

- Programmable compensation parameters
- Linear, S curve, and parabolic acceleration profiles
- Non-volatile program memory
- Single or multi-axis capability
- Compatible packaging with our DC PWM Single Board Drive, or modular brushless AC synchronous servos, AC induction servos and spindle drive amplifiers

INDUSTRIAL DRIVES has immediate solutions for your motion control requirements. Write for more detailed information or talk to one of our applications engineers today.

INDUSTRIAL DRIVES

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Litton

Poly-Scientific

Slip Ring Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
703-953-4751, FAX 703-953-1841
TWX 710-875-3694

HOW TO SPECIFY A SLIP RING

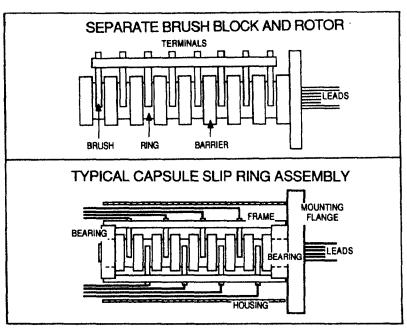
Many of the more than 4,000 Poly-Scientific slip ring designs are available for use in their existing configuration, or they may be modified to meet your specific requirements. New designs can also be created to meet the most demanding specifications.

Our engineers are experienced in a wide range of slip ring applications. We utilize resources such as the Anvil computer-aided design (CAD) system. And, a very active in-house quality circle program solicits the best inputs from all of our many skilled craftspeople, from start to finish.

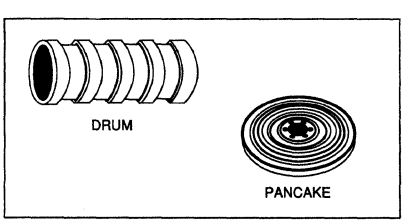
This section is designed to guide you through the process of specifying a slip ring. We've outlined below the major considerations that a slip ring engineer will need to know about your application.

A. Basic Slip Ring Design

Throughout these pages, you will see the terms "slip ring capsule" and "slip ring separates". The term "separate" indicates an individual rotor/brush block combination. The term "capsule" is used to denote a self-contained unit consisting of a rotor, stator and its own integral ball bearings.



There are two basic slip ring configurations to consider based on space allocation in your system: the more common drum approach where each ring is adjacent to the next along the centerline, somewhat like the threads on a bolt, and the pancake approach where the rings are concentric with one another like the grooves on a phonograph record. The pancake approach is used when length is at a premium but diameter is less restrictive.



B. Defining the Mechanical Envelope

The envelope is, of course, largely dictated by the space available in the system. The slip ring engineer should be given the maximum space available in the system so all existing candidate designs can be considered. It is imperative that the space required for the slip ring be specified in the early stages of the system design and that it be consistent with the structural and electrical demands.

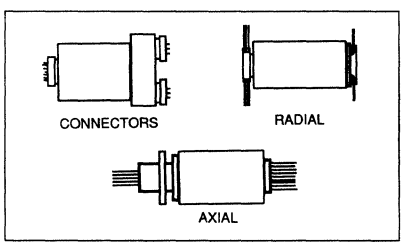
C. Defining System Interface Requirements

The slip ring engineer will need to know these system interface considerations:

1. Is a bore required through the slip ring for routing coolant plumbing, hydraulic lines, pneumatic lines, waveguides, etc? In such applications, the slip ring actually mounts concentric with these lines in the system.

2. How will the slip ring attach to the system? It is never advisable to hard mount both the rotor and the stator to the system since the slip ring bearings may overload if there is any misalignment between them and the system bearings.

3. How should the electrical connections to the slip ring be made? Is it desirable to have connectors integral with the slip ring on both the rotor and stator, or would flying leads on one or the other ends be desireable? And if flying leads are preferred, should they exit the rotor in a radial or axial direction, and what length should the leads be?



D. Defining Electrical Requirements

The current specified enables the slip ring engineer to propose a unit with the appropriate cross-sectional area of the rings, brushes and lead wires. The specified voltage dictates the spacing between adjacent rings and brushes. It is helpful in achieving the most cost effective and smallest practical envelope not to rate all circuits at the maximum level. For example, if you need 20 circuits total, three of which must carry ten amps, designate three for high current. Don't go for 100% functional interchangeability by specifying that all 20 be able to carry ten amps. And, if the ten amps is a surge current with a continuous current of only two amps, tell us that, too. There is no reason for you to pay for ten amps continuous capacity when you only need two.

Be aware that voltage surges and spikes are the major cause of system slip ring failures. Poly-Scientific uses a very conservative approach to circuit design, however, it is not uncommon in some power supply systems to see voltage spikes ten or more times the normal operating voltage. We strongly recommend surge protection on all power supplies.

Most smaller slip rings will satisfactorily conduct signals to 1 MHz or 500 Kilobits. Special slip rings can be used to pass broadband signals from dc to 1 gigahertz and data rates of 500 megabits or even higher. Crosstalk, insertion loss and bit error rate information can be provided if data rates, formats and impedances are defined.

E. Defining Mechanical Requirements

1. Operating speed (rpm's). Almost any slip ring can operate successfully at speeds to 100 RPM although many applications only require operation at a few rpm. But slip rings are also routinely used to instrument jet turbine engines operating at speeds in excess of 20,000 RPM. The operating speed in conjunction with the diameter dictates the surface speed of the brush relative to the ring and hence the internal design approach and material selection.

2. What rotational life is necessary for your application? Will the unit oscillate or rotate at a continuous speed?

F. Defining the Environment

The environment in which the slip ring must survive is a key factor. Operating temperature is important in specifying the proper lubricant. And if the slip ring will operate exposed to the elements or to a hostile environment, integral seals must be included in the design. Any unusual shock or vibration should also be specified.

The next eight pages of the catalog give a brief overview of our slip ring design and production expertise. The last page of our section allows you to list your specific application needs. For specific product information, please contact our sales department at 1-800-336-5917 (in Virginia, call 703-953-4751).

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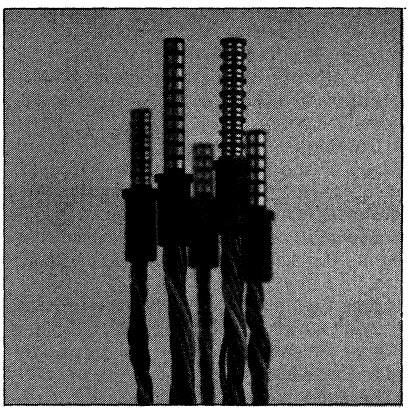
SLIP RING SEPARATES

Sometimes a self contained "capsule" slip ring is not practical due to size constraints or cost limitations. (Don't however, fail to include in this comparison your costs for mating the slip ring and brush block or to consider the risk of damage to the fragile unprotected brushes). If a separate rotor/stator approach is dictated for your application please review the following tabulation of an assortment of candidate designs—or contact us for a custom design.



Rotor Specifications

NUMBER OF CIRCUITS	PART NUMBER	MATING BRUSH BLOCK	RING O.D.	RING PITCH	SHAFT DIAMETER	SHAFT LENGTH	FLANGE DIAMETER	SPECIAL FEATURES
1-10	258	259	.081	.050	.125	.250	.150	P, RB, UG, VG, S, FB
1-37	263	262	.220	.050	.250	.375	.312	FB, RB
1-10	865	259	.080	.050	.109	.187	.170	S, FB
1-20	1202	262	.125	.050	.250	.375	.312	FB
8	1454	1455	.550	.060	—	—	.580	.376 Bore, RB, VG
10	1546	1547	2-.331 8-.151	.060	.187	.250	.345	VG #2 Ring Segment, #1 Shorted to #2
5	1555	259	.081	.050	.141	.300	.180	FB
19	2037	2038	1.860	.030	—	—	—	1.500 Bore. .685 VG
3	2384	2981 2385	.067	.025	.071	.070	.115	Double V-Groove
1-10	2690	259	.081	.050	.125	.250	.150	FB, Same as 258
1-37	2731	262	.220	.050	.250	.375	.312	RB, Same as 263
1-10	2914	259	.081	.050	.125	.250	.150	FB
5	3046-1	3046-2	.550	.060	—	—	.580	.376 Bore, RB, VG
6	3975	3416	.067	.025	.061	.125	.109	Double V-Grooves

Abbreviations used:

FB - Flat Barrier
RB - Raised Barrier
P - Plastic Backshaft
VG - V-Groove
UG - U-Groove
S - Stainless Steel Backshaft

Circuits 1-10–Option of having 1 through 10 circuits

Brush Block Specifications

NUMBER OF CIRCUITS	PART NUMBER	RING DIAMETER	PITCH	MOUNTING HOLE DIAMETER	HOLE SPACING	SETTING LENGTH	THICKNESS	SPECIAL FEATURES
1-10	259	.081	.050	.090	.437	.250	.188	-Silver Terminal -Tin Terminals -Gold Terminals -Leads
1-37	262	.220	.050	.090	.600	.250	.250	-Terminals
10	1547	.331 .151	.060	.116	.656	.312	.312	-Leads, -Terminals
8	1455	.550	.060	.096	.812	.290	.125	-Terminals (MD4036-2)
19	2038	1.864	.030	.090	.600	1.035	.250	-Terminals
6	3416	.067	.025	—	—	.200	.100	-Terminals -Double Brushes
3	2981	.067	.025	.053	.140	.180	.150	-Double Brushes -PCB Terminals
3	2385	.068	.025	—	—	.200	.100	-Terminals

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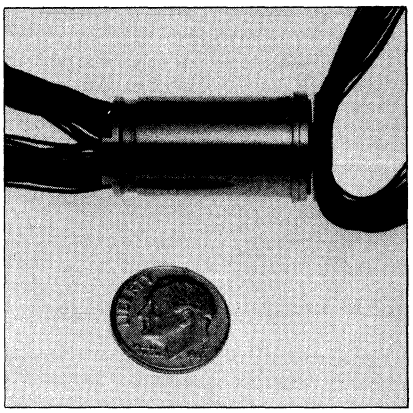
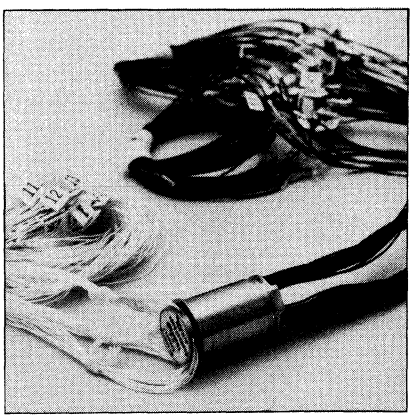
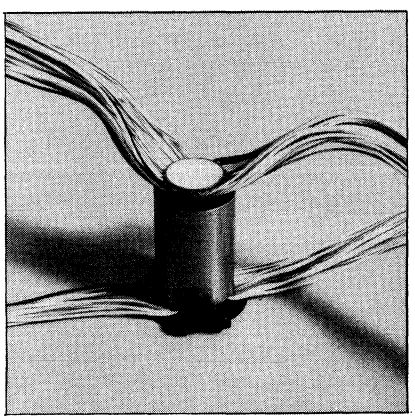
MINIATURE SLIP RING CAPSULES

These smallest of all slip ring assemblies are widely used in the pitch, roll and yaw axes of inertial navigation systems where there can be no sacrifice in reliability to achieve packaging density.

Very tight pitch controls are maintained on individual ring locations with center-to-center spacings as small as 0.015 inch between adjacent rings.







NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING		LENGTH	DIAMETER
		PER CKT	TOTAL		
16	267	1.2A	10A	.912	.375
20		1.2A	14A	1.932	.375
24		1.2A	17A	1.152	.375
28		1.2A	20A	1.272	.375
32		1.2A	23A	1.392	.375
36		1.2A	25A	1.512	.375
20	264	1.4A	17A	1.035	.500
40		1.4A	33A	1.635	.500
60		1.4A	49A	2.235	.500
7	2492	.4A	2A	.61	.375
12	2274	1.2A	12A	.728	.373
15	2493	.36A	4A	.660	.375
16	2075	1.3A	13A	.882	.372
17	1804	1.2A	16A	1.375	.350
30	2245	.7A	20A	.979	.380
32	1444	1.2A	29A	1.468	.375
36	2754	1.2A	31A	1.173	.498
40	3069	1.4A	37A	1.30	.682
45	2759	1.1A	36A	1.05	.593
50	2044	.95A	36A	1.025	.593
50	1937	1.4A	45A	1.470	.683
54	1956	1.2A	38A	1.403	.560
80	2210	1.4A	69A	2.00	.658
95	4175	1.6A	77A	3.09	.880

THE FOLLOWING MINIATURE SLIP RINGS HAVE A BORE:

NUMBER OF CIRCUITS	PART NUMBER	CURRENT RATING		LENGTH	DIAMETER	BORE
		PER CKT	TOTAL			
8	2395	1.6	7A	.70	1.75	0.75
30	4198	2.6A	36A	2.785	3.081	1.50
32	2335	4A	57A	3.39	4.10	2.30
12	2472	4A	22A	3.440	4.10	2.30
51	2837	4A	90A	4.50	4.10	2.30

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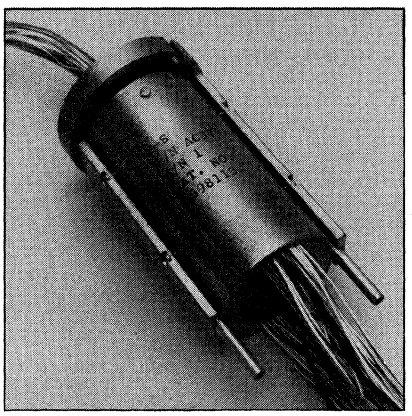
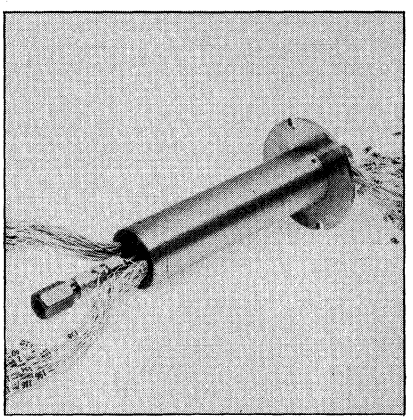
HIGH SPEED SLIP RINGS

For successful slip ring operations above several thousand RPM, increased structural demands and frictional heating at the sliding contact surface are two concerns that must be addressed. Applications for high speed slip rings include aircraft turbine testing, stressometer feedback in rolling mills, and gasoline or diesel engine testing.

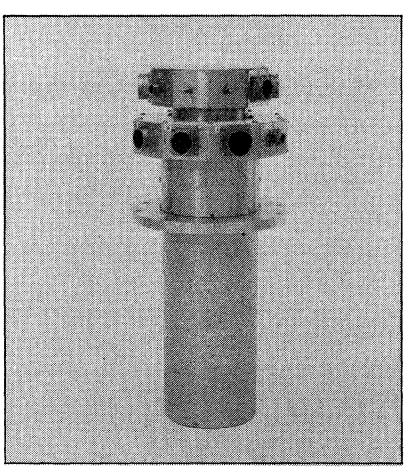




NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
15	2645	3.75	14.01	12.593	Composite	Separate
19	2275	9.84	9.05	7.48	Composite	Separate Ring & Brush Block
28	3042	1.635	.685	N/A	Gold	Liquid Cooled
28	3762	1.67	1.0	N/A	Gold Multifilament	Gas Cooled
35	3757	2.53	1.60	N/A	Gold Multifilament	Gas Cooled
40	1823	4.08	1.75	N/A	Composite	
64	4160	5.0	3.5	1.5	Gold Multifilament	
100	3057	6.40	1.5	N/A	Gold	Liquid Cooled
200	4064	10.0	2.25	N/A	Gold	Liquid Cooled
300	4075	11.75	2.28	N/A	Gold	Liquid Cooled

VACUUM AND SPACE CAPSULES

The use of slip rings in a hard vacuum environment focuses special attention on the area of outgassing organics that could interfere with other components in the system and in the area of lubrication for long term operation. Our contact material recommendations are based on a two year continuous life test program that we conducted in a 10^{-7} environment and have been proven in numerous space flights.



NUMBER OF CIRCUITS	PART NUMBER	LENGTH	DIAMETER	BORE	BRUSH	NOTES
24-84	2832	7.167-11.650	2.44	N/A	Composite 4 per ring	Cylindrical Separate
25	3881	1.376	5.832	1.24	Composite	2 sided pancake
31	3304	6.663	2.125	N/A	Gold Monofilament	Cylindrical Separate
34	2857	1.94	6.95	2.68	Gold 4 per ring	2 Sided Pancake Separate
70	3192	4.61	1.46	N/A	Gold Multifilament	Concentric Capsule
170	4238	18.00	6.00	N/A	Gold	Capsule, Lubrication Reservoir

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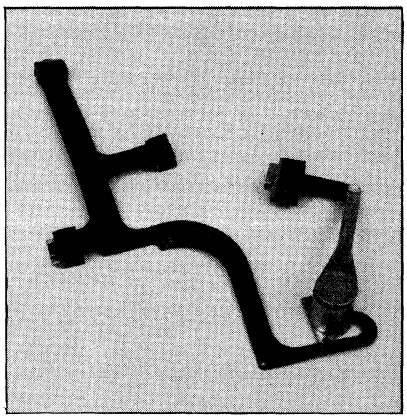
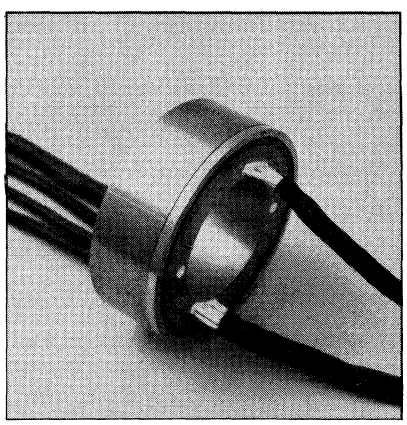
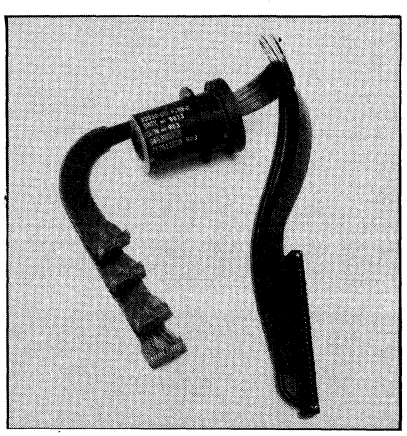
POLY-TWIST CAPSULES

The Poly-Twist is a reliable slip ring substitute for limited rotation applications. Sometimes called a twist-cap, this device provides a self-contained, no-sliding contact rotary interface using flexible circuit tapes. Typical dimensions and data are tabulated below for a few of our many twist-cap designs. Although the majority of applications for the thousands of units supplied to date have required miniature twist-cap assemblies, some very large designs have also been provided.

NUMBER OF CIRCUITS	PART NUMBER	ROTATION	CURRENT CAPACITY	LENGTH	DIAMETER
14	2728	+/-55	14 @ 12A	2.90	1.75
24	2938	+/-100	1 @ .2A 4 @ 1.2A 19 @ .8A	2.50	.75
24	3182	+/-45	4 @ 1.4A 20 @ .5A	1.10	.31
24	3197	+/-45	24 @ 1A	1.07	.75
38	2937	+/-90	4 @ 3.0A 34 @ 1.0A	2.00	5.75
45	2911	+/-45	2 @ 1.0A 4 @ 3.0A 4 @ 2.2A 35 @ .6A	1.75	1.20
46	2729	+/-55	4 @ 2.0A 42 @ 1.0A	2.90	1.75
50	2904	+/-90	2 @ 2.3A 2 @ 2.5A 4 @ 4.5A 6 @ 1.0A 36 @ 7.0A	1.63	1.00
51	3196	+/-45	51 @ 1.0A	1.12	.87
60	2613	+/-75	12 @ 3.8A 48 @ 1.2A	1.69	1.00
60	2644	+/-300	12 @ 0.9A 48 @ 0.2A	1.56	0.68
63	3004	+/-100	3 @ 3.5A 6 @ 4.5A 12 @ 1.7A 42 @ 1.2A	2.77	1.50
68	2783	+/-30	68 @ 1.7A	2.00	.69
80	2661	+/-210	24 @ 3.0A 56 @ 1.0A	2.25	2.50
80	3195	+/-70	80 @ .6A	.635	2.40
84	3003	+/-100	1 @ 3.4A 14 @ 1.5A 69 @ .8A	2.27	1.50
88	3719	+/-145	3 @ 5A 7 @ 2A 78 @ 1A	3.50	1.37
98	2805	+/-30	12 @ 4.0A 86 @ 1.0A	2.50	.99
110	3165	+/-200	22 @ 2.7A 88 @ 1.73A	1.90	2.50
110	2804	+/-60	20 @ 4.0A 90 @ 1.0 A	1.35	1.80
111	3053	+/-110	4 @ 5.8A 4 @ 4.1A 4 @ 2.1A 28 @ 1.4A 71 @ .8A	3.00	1.40
172	4134	+/-90	16 @ 5A 156 @ 2A	5.58	2.25
176	3002	+/-35	12 @ 3.2A 27 @ 2.6A	3.10	2.38
192	3428	+/-210	12 @ 3.0A 17 @ 2.5A 163 @ 1.0A	3.37	3.69
220	3842	+/-75	170 @ 1.5A 50 @ 5A	4.30	1.80
1920	4148	+/-90	1920 @ 3A	5.00	31.80







PolyTwist® is a registered trademark of Litton Poly-Scientific.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.

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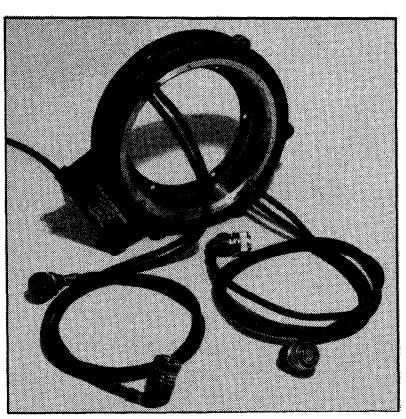
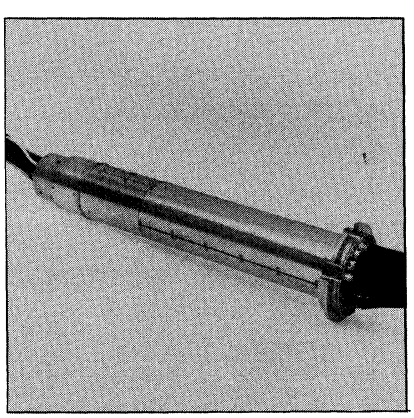
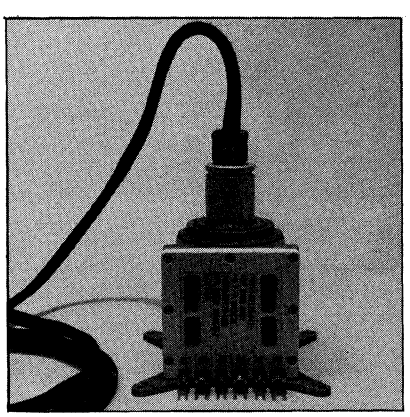
HELICOPTER SLIP RINGS

Slip rings that power de-icing and blade folding systems must transfer high current levels to blade systems rotating at high speeds. They must also withstand vibration levels and environmental hazards typical of helicopter operation. The latest de-icing applications include both main and tail rotor slip rings, with main rotor current levels to 60 amperes and tail rotor speeds to 1,500 RPMs.

		POWER				SIGNAL				
PART NUMBER	ROTATIONAL SPEED	DIMENSIONS	NUMBER OF CKTS	CURRENT RATING	VOLTAGE RATING	NUMBER OF CKTS	GAUGE OR TYPE	INTENDED SIGNAL	APPLICATION	MAX WEIGHT (LB)
1209	264 RPM	O.D. 3.999 Bore 3.000 Length 12.190	8	50A	200V 500V (Peak)	N/A	N/A	N/A	Sea Knight	
2876	258 RPM	O.D. 3.200 Length 6.500	3	60A	200VAC 400Hz	3	28VDC 5A		Main Rotor De-Ice SRA for U.S. Army Blackhawk	
3018	1500 RPM	O.D. 10.190 Bore 6.130 Length 4.462	3	20A	1800V (Peak)	N/A	N/A	N/A	Tail Rotor De-Ice for Seahawk/ Blackhawk	
3091	1500 RPM	O.D. 9.250 Bore 7.000 Length 1.650	2	16AWG	1500V	N/A	N/A	N/A	Tail Rotor De-Ice AH 64 Apache	2.40
3741	432 RPM	O.D. 3.150 Length 21.000	N/A	N/A	N/A	150	50VDC, 1A 24AWG		Main Rotor A129 Helicopter	
3742	1657 RPM	O.D. 5.000 Bore 2.20 Length 5.182	N/A	N/A	N/A	50	24 AWG		Tail Rotor	
4101	258 RPM	O.D. 4.190 Length 11.800	3 3	60A 25A	200V 400Hz	12	3A 28V	Pulses to control/ monitor rotor head loads	Main Rotor De-Ice and Blade Fold for Seahawk	10.5
4103	397 RPM	O.D. 3.250 Length 20.500	4	60A	220V	8 58	2 or 6A 1A	Resolver	V-22 Osprey	23
4106	210 RPM	O.D. 5.510 Length 22.676	14 22 1	130A 10A Bonding Ring	270VDC 200V 400Hz	32	24AWG	Signal & health monitoring Resolver	EH-101; De-Ice & Blade Folding ckts	39.5
4239	210 RPM	O.D. 5.510 Length 16.410	22 1	10A Bonding Ring	200V 400Hz	32	24AWG	Resolver	Same as 4106 w/o De-Ice ckts	19.0







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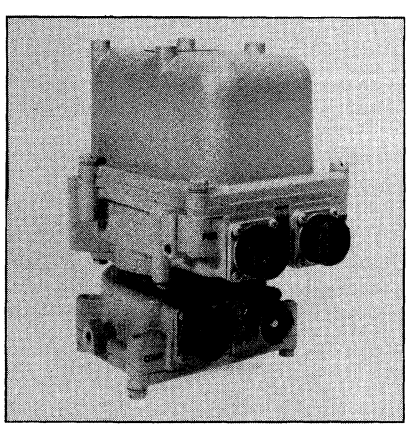
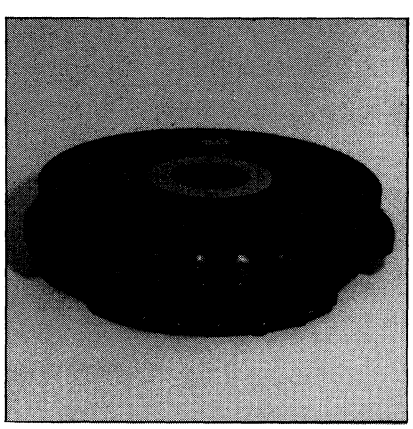
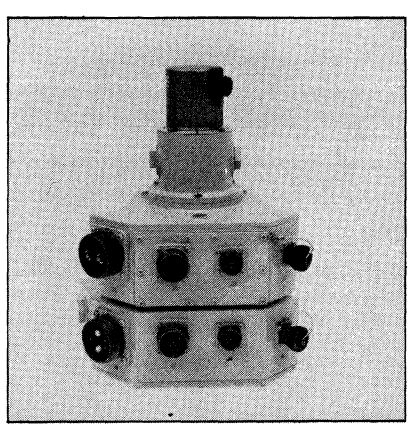
VEHICULAR SLIP RINGS

Electrical and hydraulic slip rings are used in vehicles such as tanks, retrievers, mobile missile launchers, and armored personnel carriers. A typical armored vehicle might contain slip rings in the turrett, the commander station, and the periscope.

	POWER			SIGNAL			
PART NUMBER	NUMBER OF CIRCUITS	CONT. CURRENT RATING	VOLTAGE RATING	NUMBER OF CIRCUITS	GAUGE OR TYPE	INTENDED SIGNAL	SPECIAL FEATURES
2985	1 1	150A 150A	150V Peak Ground	12	Control	5A, 150V	
2993	1 1	150A 150A	150V Ground	24	Control	5A, 150V	
2869				160	20 AWG	28 VDC 7.5A	4 hydraulic at 200 PSI, 2 GPM; 1 pneumatic at 6 PSI
2772	2 1 1	300A 600A 75A	28VDC	40	Signal/ low power	28VDC 7.5A	1 pneumatic at 1200 PSI, 600 CFM
2676	1 1	150A 150A	Ground	14	3A		1 hydraulic at 200 PSI, 1 hydraulic at 50 PSI, 1 pneumatic at 2 PSI
2918	4	200A	28VDC	2 55	Twin AX 22 AWG	6MHz 4A, 28VDC	1 hydraulic at 2000 PSI, 34 GPM; 1 hydraulic at 100 PSI, 34 GPM; 1 pneumatic at 6 PSI, 15 CFM
3489	1 1	150A 150A	Ground	80		5A	
3733	2	200A	24VDC	42	20 AWG	3A, 28VDC	CBR Air Channel
4231	13	2 @ 15A 2 @ 10A 2 @ 5A 6 @ 3A 1 @ 10A	150V Peak Ground	34 1	Control RG 179	2A, 150V 10MHz	6.5 Inch Bore







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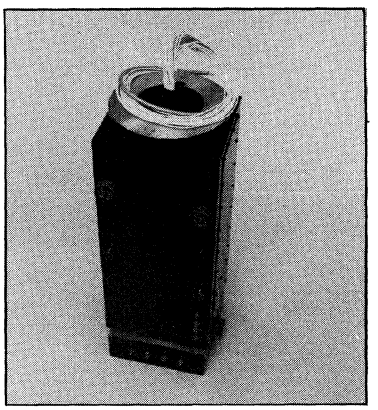
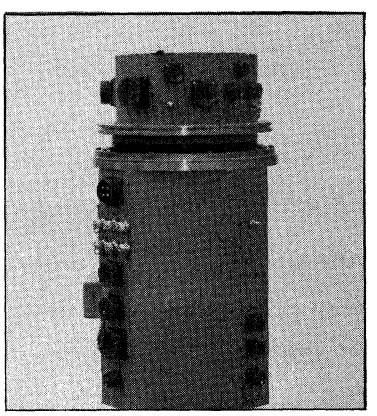
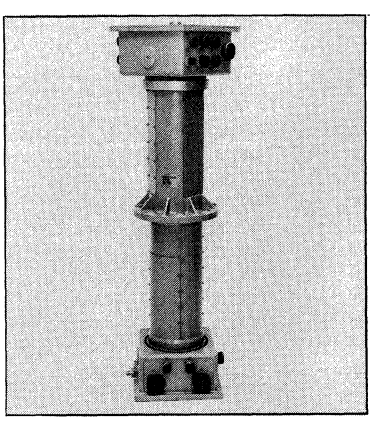
PEDESTAL SLIP RINGS

Typically found in radar, missile and gun fire control systems, Pedestal Slip Rings contain varying combinations of logic, control, and high frequency analog signal and power circuits.

NUMBER OF CIRCUITS	PART NUMBER	NUMBER OF POWER CIRCUITS/ CURRENTS	LENGTH	DIAMETER	BORE	SPECIAL FEATURES
65	2912	12 @ 10A	21.0	7.3	None	3-35 MHz channels
72	2672	6 @ 150A	33.3	12.0	None	Rugged & Sealed 4 10MHz channels
218	2686	16 @ 10A	17.8	3.6	None	Very high circuit density
259	2258	9 @ 160A 5 @ 10–30A	60.0	12.0	None	12-60 MHz Channels
18	4062	0	3.9	5.5	3.2	Integral Resolver
19	2608	3 @ 550A 2 @ 110A	8.3	20.8	1.0	
37	2945	0	5.9	7.1	2.7	
57	4120	13 @ 22A	17.2	11.4	4.5	
78	4189	6 @ 10A	11.0	7.9	3.0	Unlubricated contact technology
103	3474	18 @ 3A	14.6	7.4	3.5	4-1 GHz ckts.
127	2480	17 @ 60A	25.5	15.3	9.7	Lightweight (88 lbs)
150	2446	3 @ 50A 6 @ 20A	29.0	16.0	8.0	Sealed for shipboard use
153	2607	15 @ 50A 4 @ 20A	50.0	8.0	1.3	Meets MIL-STD-901 Hammer Drop
176	2284	10 @ 100A 95 @ 10-20A	33.0	12.8	6.0	12-6 MHz Channels
252	2125	4 @ 100A 3 @ 60A	37.5	21.5	10.0	3-30 MHz Channels







Litton

Poly-Scientific

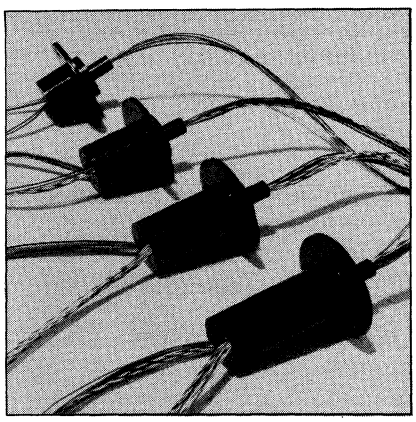
Slip Ring Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
703-953-4751, FAX 703-953-1841
TWX 710-875-3694

INDUSTRIAL SLIP RINGS

NUMBER OF CIRCUITS	PART NUMBER	CONTINUOUS CURRENT	LENGTH	DIAMETER	NOTES
6 12 18 24	4023	2A	.76 1.24 1.72 2.20	.870	Suitable for CCTV; Units can be shipped from stock
1-12	4183	2A	1.58	1.36	0.985 inch through bore
2	3773	5A	1.50	1.00	Water tight
10	4221	.5A	.78	.37	#10 circuit is a switch circuit
12	4102	.5A	BB 1.05 SR 1.67	.982 .46	Slip ring and brush block set Slip ring bore .196 inch
14	3141	1 ground-150A 1-150A 12-7.5	9.28	11.25	Sealed, rugged construction
16	4019	1A	2.35	1.00	Fiber brush capsule. 3000 RPM

No more than 20% of all rings should be loaded with rated current simultaneously.

Many industrial applications such as continuous-panning CCTV cameras, automated machinery and robotic end-effectors can benefit from the continuous, unrestrained, rotational freedom of a slip ring. Our 4023 Industrial Slip Rings offer the reliability of precious metal contacts at an affordable price. This is made possible by standardizing on four basic models (6, 12, 18, and 24 rings), which are mass produced for volume pricing.



SPECIAL SLIP RINGS

Cable Reel Slip Rings

Cable reel slip rings can be found in a wide range of military and industrial applications including marine/seismic exploration, underwater towed vehicles, remote tele-operated vehicles, construction cranes, and buoyant submarine antennas. These slip rings are designed for a particularly rugged environment while also providing field accessability of the brush block assemblies if repairs are necessary. With access plates in place, sealed bearings, and integral gasketed connectors, the internal portion of the unit is well protected from environmental conditions.

Mooring Slip Rings

Deep water drilling requires a slip ring to allow complete freedom to weathervane for floating power generation stations (SALM type installations). Experience to date in mooring applications include currents to 600 amps, voltages to 35,000 volts (transmission of 36 megawatts of power) in sizes to 8 feet in diameter by 10 feet in length.

Medical Electronics Slip Rings

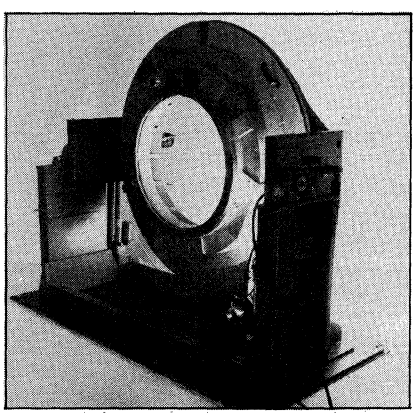
Slip rings are used in various scanner applications, particularly for computed axial tomography (CAT Scanners) which require the need to scan at faster speeds, unencumbered by mechanical stops. These units provide a large through bore for mounting as an integral part of the gantry.

Voltages to 200,000 volts are handled safely with careful attention to gradients, internal surface contours, material selection, debris management and dielectric oil compatibility.

Our slip rings require minimum inertia for spin-up and braking consistent with structural and electrical safety. Drive torques for oil-filled body concentric mounts are typically in the 50-100 ft-lb range.

Slip rings for medical scanners are built on a history of reliable low maintenance applications, with reliability levels exceeding a million circuit hours being demonstrated.

Our CT slip rings are typically sealed with static seals and redundant dynamic lip seals at all rotary interfaces.



Slip Ring Applications Are Only Limited by Your Imagination

These are just a few of the unique applications of slip ring technology. When you need to pass power and/or data through a rotating interface—turn to Litton.

Many of the designs and manufacturing processes are proprietary and are covered under one or more U.S. or European patents.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.

Litton

Poly-Scientific

Slip Ring Products
1213 North Main Street
Blacksburg, Virginia
24060-3100
703-953-4751, FAX 703-953-1841
TWX 710-875-3694

CUSTOMER SPECIFICATION FORM

Date _____ Engineer _____ Customer Part No _____

Customer Name _____ Phone Number _____

Address _____

CAPSULE ☐ SEPARATE SLIP RING ☐ SEPARATE BRUSH BLOCK ☐ POLY-TWIST ☐ (for +/- _____ Degrees)

Application _____

Number of Rings _____ (Detail circuit functions below)

Size: Available length _____ Diameter _____ Bore _____

Wear (life): Hours (or yrs) _____ @ Duty Cycle _____

Environment: Temperature: Operating Range _____°C, Pressure: Normal _____ Minimum _____

Vibration: _____ g's @ _____ Hz Shock _____ g's

Sealing: None _____ Dust _____ Water Spray _____ Submersion _____

Rotational Speed: Normal _____ Maximum _____

CIRCUIT DATA

Circuit Function	No. Rings	Current (amps)		Working Volts	Digital Risetime or Freq. (Hz)	Crosstalk Isolation (dB)
		Normal	Max			

Torque, max starting _____ gm-cm Weight-max _____

Lead Length: Rotor end _____ Stator _____

Connectors: Rotor end _____ Stator _____

Additional Requirements: (Integral Potentiometer, Resolver, Switch, Hydraulics, Pneumatics, Optical Channel, etc.)

_____

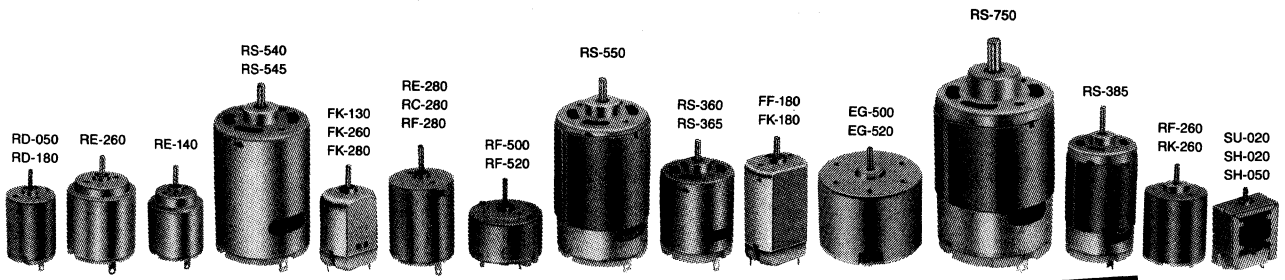
_____

_____

_____

Please provide sketch of available mounting space if possible.

Call us toll-free at **800-336-5917** (In Virginia, call 703-953-4751) for more information.



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Mabuchi Subfractional-HP motors. Small. Light. Reliable. Efficient. Better than ever.

We're the world's largest manufacturer of subfractional-HP motors — producing over 2.3 million per day! Shown here is merely a small sampling of the extensive spectrum of our standard motors with average performance characteristics at indicated voltage. So comprehensive is our range of standard models, it's a virtual certainty there's one or more to fit your needs perfectly — that's cost-effectiveness!

Please request or fill out a questionnaire and/or indicate your desired performance: we'll suggest the motors most suited to your needs.

Power curves and 3-view drawings with production tolerances available upon request. Mabuchi Subfractional-HP motors are used for such machine worlds as audio/video equipment, home appliances, personal care, cameras, peripherals, office/medical equipment, automotives, garden tools, hand tools, etc.

MOTOR				SIZE						TYPICAL CHARACTERISTICS								
										NO LOAD		AT MAXIMUM EFFICIENCY						Stall
Series	Group	Type	Model	Outside Diameter (inch)	Housing Length (inch)	Typical Power Source	Operating Voltage Range V	Winding Code Number	Voltage V	Speed RPM	Current AMP	Speed RPM	Current AMP	Torque OZ-IN	Output W	Eff. %	Stall Torque OZ-IN
ECONOMY	STANDARD	RE	RE-140	.827	.984	DRY CELL	1.5-3.0	2270	1.5	8,200	0.190	6,250	0.62	0.089	0.40	44.2	0.375
			RE-260	.937	1.059		1.5-4.5	2670	3.0	12,500	0.230	10,250	1.03	0.222	1.68	54.1	1.222
			RE-280	.953	1.201		1.5-6.0	2865	3.0	9,200	0.155	7,800	0.85	0.276	1.60	62.3	1.81
		SU	SU-020	.709 × .374	.744		1.0-3.0	09170	3.0	11,800	0.080	8,150	0.18	0.022	0.132	24.6	0.071
	CARBON	RC	RC-280S	.953	1.201		4.5-12.0	20120	6.0	7,800	0.125	6,450	0.60	0.417	2.00	56.0	2.430
		FK	FK-130S	.791 × .594	.988		4.5-20.0	07500	12.0	7,200	0.030	5,350	0.09	0.108	0.43	40.8	0.424
			FK-260S	.953 × .720	1.059		4.5-15.0	10350	12.0	7,300	0.036	5,950	0.16	0.244	1.07	56.3	1.32
			FK-280S	.953 × .720	1.201		4.5-20.0	10350	12.0	5,700	0.028	4,650	0.13	0.253	0.87	57.5	1.39
		SH	SH-020S	.709 × .374	.744		4.5-12.0	09170	6.0	19,000	0.110	13,600	0.28	0.061	0.608	36.8	0.213
			SH-050S	.709 × .374	.866		4.5-12.0	09170	9.0	23,400	0.105	17,350	0.30	0.090	1.151	42.6	0.347
LOW NOISE	STANDARD	RF	RF-260T	.953	1.059	DRY CELL BATTERY RECTIFIED A.C.	1.0-9.0	3255	1.2	5,700	0.160	4,750	0.800	0.164	0.575	59.9	0.986
			RF-280	.953	1.201		1.5-12.0	2485	3.0	7,300	0.115	6,130	0.602	0.236	1.069	59.2	1.472
			RF-500T	1.260	.768		1.5-9.0	14430	6.0	3,650	0.024	3,050	0.122	0.196	0.441	60.0	1.194
			RF-520T	1.260	.846		1.5-12.0	12580	12.0	4,550	0.018	3,890	0.106	0.278	0.799	62.8	1.917
		RD	RD-050T	.673	9.13		1.5-6.0	09220	4.5	7,600	0.039	5,710	0.118	0.054	0.23	43.5	0.222
			RD-180S	.839	1.142		1.2-12.0	2085	2.4	5,310	0.052	4,530	0.304	0.142	0.476	65.2	0.972
		FF	FF-180S	.803 × .606	1.264		1.0-6.0	3534	1.2	7,550	0.220	6,250	1.08	0.179	0.83	63.7	1.06
	CARBON	RK	RK-260S	.953	1.059		5.0-15.0	12250	12.0	10,900	0.056	9,030	0.27	0.289	1.925	59.5	1.681
		FK	FK-180S	.803 × .606	1.264		4.5-15.0	14150	6.0	7,050	0.060	5,700	0.26	0.197	0.83	53.6	1.04
HEAVY DUTY	CARBON	RS	RS-360S	1.091	1.283	BATTERY RECTIFIED A.C.	4.5-26.0	14250	12.0	7,300	0.090	5,850	0.36	0.556	2.40	55.6	2.81
			RS-365S	1.091	1.283		6.0-26.0	1885	18.0	20,800	0.220	17,000	0.99	0.897	11.3	63.3	4.93
			RS-375S	1.091	1.488		12.0-26.0	2073	24.0	25,800	0.230	21,700	1.21	1.19	19.1	65.8	7.50
			RS-385S	1.091	1.488		12.0-26.0	2073	24.0	22,000	0.180	18,800	1.05	1.27	17.6	69.7	8.68
			RS-395S	1.091	1.831		6.0-26.0	2455	12.0	10,000	0.190	8,400	1.00	1.36	8.4	69.6	8.61
			RS-540	1.406	1.969		3.0-12.0	7516	3.6	19,100	2.85	15,700	13.1	2.19	25.4	53.8	12.3
			RS-545S	1.406	1.969		6.0-26.0	5016	6.0	15,000	1.20	12,600	6.35	2.87	26.8	70.3	18.1
			RS-550S	1.406	2.244		3.6-15.0	7522	6.0	12,400	0.70	11,300	7.34	3.87	32.3	73.3	44.4
			RS-750S	1.661	2.362		4.5-18.0	8027	9.6	18,400	1.8	15,800	11.10	6.76	79.1	73.9	48.6
ELECTRONIC GOVERNOR		EG	EG-500AD-6F	1.429	.984	DRY CELL RECTIFIED A.C.	4.2-7.5	18290	6.0	2,400 RPM at 8 G-CM load								
			EG-500AD-9F	1.429	.984		6.0-11.0	14430	9.0									
			EG-500AD-2F	1.429	.984		8.4-15.0	12580	12.0									
			EG-520AD-6F	1.429	1.063		4.2-7.5	16340	6.0									
			EG-520AD-9F	1.429	1.063		6.0-11.0	14470	9.0									
			EG-520AD-2F	1.429	1.063		8.4-15.0	12580	12.0									

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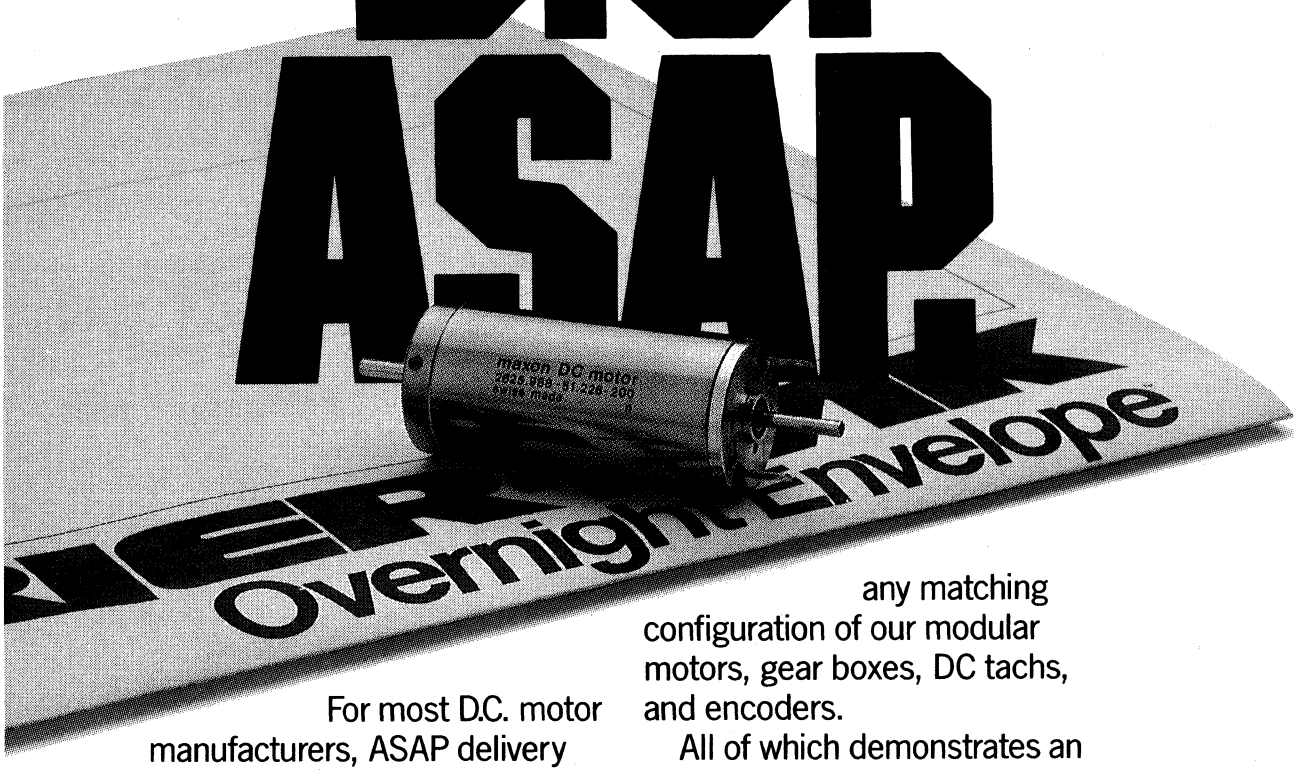
D.C. ASAP.



For most D.C. motor manufacturers, ASAP delivery actually means several weeks.

But when maxon DC motors says ASAP, we truly mean it.

Because we maintain an extensive stock program. So if you choose any motor from our Stock Program Catalog, you'll get a prototype in just days.

Besides a broad selection of ferrite, AlNiCo, and rare earth D.C. motors, our ASAP delivery applies to virtually any matching configuration of our modular motors, gear boxes, DC tachs, and encoders.

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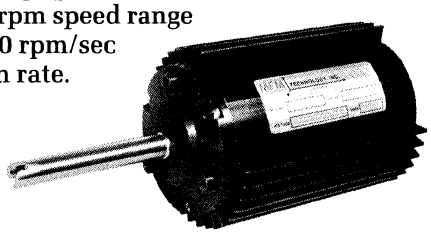
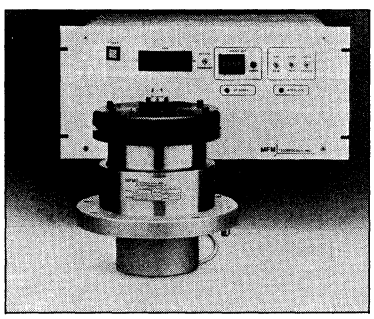
Complete Velocity and Positioning Servo Systems. Interface with User Host Computers and Controllers.

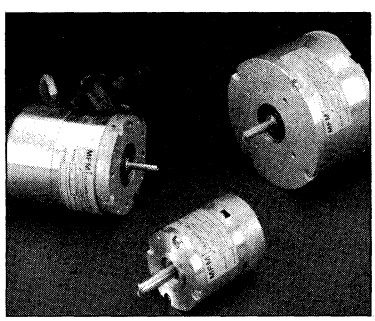
High performance semi-custom brushless DC motors are designed to meet critical process control requirements. Model D16824 Spinner Motor used in semiconductor wafer fabrication equipment has a 0 to 12,000 rpm speed range and a 50,000 rpm/sec acceleration rate.



Precision ball-bearing spindles with imbedded brushless DC motors are available with micro-inch shaft run-out tolerances. Model BDC 0530 linear sine-wave drive offers closed-loop servo control and IEEE-488 or RS-232 digital interface.

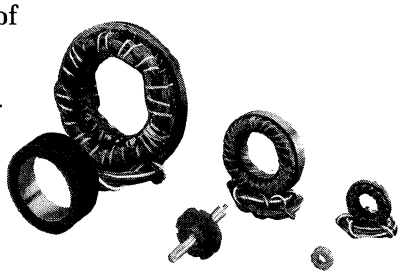


Using samarium-cobalt magnets, MFM brushless DC motors are available in 10 frame sizes from 1.25 inch through 10.0 inch diameter with peak torque ratings from 13.5 oz-in. to 4500 lb-in. Modular motor components are matched to provide optimum performance using 1,350 standard stator configurations.

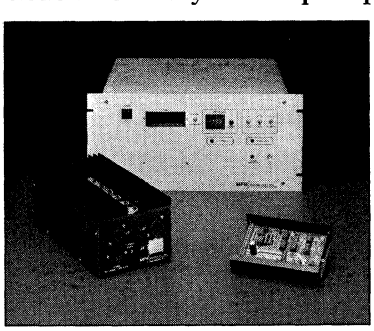


Model BDC 2000 is a 1000 Watt brushless PWM sine-wave drive configured as a transconductance amplifier for ±10 volt speed commands. Model BDC 2001 is available as a six-step drive with four quadrant operation.

Unhoused motors are supplied as kits for direct mounting onto the driven shaft to eliminate performance-reducing effects of conventional couplings, belts, or pulleys. Choice of resolver, optical encoder, or Hall effect commutation available.



Linear sine-wave drives are recommended for magnetic, optical, and sensitive instrument applications where very low torque ripple and virtually no EMI/RFI are essential for proper performance.



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MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MECH. POWER OUTPUT (W)	MAX. CONT. TORQUE (oz-in)	RECOM-MENDED MAX SPEED (RPM)
MOTORS								
	1016	10	(.39)	16	(.63)	0.45	.07	13,000
		FITS GEARHEAD SERIES 10/1, & 12/3						
	1212	12	(.47)	12.2	(.48)	0.1	.01	15,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1219	12	(.47)	18.7	(.74)	0.45	.11	12,000
		FITS GEARHEAD SERIES 12/3, & 10/1						
	1331	13	(.51)	31.2	(1.23)	2.0	.36	12,000
		FITS GEARHEAD SERIES 15/5						
	1516	15	(.59)	15.8	(.62)	0.3	.07	12,000
		FITS GEARHEAD SERIES 15/1, 15/2, 15/3, & 15/5						
	1524	15	(.59)	23.8	(.94)	0.6	.14	12,000
		FITS GEARHEAD SERIES 15/1, 15/2, 15/3, & 15/5						
	1616	16	(.63)	15.8	(.62)	0.45	.11	12,000
		FITS GEARHEAD SERIES 16/1, 16/2, 16/3, & 16/5						
	1624	16	(.63)	23.8	(.94)	0.9	.21	12,000
		FITS GEARHEAD SERIES 16/1, 16/2, 16/3, & 16/5						
	2017	20	(.79)	17.2	(.68)	0.45	.11	12,000
	2025	20	(.79)	24.8	(.98)	0.9	.21	8,000
	2225	22	(.87)	24.8	(.98)	1.0	.28	8,000
		FITS GEARHEAD SERIES 22/2						
	2230	22	(.87)	30.0	(1.18)	2.0	.36	8,000
		FITS GEARHEAD SERIES 22/2, & 34PG						
	2233	22	(.87)	32.8	(1.29)	2.0	.43	8,000
		FITS GEARHEAD SERIES 22/2, 23/1, & 34PG						
	2338	23	(.91)	37.6	(1.48)	3.5	.85	8,000
		FITS GEARHEAD SERIES 34PG, & 23/1						
	2842	28	(1.10)	42.0	(1.65)	6.0	2.80	5,000
		FITS GEARHEAD SERIES 23/1, 34PG, & 38/1						
	3540	35	(1.38)	40.0	(1.57)	10.0	3.55	5,000
		FITS GEARHEAD SERIES 34PG, & 38/1						
	3557	35	(1.38)	57.0	(2.24)	15.0	6.38	5,000
		FITS GEARHEAD SERIES 34PG, & 38/1						
	3557...CS	35	(1.38)	57.0	(2.24)	20.0	7.09	5,000
		FITS GEARHEAD SERIES 34PG, & 38/1						
GEARMOTORS								
	2020	20	(.79)	20.0	(.79)	0.4	.21 to 1.42	200 to 3,000
	2034	20	(.79)	33.3	(1.31)	0.8	.43 to 1.42	500 to 2,000

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- Motor-Tachometers

MOTOR STYLE SELECTOR

STYLE	SERIES	CASE DIAMETER (mm)	CASE DIAMETER (in)	OVERALL LENGTH (mm)	OVERALL LENGTH (in)	CONT. MAX. POWER OUTPUT (W)	MAX. CONT. TORQUE (oz-in)	RECOM-MENDED MAX SPEED (RPM)
	GNM 2636	45	(1.77)	98	(3.86)	22.0	13.14	4,000
	FITS GEARHEAD SERIES G1.2 & G12.1							
	GNM 2670	45	(1.77)	142	(5.59)	40.0	21.72	4,000
	GNM 3125	55	(2.17)	126.5	(4.98)	30.0	15.07	4,000
	FITS GEARHEAD SERIES G24							
	GNM 3150	55	(2.17)	126.5	(4.98)	55.0	27.65	4,000
	FITS GEARHEAD SERIES G2.6							
	GNM 3175	55	(2.17)	126.5	(4.98)	75.0	37.74	4,000
	FITS GEARHEAD SERIES G11.1							
	GNM 4125	70	(2.76)	118	(4.65)	45.0	32.71	3,000
	FITS GEARHEAD SERIES G8N							
	GNM 4150	70	(2.76)	143	(5.63)	75.0	52.67	3,000
	FITS GEARHEAD SERIES G11.2							
	GNM 4175	70	(2.76)	168	(6.61)	100	79.01	3,000
	GNM 5440	83	(3.27)	166.5	(6.56)	125	79.37	3,000
	FITS GEARHEAD SERIES G3.1 & G6.1							
	GNM 5480	83	(3.27)	206.5	(8.13)	210	149.53	3,000
	FITS GEARHEAD SERIES G6.1, G40.1, GC10, & GC20							
	GNM 6250	100	(3.94)	193	(7.60)	250	133.00	3,000
	GNM 62100	100	(3.94)	243	(9.57)	450	225.00	3,000
	GNM 7045	120	(4.72)	202	(7.95)	175	177.87	3,000
	GNM 7085	120	(4.72)	256	(10.08)	300	295.16	3,000
	GNM 70130	120	(4.72)	313	(12.32)	430	414.88	3,000
	FITS GEARHEAD SERIES G50.1, GC10, GC20, & GC30							

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GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM	RATIOS TO	MAX. CONT. TORQUE (oz-in)	INTER-MITTENT TORQUE (oz-in)
GEARHEADS									
	10/1	10	(.394)	2	(.079)	4:1	102.4:1	≤ 14.0	≤ 28.3
		FITS MOTOR SERIES 1016, 1212, & 1219							
	12/3	12	(.472)	2	(.079)	9.17:1	154.368:1	≤ 5.6	≤ 14.1
		FITS MOTOR SERIES 1212, 1219, & 1016							
	15/1 & 16/1	17	(.669)	2	(.079)	11.8:1	5752:1	≤ 2.8	≤ 7.1
		FITS MOTOR SERIES 1516, 1616, 1524, & 1624							
	15/2	16	(.630)	2	(.079)	3.45:1	235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524							
	15/3	16	(.630)	2	(.079)	6.3:1	235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1516, & 1524							
	15/5	16	(.630)	3	(.118)	6.3:1	235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1516, 1524, & 1331							
	16A	16	(.630)	2	(.079)	11.8:1	5752:1	≤ 4.2	≤ 14.2
		FITS MOTOR SERIES 1516, 1524, 1616, & 1624							
	16/2	17	(.669)	2	(.079)	3.45:1	235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, & 1624							
	16/3	17	(.669)	2	(.079)	6.3:1	235,067:1	≤ 4.3	≤ 14.2
		FITS MOTOR SERIES 1616, 1624							
	16/5	17	(.669)	3	(.118)	6.3:1	235,067:1	≤ 14.2	≤ 42.6
		FITS MOTOR SERIES 1616, 1624							
	22B	24	(.945)	4	(.157)	9:1	2187:1	≤ 14.2	≤ 56.6
		FITS MOTOR SERIES 2225, 2230, & 2251							
	22/2	23.8	(.937)	4	(.157)	3.1:1	983,447:1	≤ 14.2	≤ 56.7
		FITS MOTOR SERIES 2225, 2230, & 2233							
	23/1	23	(.906)	6	(.236)	14:1	1526:1	≤ 100	≤ 141.6
		FITS MOTOR SERIES 2233,2338, & 2842							
	34PG	34	(1.339)	8	(.315)	12:1	54880:1	≤ 710	≤ 710
		FITS MOTOR SERIES 2233, 2338, 3540, & 3557							
	38/1 & 38/2	38	(1.60)	8	(.315)	14:1	1526:1	≤ 1.418	≤ 2.127
		FITS MOTOR SERIES 3540, 3557, & 2842							
	G1.1	—		6	(.236)	7.3:1	38:1	≤ 92	≤ 283.2
		FITS MOTOR SERIES GNM 2145							
	G1.2	—		8	(.315)	7.3:1	38:1	≤ 155.7	≤ 283.2
		FITS MOTOR SERIES GNM 2636							
	G2.6	—		10	(.394)	4.8;1	36:1	≤ 424.8	≤ 1132.8
		FITS MOTOR SERIES GNM 3150							

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GEARHEAD STYLE SELECTOR

STYLE	SERIES	OUTSIDE DIAMETER (mm)	OUTSIDE DIAMETER (in)	SHAFT DIAMETER (mm)	SHAFT DIAMETER (in)	RATIOS FROM	RATIOS TO	MAX. CONT. TORQUE (oz-in)	INTER-MITTENT TORQUE (oz-in)
	G3.1	—		12	(.472)	5.6:1	35:1	≤ 877.9	≤ 1,840.8
	FITS MOTOR SERIES GNM 5440								
	G4	—		8	(.315)	15:1	43740:1	≤ 339.8	≤ 424.8
	FITS MOTOR SERIES GNM 2145, & 2130								
	G4A	—		8	(.315)	60:1	9720:1	≤ 453.1	≤ 566.4
	FITS MOTOR SERIES GNM 2130, & 2145								
	G5	34	(1.34)	8	(.315)	30:1	54880:1	≤ 710	≤ 710
	FITS MOTOR SERIES GNM 2130, & 2145								
	G6.1	83	(3.27)	20	(.787)	8:1	185.7:1	≤ 7,080	≤ 18,408
	FITS MOTOR SERIES GNM 5440, & 5480								
	G8N	—		12	(.472)	15:1	405:1	≤ 2,832	≤ 2,832
	FITS MOTOR SERIES GNM 4125								
	G11.1	56	(2.21)	14	(.551)	8.3:1	242.9:1	≤ 3,115	≤ 4,248
	FITS MOTOR SERIES GNM 3175								
	G11.2	56	(2.21)	14	(.551)	8.3:1	242.9:1	≤ 3,115	≤ 4,248
	FITS MOTOR SERIES GNM 4150								
	G12.1	—		10	(.394)	10:1	810:1	≤ 708	≤ 1,133
	FITS MOTOR SERIES GNM 2636								
	G13.1	45	(1.772)	15	(.591)	15:1	540:1	≤ 1,420	≤ 1,704
	FITS MOTOR SERIES GNM 2670								
	G24	—		10	(.394)	15:1	540:1	≤ 1,416	≤ 1,699
	FITS MOTOR SERIES GNM 3125								
	G40.1	—		15	(.591)	10:1	56:1	≤ 3,540	≤ 9,912
	FITS MOTOR SERIES GNM 5480								
	G50.1	—		20	(.787)	10:1	40:1	≤ 5,310	≤ 14,160
	FITS MOTOR SERIES GNM 70130								
	GC10	—		19	(.748)	3.38:1	15.17:1	≤ 8,780	≤ 17,700
	FITS MOTOR SERIES GNM 5480 & 70130								
	GC20	—		24	(.940)	19.85:1	44.42:1	≤ 16,992	≤ 42,480
	FITS MOTOR SERIES GNM 5480, & 70130								
	GC30	—		28	(1.102)	60.19:1	129.50:1	≤ 45,314	≤ 94,876
	FITS MOTOR SERIES GNM 70130								

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SPECIFICATIONS

Excitation: The input voltage and frequency.

Transformation Ratio: The ratio of the output voltage, at maximum coupling, to the input voltage.

Phase Shift: The lead or lag of the output voltage with respect to the input voltage. For most synchros and resolvers, the phase shift can be approximated by the angle whose tangent is the ratio of the primary winding's DC resistance to its reactive component.

Impedance: Specified as R + jX, where R is the AC resistive component and X is the reactive component. Important impedances are: (a) Z_{po} (or Z_{ro} for rotor primary units), which is the impedance of the primary winding with the secondary open; (b) Z_{so}, which is the impedance of the secondary winding with the primary open; and (c) Z_{ss}, which is the impedance of the secondary with the primry shorted (essentially when driven by a low impedance).

Null Voltage: The voltage remaining when the unit is at electrical zero or in the minimum coupling position.

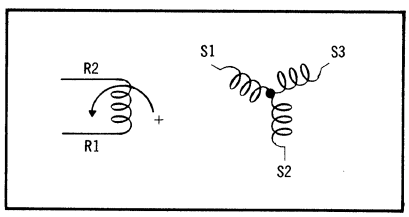
Accuracy: The error of the position of the rotor with respect to the electrical angle. It is defined as the output voltage driven by the "speed" (pole pairs) of the unit, referenced to the starting point of the calibration (usually the electrical zero position). Error is commonly expressed in minutes of arc (1/60 of a degree) or in seconds of arc.

Loads: For a transmitting unit, the impedance that the output voltage signal faces. This can be a receiver, a differential with its load, a control transformer, an A/D converter, etc.

Operation Temperature: The ambient temperature range over which the unit performs its primary function.

FUNCTIONS

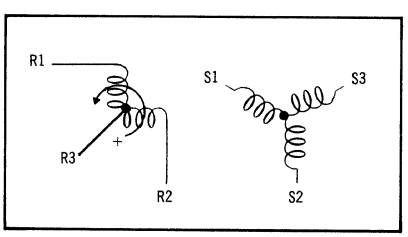
Transmitter: A unit with a Y-connected stator that outputs a signal proportional to the position of its single-phase excited rotor. High power units, called "torque transmitters," are used to drive one or more receivers. Low power transmitters are used to drive control transformers.



Receiver: A unit with a three-phase stator excited by the input, usually from a torque transmitter, and a single-phase rotor that follows the resulting stator field. Usually used to drive a position pointer.

Control Transformer: A unit with a three-phase stator excited by the input from a transmitter and a single-phase rotor mechanically driven to the null position by an external motor or other device.

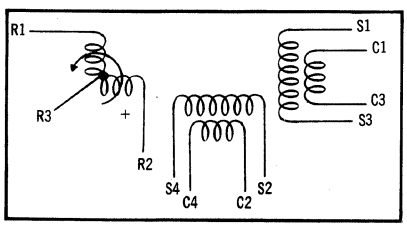
Differential: A unit with a three-phase stator and a three-phase rotor. It is usually connected between a transmitter, which excites its stator, and a receiver or control transformer. It can be used to "dial in" correction factors for the synchro chain.



Transolver: A unit with a three-phase stator and a two-phase rotor that can be used either as a control transmitter (with one rotor phase excited and the other shorted), or as a control transformer with the signal obtained from one phase of the rotor—making sure the other phase is equally loaded to prevent unbalances.

Differential Resolver: A unit with a two-phase stator and a three-phase rotor that is used as a transolver with the advantage that when connected as a control transformer, the signal does not travel through slip rings.

Resolver: A unit with a two-phase rotor and a two-phase stator that is used to create or receive SIN-COS signals such as vector resolutions for solving inertial platform coordinate transformations, unknowns of right triangles, etc. Resolvers can also be used as transmitting, differential, or receiving elements by proper choice of impedances. It is also possible to use resolvers as phase shifters where, in one mode, one rotor phase is excited and the two stator windings are feeding an appropriate RC network and indicating a phase shift, referred to the input, that corresponds to the rotor position.



Compensated Resolver: A unit with a "2×2" phase stator and a two-phase rotor used as a resolver with the added benefit of feedback windings in parallel with the stator windings that increase the useful accuracy over a wide range of environmental operating conditions.

Linear Transformer: A unit with a single-phase stator and single-phase rotor designed to provide a linear output voltage that is directly proportional to the rotor input angle. It operates over a range of less than ±90°, and is analogous to a potentiometer providing infinite resolution, but without contact between the elements. It can be used only with AC voltages.

Brushless Synchro: Available in two types—hairspring and bobbin. Hairspring synchros use spiral wound conductor springs to pick off the rotor signal, and are generally limited to a ±165° rotation. Most have mechanical stops to prevent damage due to overrotation. Bobbin synchros pick off the rotor signal with rotary transformers inside the unit, allowing the rotor unlimited motion.

Pancake Unit: A name derived from the physical dimensions of the unit, which has a diameter that exceeds axial length. Sizes range from under 1" to 20" or more. The unit is frequently used as a gimbal pickoff element and is designed to fit a particular application envelope. It can be supplied as a rotor and stator only.

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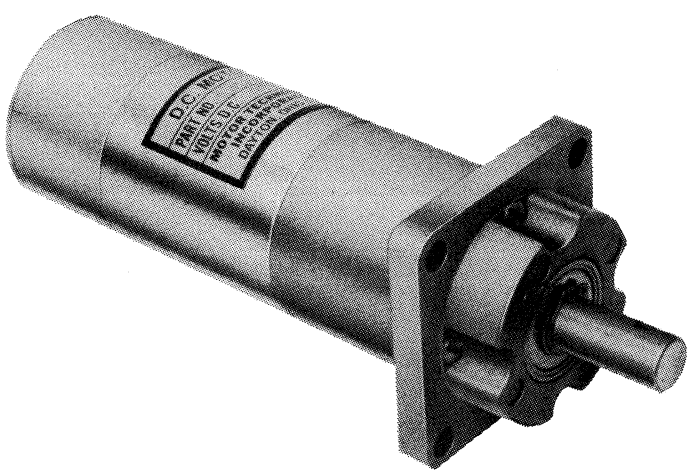

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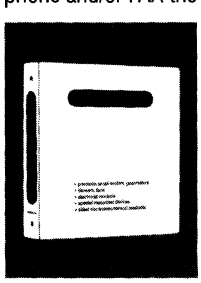

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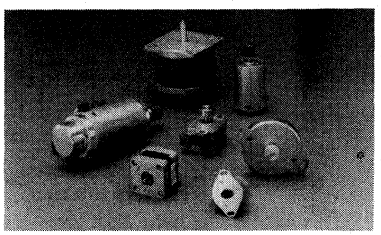
FEATURES



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Sheet metal models in sizes 08 to 28 with step angles of 1.8° to 18° Laminated models in sizes 14 to 42 with step angles of 0.9° to 5°

BENEFITS

- WIDE RANGE OF MODELS – Many sizes and types offer customers a unique single source
- PRECISION/AUTOMATED PRODUCTION – Dependable performance delivered in high volume
- CUSTOM DESIGN – Size, step-angle, and other parameters can be tailored to specific requirements
- OPTIONS AVAILABLE – Pulleys, connectors, shaft modifications and double-ended shafts

LAMINATED TYPE STEPPING MOTOR

Model No.	Ø	PER WINDING			Holding Torque	Model No.	Ø	PER WINDING			Holding Torque
		VDC	AMPS	OHMS	g-cm			VDC	AMPS	OHMS	g-cm
0.9° STEP ANGLE						23LM-C033	4	1.5	4.8	0.31	5,500
17PY-Q004	4	4	0.16	75	500	23LM-C202	4	4	1.1	3.5	2,500
17PY-Q013	4	3.3	0.66	5	550	23LM-C226	4	12	0.38	32	2,500
17PY-Q201	2	9.2	0.23	38	550	23LM-C302	4	1.3	3.9	0.33	4,500
1.8° STEP ANGLE						23LM-C108	4	5.4	1.5	3.6	6,000
14PM-K001	4	12	0.24	48	650	23LM-C401	4	1.7	4.7	0.37	8,000
14PM-K004	4	9	—	37.5	500	23LM-C503	4	3.4	2.9	1.16	10,800
15PM-K003	4	12	0.16	75	550	34PM-C007	4	5.5	1.25	4.4	10,000
15PM-K004	4	8.6	0.36	24	650	34PM-C108	4	12	1	12	20,000
15PM-K005	2	7.4	—	37	650	34PM-C213	4	2.2	7	0.31	30,000
15PM-K201	2	9	0.24	37.5	550	42PM-C012	4	2.3	6.2	0.37	45,000
15PM-K202	2	12	0.16	75	650	42PM-C109	4	12	1.5	7.7	81,000
17PM-M004	4	12	0.32	37.5	600	3.6° STEP ANGLE					
17PM-M012	4	6	0.67	9	900	17PS-C026	4	12	0.24	50	900
17PM-M021	4	9	0.5	18	600	17PS-C031	4	6	0.67	9	760
23LM-C004	4	6	1.2	5	5,500	17PS-C035	4	12	0.32	38	760
23LM-C006	4	24	0.3	80	5,500	17PS-C037	4	12	0.16	75	504

PERMANENT MAGNET TYPE STEPPING MOTOR

Model No.	Ø	PER WINDING			Holding Torque	Model No.	Ø	PER WINDING			Holding Torque
		VDC	AMPS	OHMS	g-cm			VDC	AMPS	OHMS	g-cm
7.5° STEP ANGLE						15° STEP ANGLE					
15BB-H052	4	12	0.17	70	120	15BA-H052	4	12	0.17	70	150
17BB-H151	4	16	0.13	120	430	15BA-H053	4	24	0.086	280	150
17BB-H152	4	12	0.24	50	480	15BA-H056	4	8	0.27	30	150
23BB-H002	4	12	0.34	36	900	17BA-H153	4	12	0.96	12.5	600
23BB-H005	4	5	0.75	66	900	17BA-H155	4	4	0.4	10	350
23BB-H053	4	24	0.2	120	1200	18° STEP ANGLE					
28BB-H101	4	5	1.4	3.6	2600	08BJ-H002	4	5	0.09	60	65
28BB-H112	2	37	2.06	1.8	2880	15BJ-H054	4	15	0.44	34	200
						15BJ-H057	4	72	1.2	6	200

NOTE: First two digits of P/N denote motor frame size in 1/10th of an inch.
EXAMPLE: 15BJ-H057 has a frame size of 1.5 inches.

NMB TECHNOLOGIES INCORPORATED

MOTOR DIVISION

For complete specifications and pricing, contact

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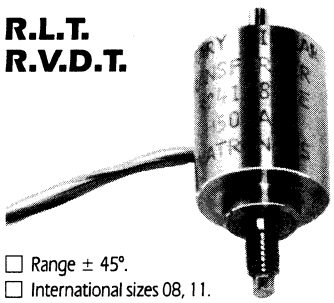
- ☐ Single and Tandem.

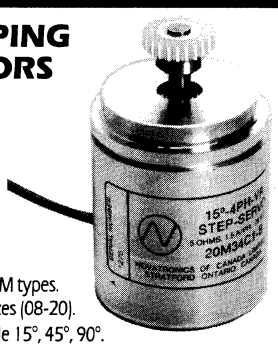
R.L.T. R.V.D.T.



- ☐ Range ± 45°.
- ☐ International sizes 08, 11.
- ☐ Positioning accuracy ± 0.75°.
- ☐ Rotary Variable Differential Transformers.
- ☐ Rotary Linear Transformers.

MOTORS AND ACTUATORS

STEPPING MOTORS



- ☐ VR and PM types.
- ☐ Frame sizes (08-20).
- ☐ Step angle 15°, 45°, 90°.
- ☐ 3 and 4 phase. ☐ With or without lead screws.

SERVOS

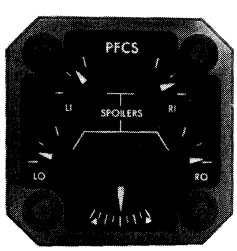
- ☐ Frame sizes.
- ☐ With or without gearheads.
- ☐ With or without tachogenerators.
- ☐ Inertial damping available.

BRUSHLESS DC MOTORS

- ☐ High reliability.
- ☐ High torque. ☐ Low current.
- ☐ Free from EMI. ☐ Long life. ☐ Frame sizes 08-20.
- ☐ Electronics packaged – internal or external.

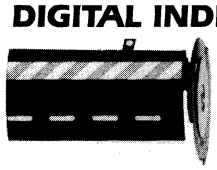
INDICATORS

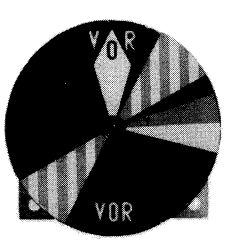
POWERED FLIGHT CONTROL SURFACE INDICATOR



- ☐ Custom electromechanical cockpit display module.
- ☐ 5 display function. ☐ 8 channel outputs to FDR.
- ☐ Input signals from 8 synchro sensors.
- ☐ Meets stringent lighting requirements.
- ☐ MTBF: 40,000 aircraft operational hours.
- ☐ Total design and manufacturing capability.

DIGITAL INDICATORS





- ☐ Electromagnetic wheels.
- ☐ Flags and shutters.
- ☐ Bi-directional built-in detent memory.
- ☐ Excellent readability.
- ☐ In-house custom silk screening.

Call or write: Laraine Murray, Director of Sales/Bernard Dilliott, Director of Engineering
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TELEPHONE: (519) 271-3880 • TELEX: 06-955394 • FAX: (519) 271-9781

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

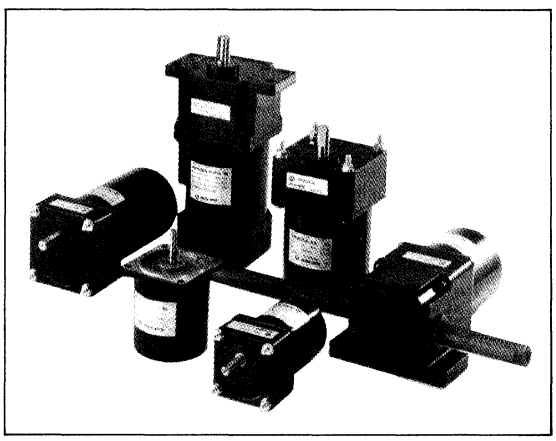
W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

ORIENTAL MOTOR®

HIGH QUALITY FHP ELECTRIC MOTORS



Oriental Motor's reputation for high quality, cost-effective products is well known among automation equipment manufacturers. These motors are used in a variety of products that touch and improve the lives of millions of people. From automating the office in printers, to automating medical and factory automation equipment, **Oriental Motor** is there.

Oriental Motor has over 2000 different standard products that are available in quantities from one, to huge OEM volumes. All **Oriental Motor** products are built with the pride and craftsmanship of a century of manufacturing experience. The engineers at **Oriental Motor** have strived to designed each product to give years of trouble-free service.

Our Product line has 4 different parts: **Oriental Motor** brand AC motors, gearmotors, and speed control motors. **Vexta** Control motors including Step motors and DC brushless motors. **Orix** long life fans, and **SUPER VEXTA** motion control systems.

Features:

Over 2000 standard products available, request our general catalog.
Instrument quality motors at reasonable prices.
Designed with ball bearings for long-life and maintenance-free service.
Available in quantities from one piece to the largest OEM volumes.
Backed by Oriental Motor reputation for award-winning quality.
Standard versions available from stock or with short 3 to 6 week lead times.
Available from our nation-wide stocking distributor network.

Induction Motors

Specifications **115V. 60Hz. – Continuous Ratings**

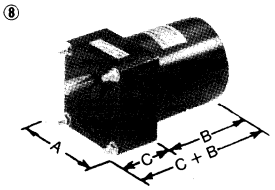
Model and Dimensions No.			Motor Specifications						Gearmotor	
			Output Power Watts	Rated Load			Starting Torque (oz-in)	Capacitor Mfd	Speed Range (rpm)	Torque Range (lb-in)
Motor	Gearhead			Amps	Rpm	Torque (oz-in)				
0IK05GK-AA	**0GK□KA**	①	0.5	0.1	1200	0.56	0.69	0.8	600 ~ 10	0.09 ~ 3.6
0IK1GK-BA	**0GK□KA**	②	1	0.1	3000	0.46	0.42	0.8	1200 ~ 20	0.07 ~ 3.0
2IJ3GA-AA	**2GA□KA**	③	3	0.2	1450	2.9	3.5	1.5	600 ~ 10	0.44 ~ 13
2IK6GK-AA	**2GK□KA**	④	6	0.25	1500	5.5	5.5	2.0	600 ~ 10	0.87 ~ 22
3IK15GK-AA	**3GK□KA**	⑤	15	0.4	1500	14.0	10.5	4.0	600 ~ 10	2.1 ~ 43
4IJ15GA-AA	**4GA□KA**	⑥	15	0.45	1550	13.2	10.4	3.0	600 ~ 10	2.0 ~ 43
4IK25GK-AA	**4GK□KA**	⑦	25	0.6	1500	23.0	15.5	4.5	600 ~ 10	3.5 ~ 69
5IK40GK-AA	**5GK□KA**	⑧	40	0.9	1550	36.0	28.0	8.0	600 ~ 10	5.5 ~ 87
4IK40GS-AFA	**4GS□K**	⑨	40	1.1	1500	36.0	28.0	8.0	600 ~ 10	9.5 ~ 87
5IK60GS-AFUL	**5GS□K**	⑩	60	1.3	1550	53.0	42.0	12.0	600 ~ 10	13 ~ 130

① ~ ④ UL recognized, impedance protected; ⑤ ~ ⑩ UL recognized, thermally protected.
The box (□) represents the desired gear ratio, which ranges from 3 to 180 as follows: 3, 3.6, 5, 6, 7.5, 9, 12.5, 15, 18, 25, 30, 36, 50, 60, 75, 90, 100, 120, 150, 180.
Please refer to Page 6 (Gearheads) to calculate speed and torque for a particular gearmotor.

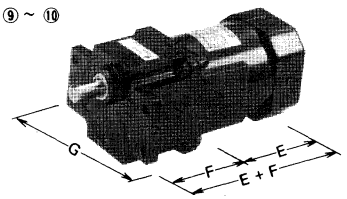
Dimensions (unit = inch)

Gearmotor	A	B	C
①	1.65	1.97	1.02
②	1.65	1.97	1.02
③	2.36	2.56	1.02/1.38
④	2.36	2.95	1.26/1.65
⑤	2.76	3.15	1.26/1.65
⑥	3.15	2.96	1.26/1.67
⑦	3.15	3.35	1.26/1.67
⑧	3.54	4.13	1.65/2.36
Gearmotor	E	F	G
⑨	3.94	2.36	4.73
⑩	4.73	2.56	5.12

① ~ ⑧



⑨ ~ ⑩



Oriental Motor instrument quality AC motors are available in 5 types:
Induction motors AC PSC Reversible motors for continuous duty applications.
Instantly Reversible AC motors with friction brake for reversing and simple positioning.
Synchronous AC motors for precise speed regardless of load fluctuation.
AC Torque motors for applications requiring continuous stalling.
AC Speed control motors for adjustable speed over a 19:1 range without brushes.
All motors can use our modular gearheads for speed reduction and torque multiplication. Gear ratios from 3:1 to 180:1 and higher are available.

The list above is a partial list of the wide variety of motors that Oriental Motor produces. Our AC motors are also available made-to-order (shaft flats, special shaft lengths, custom windings, special lead wire colors, assembled with connectors, etc.) are available in moderate OEM quantities. Contact your local sales office for details.

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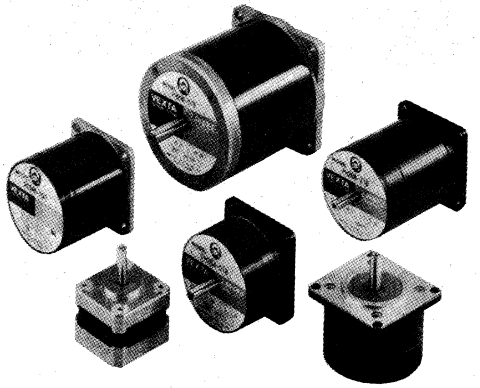
FOR MORE INFORMATION CALL: LOS ANGELES (213) 515-2264; SAN JOSE (408) 988-2655; CHICAGO (312) 577-0310; NEW YORK (201) 882-0480

VEXTA® STEPPING MOTORS



These Hybrid stepping motors are designed and manufactured by Oriental Motor and are sold under our VEXTA brand name. They are used in a wide variety of applications ranging from Printers for Office Automation, to robots and assembly machines for Factory Automation. Many models are interchangeable with other step motors for improved quality and cost reduction. Oriental Motor is the premier step motor supplier to the world of motion control.

Available in quantities from one piece to the largest OEM volumes.
Backed by Oriental Motor reputation for award-winning quality.
Standard versions are available from stock or with 3 to 6 week lead times.
Step angle error is small and non-accumulative.
Rotating speed proportional to input pulse frequency.
Available from our nation-wide stocking distributor network.

1.8° AND 0.9° FULL STEP VERSIONS AVAILABLE!

Model Number		Voltage	Current per phase	Holding Torque		Resistance per phase ohm/phase	Inductance per phase mH/phase	Rotor Inertia		Installing base size	Length	Weight
Single Shaft	Double Shaft	V.DC	A/phase	oz-in	N-cm			oz-in²	g-cm²	in.sq. (mm.sq)	in. (mm)	lbs (kg)
PXB43H-01AA	**PXB43H-01BA**	4	0.95	15.3	10.8	4.2	2.2	8.8×10^{-2}	16	1.65 (42)	1.30 (33)	0.44 (0.2)
-02AA	**-02BA**	9.6	0.4			24	13					
PXB44H-02AA	**PXB44H-02BA**	6	0.8	22.2	15.7	7.5	6.5	13.1×10^{-2}	24	1.65 (42)	1.54 (39)	0.55 (0.25)
-03AA	**-03BA**	12	0.4			30	28					
-04AA	**-04BA**	24	0.2			120	105					
PX245-01AA	**PX245-01BA**	4	1.2	30.6	21.6	3.3	2	0.19	35	1.65 (42)	1.85 (47)	0.73 (0.33)
-02AA	**-02BA**	6	0.8			7.5	4.7					
-03AA	**-03BA**	12	0.4			30	17.6					
PH264-01	**PH264-01B**	4	1.1	40.3	28.4	3.6	3.6	0.3	57	2.22 (56.4)	1.54 (39)	0.88 (0.4)
-02	**-02B**	12	0.4			30	30					
-03	**-03B**	24	0.2			120	130					
PH265-01	**PH265-01B**	6	0.85	58.3	41.2	7.1	9	0.6	110	2.22 (56.4)	2.01 (51)	1.2 (0.54)
-02	**-02B**	12	0.42			29	36					
-03	**-03B**	24	0.21			114	144					
-04	**-04B**	5	1			5	6.3					
-05	**-05B**	1.4	3.8			0.37	0.5					
PH266-01	**PH266-01B**	6	1.2	83.3	58.8	5	8	0.74	135	2.22 (56.4)	2.13 (54)	1.3 (0.6)
-02	**-02B**	12	0.6			20	32					
-03	**-03B**	24	0.3			80	128					
PH268-21	**PH268-21B**	5.4	1.5	125	88.2	3.6	6	1.1	200	2.22 (56.4)	2.99 (76)	2.1 (0.95)
-22	**-22B**	12	0.68			17.7	30					
-23	**-23B**	24	0.34			70.6	120					
PH2610-01	**PH2610-01B**	6	1.88	150	105.8	3.2	7	1.75	320	2.22 (56.4)	3.98 (101)	2.64 (1.2)
-02	**-02B**	12	0.94			12.8	28					
-03	**-03B**	24	0.47			51.0	115					
PH296-01	**PH296-01B**	1.8	4.5	174	123	0.4	1.4	3.1	560	3.27 (83)	2.44 (62)	3.3 (1.5)
-02	**-02B**	5.5	1.25			4.4	14					
-03	**-03B**	14	0.7			20	60					
PH299-01	**PH299-01B**	3	4	306	216	0.75	4.5	6.0	1100	3.27 (83)	3.68 (93.5)	5.5 (2.5)
-02	**-02B**	6	2			3	18					
-03	**-03B**	12	1			12	72					

The list above is only a partial list of the wide variety of stepping motors that Oriental Motor produces. Our VEXTA brand of step motors are also available in:

"M" version 0.9° Full step 0.45° Half step versions for 400 and 800 steps per revolution for smoother moves and better accuracy.
8 lead wire versions of the motors listed above are available for maximum flexibility in driver selection.
"L" Lamination versions are available for lower noise and microstepping compatibility.
Step motors that are made-to-order (shaft flats, special shaft lengths, custom windings, special lead wire colors, assembled with connectors, etc.) are available in moderate OEM quantities. Contact your local sales office for details.

And best of all, it's backed by Oriental Motor's award winning quality and century of manufacturing experience. FOR MORE INFORMATION CALL ORIENTAL MOTOR AT (213) 515-2264.

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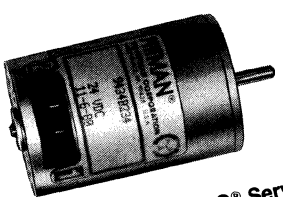
COMPUTER TESTED BRUSH-COMMUTATED

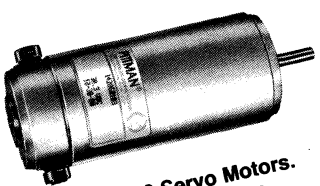
Now all Pittman® motors are available optionally with optical encoders. Every motor is thoroughly tested by a sophisticated computer-controlled instrument array that checks eight vital performance parameters and records the measured values. And every unit is composed of standardized sub-components pre-assembled to extremely demanding specifications. That's Pittman, applying the latest in mass production techniques to reliable, precision motion control products to assure you of a welcome combination of performance and economy. Choose the motor type you need. Then contact us for complete data and application assistance. Call (215) 256-6601. TWX: 510-661-8696. FAX: 215-256-1338.

Series 8000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.2 in.; 3 lengths to 2.4 in. overall. Stall torques to 12 oz.-in. Mechanical time constants about 21 ms.

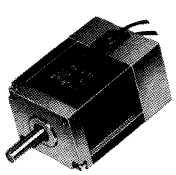
Series 9030 Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in. Stall torques to 41 oz.-in. Mechanical time constants as low as 9.2 ms (some models).



Series 9000 LO-COG® Servo Motors. 7-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 1.6 in.; 3 lengths to 2.5 overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 14.9 ms. (some models).



Series 14000 Servo Motors. 11-slot armatures. Voltage inputs to about 40 VDC. Nominal O.D. 2.13 in.; 4 lengths to 5.2 in. overall. Stall torques to 286 oz.-in. Mechanical time constants as low as 6.2 ms. (some models).



Series 7000 Servo Motors. 13-slot armatures. 4 pole, samarium cobalt fields. Voltage inputs to about 40 VDC. 1 in. x 1.25 in. cross section; lengths to 1.85 in. overall. Stall torques to 24 oz.-in. Mechanical time constants as low as 4.8 ms (some models).

PITTMAN®
HARLEYSVILLE, PA 19438-0003 USA
A DIVISION OF PENN ENGINEERING & MANUFACTURING CORP

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SWEDEN: L. Ostergren EL-AB Solna Tel.: 08-734 06 10
UNITED KINGDOM: Servodata Ltd. Newbury, Berks Tel.: 0635-45373
WEST GERMANY: Servotech GmbH Wiesbaden Tel.: (0 61 21) 50 10 81

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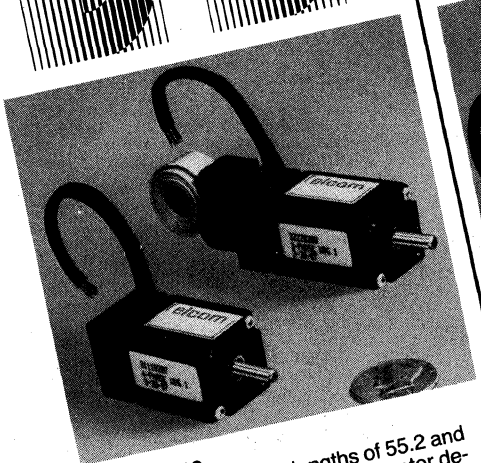
DEMONSTRABLY SUPERIOR BRUSHLESS SERVO MOTORS



Series 3000
30mm sq. frame size; lengths of 55.2 and 65.4mm. At 7,200 rpm, longest motor develops 1/15 hp, continuous duty, with normal heat sink.

Series 4000
40mm sq. frame size; lengths of 67.8, 75.3, and 83.0mm. At 7,200 rpm, longest motor develops 1/6 hp, continuous duty, with normal heat sink.

Series 5000
50mm sq. frame size; lengths of 77.4, 90.1, and 102.8mm. At 7,200 rpm, longest motor develops 1/3 hp, continuous duty, with normal heat sink.

All motors are available with your choice of 3-phase or 4-phase stator winding connections. Options include optical encoders and/or planetary gearheads. Get the whole story on unique Pittman® ELCOM® electronically commutated servo motors by calling (215) 256-6601. TWX: 510-661-8696. FAX: (215) 256-1338.

- **Samarium cobalt rotor construction**
- **Exceptional thermal efficiency**
- **Negligible magnetic cogging**
- **Very low winding inductances**
- **High torque-to-inertia ratios**
- **Low mechanical time constants**
- **Very high performance at speeds to 25,000 rpm**

PITTMAN®
HARLEYSVILLE, PA 19438-0003 USA
A DIVISION OF PENN ENGINEERING & MANUFACTURING CORP

CANADA:
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Milano
Tel.: (02) 6120551/2/3/4

THE NETHERLANDS:
Nijkerk Elektronika B.V.
Amsterdam
Tel.: (20) 5 49 59 69

SWEDEN:
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UNITED KINGDOM:
Servodata Ltd.
Newbury, Berks
Tel.: 0635-45373

WEST GERMANY:
Servotech GmbH
Wiesbaden
Tel.: (0 61 21) 50 10 81

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39-C

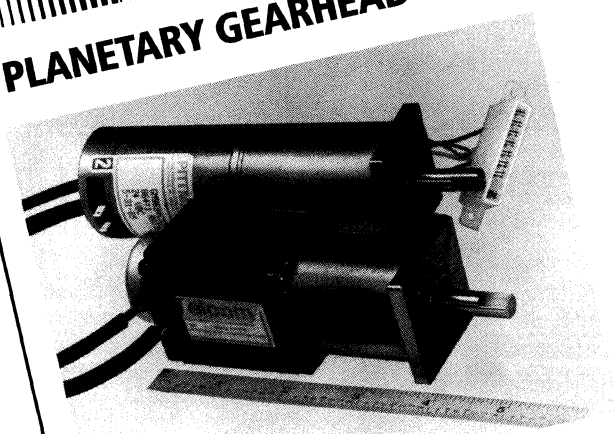
GEAR MOTORS

SPUR GEARHEAD

Series GM8700 Gearmotors. Output torques to 100 oz.-in. with standard gearing. Uses selected 8000 Series servo motor plus spur gearbox. Eleven available ratios from 6.3:1 to 1804:1. 1.37″ o.d.; lengths to 3.6″ overall depending on motor and gearbox specification. Optional gearing permits output torques to 160 oz.-in.

Series GM9400 Gearmotors. Torque to 175 oz.-in. with standard gearing. Uses selected 9000 or 9030 Series servo motor plus spur gearbox. Fourteen available ratios from 5.9:1 to 4730:1. 2.0″ o.d.; lengths to 3.96″ overall depending on motor and gearbox specification. Optional gearing permits output torques to 500 oz.-in.

PLANETARY GEARHEAD



This family of planetary gearheads is designed to provide reliable delivery of up to 125 lb.-in. of torque at the output shaft, dependent upon ratio and the thermal characteristics of the selected motor. Any brush-commutated DC motor in PITMO® 9000, 9030, or 14000 Series can be mated with these gearheads or, for exceptional performance in smallest size, choose any ELCOM® brushless servo motor from Series 3000, 4000, or 5000.

Eleven ratios from 4:1 to 31104:1 are available. Gears are precision hobbed from 4140 steel to AGMA 10 tolerances. Output shafts are Fatigue-Proof® steel, running in generously sized, oil-impregnated, sintered bronze bearings. Ball bearings or roller bearings are available optionally.

For a specific recommendation of a gearmotor to suit your application, please contact your local Pittman sales representative or call us at (215) 256-6601. TWX: 510-661-8696. FAX: 215-256-1338.

Fatigue-Proof® is a registered trademark of LaSalle Steel Co., Chicago, Ill.

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Brian Engineering Ltd.	Sherman Eng. Co. Ltd.	SGE-Syscom s.p.a.	Nijkerk Elektronika B.V.	L. Ostergren EL-AB	Servodata Ltd.	Servotech GmbH
Montreal	Herzliya	Milano	Amsterdam	Solna	Newbury, Berks	Wiesbaden
Tel.: 514-735-1671	Tel.: 052-542 853/541319	Tel.: (02) 6120551/2/3/4	Tel.: (20) 5 49 59 69	Tel.: 08-734 06 10	Tel.: 0635-45373	Tel.: (0 61 21) 50 10 81

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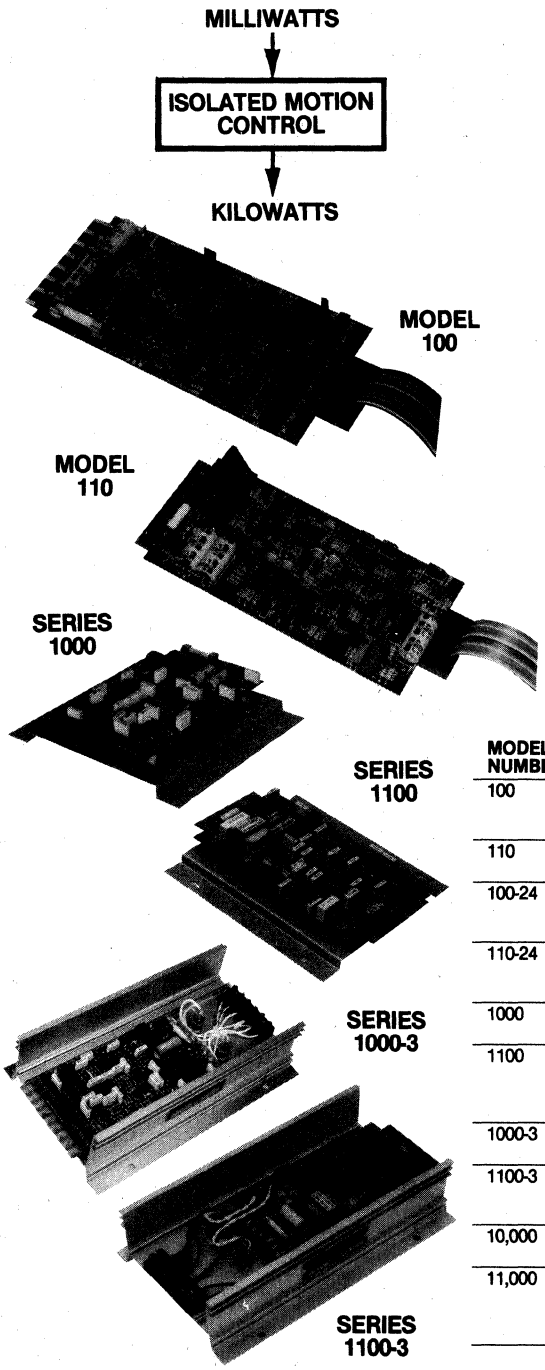
40-C

POWRUPS

ISOLATED INPUT DC MOTOR CONTROLS



8 Bit Parallel Microprocessor/TTL Compatible
1500 volt isolation ..... or
Isolated Analog Inputs
1500 volt isolation, voltage or current inputs
Bi-Directional, Regenerative (4 Quadrant) Operation
Controls large inertial loads with fast response
Output Horsepower
3 power ranges control motors from 1/50 HP to 3 HP
Motor Armature Voltage
90, 130 and 180 VDC full scale outputs; 24 VDC also available
Motor Field Voltage
For all PM motors as well as 50 and 100 VDC fields
AC Input Voltage
Nominal 115 VAC or 230 VAC, 47-63 Hz
Isolation Voltage
1500 VDC standard; up to 5000 VDC available
Speed Range
50:1 standard or wider with tach feedback
Adjustments
Full Speed, IR comp, Torque limit, offset adjust
Ambient Operating Temperature
−20°C to +70°C
Input/Output Connections
Plug removable connectors, solder lugs or ribbon cable, inputs and outputs physically separated
Failsafe Protection
Motor is de-energized if control is not powered
Torque Limiting
Adjustable torque limits, CW and CCW

MODEL NUMBER	INPUT VOLTAGE	HP RANGE	NOTES
100	115 VAC 60 Hz	1/30 HP-1/8 HP	TTL/Microprocessor Compatible; Board level; low cost for OEM applications
110	115 VAC 60 Hz	1/30 HP-1/8 HP	Isolated Analog Input; Board level; low cost for OEM applications
100-24	115 VAC 60 Hz	1/30 HP-1/8 HP	TTL/Microprocessor Compatible; Board level; low cost for OEM applications; 24 VDC output
110-24	115 VAC 60 Hz	1/30 HP-1/8 HP	Isolated Analog Input; Board level; low cost for OEM applications; 24 VDC output
1000	115/230 60 Hz	1/6 HP-1 HP	TTL/Microprocessor Compatible; Open Frame Construction
1100	115/230 60 Hz	1/6 HP-1 HP	Isolated Analog Input: User may select ±100 mv, ±5 VDC, 4-20 ma or 10-50 ma inputs. Open Frame Construction
1000-3	115/230 60 Hz	1 HP-3 HP	TTL/Microprocessor Compatible; Open Frame Construction
1100-3	115/230 60 Hz	1 HP-3 HP	Isolated Analog Input; User may select ±100 mv, ±5 VDC, 4-20 ma inputs. Open Frame Construction.
10,000	115/230 60 Hz	1/6 HP-1 HP	TTL/Microprocessor Compatible; Die Cast Case Construction
11,000	115/230 60 Hz	1/6 HP-1 HP	Isolated Analog Input; User may select ±100 mv, ±5 VDC, 4-20 ma or 10-50 ma inputs. Die Cast Case Construction.

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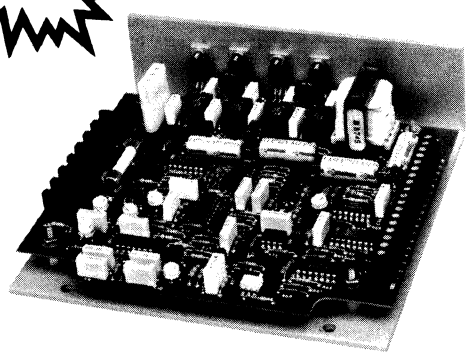
POWR-UPS

MOTOR CONTROLS

For Industrial and Robotics Applications

NEW

FULL WAVE REVERSIBLE REGENERATIVE DC MOTOR DRIVE



The 2745 series motor controls are full wave, static reversible, regenerative units that control the speed and direction of shunt wound or permanent magnet (PM) DC motors with outputs ranging from 1/6 to 3.0 horsepower.

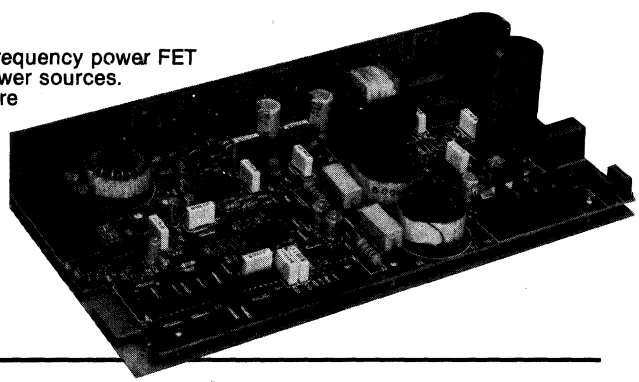
These controls are designed to be easily interfaced to microprocessors or TTL digital circuitry. Logic input signals are opto-isolated from the motor with a minimum isolation voltage of 1500 VDC. This eliminates the possibility of grounding or noise problems.

A 10 bit parallel command selects motor direction as well as 9 bit (1 part in 512) control of speed. A failsafe circuit de-energizes the motor if the control power is not present.

Model 2745 is supplied for operation from 115 VAC, 50/60 Hz mains and drives DC motors with 90 VDC armature ratings and 50-100 VDC fields. Model 2746 is supplied for operation from 220/240 VAC, 50/60 Hz mains and drives DC motors with 180 VDC armature ratings and 100-200 VDC field windings.

The units are of open frame construction, suitable for O.E.M. use in user provided enclosures. The aluminum mounting bracket serves as a heat sink for the power semi conductors. Inputs and outputs are connected by barrier strips.

24 VDC OUTPUT MOTOR CONTROLS



POWR-UPS Model 124 DC motor controls are high frequency power FET units that operate from standard 115 or 230 VAC power sources. These units are completely self contained and require no additional power supplies.

Model 124 features:

- Compatible with virtually all PM DC motors
- Bipolar outputs up to +24 VDC
- Four quadrant, regenerative operation
- Output to 2 amperes
- Armature or tachometer feedback
- Wide bandwidth for servo applications
- High frequency PWM filtered output
- Isolated analog or digital interfaces

INTEGRAL LCD SPEED/TORQUE DISPLAY

POWR-UPS Model 310 DC Motor Control is a half-wave, regenerative unit that controls the speed and direction of motor torque of motors with outputs from 1/30 to 0.5 HP. The integral front panel 10 turn potentiometer permits repeatable setting of motor speed. Model 310 features:

- 10 turn precision speed control potentiometer
- LCD readout of speed/torque analog
- Bi-directional, regenerative (four quadrant) action
- Operates from nominal 115 VAC power lines
- Controls PM or Shunt field motors up to 0.5 HP

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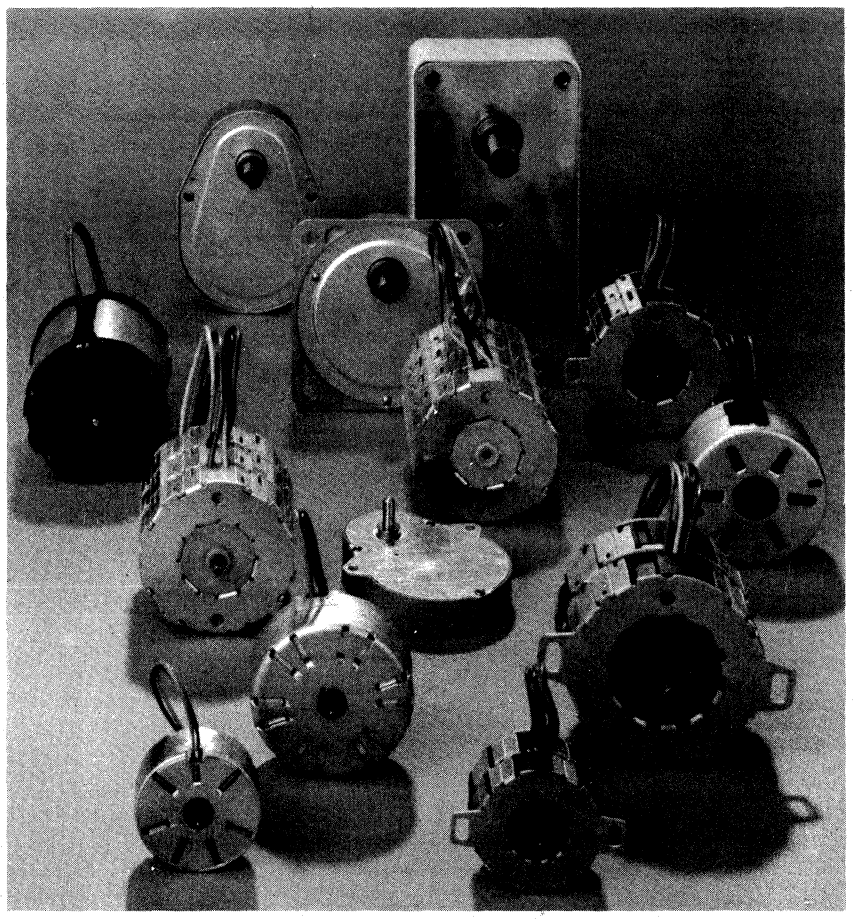
Stepper & Synchronous Motors

Step'n sync with SAIA



SAIA AG, with factories located in Murten, Switzerland, has developed complementary lines of same-size synchronous and stepper motors with interchangeable gear boxes. That makes for a commonality which means economy for you. But what's uncommon about these economical motors is their versatility: two-phase and four-phase steppers; unidirectional and reversible synchronous. And with "snap-on" reduction gears (with optional clutch) that meet any mechanical and electrical variant, you can be sure of a solution to your particular needs. Manufactured to Swiss standards of precision and quality, you can also be sure of reliability and long life.

Use this short-form catalog to specify your general requirements on the enclosed business reply card. We will send you detailed data sheets and offer engineering assistance in the selection of the right motor for your application.

SYNCHRONOUS MOTORS

UBS 1 (AMY 7)...distinguished by especially silent running and long life, this motor is used in timing relays, registering instruments, sychronous clocks. The direction of running is controlled by means of auxiliary poles.

UDS 1 (AMY 81)...an economically-priced synchronous motor with an effective ratio of size to torque. A reverse-running stop assures rapid starting in the correct direction at high torque.

UDS 5 (AMY 81-W)...a brushless DC motor that is a combination of the AMY 81 unirotational motor and an electronic circuit which enables it to be connected to DC, resulting in a brushless DC motor having the advantages of a synchronous motor--no brush wear, long life, and speed not load-dependent.

UDS 7...totally new design with non-reverse device, high torque and very high efficiency (40%). Features of the new design are the fixed permanent magnets and rotating soft iron armature. Applications include power drive for actuators, valves, flaps, feed systems, domestic appliances, office machinery, and vending machines.

UBR 1...electrically reversible, permanent magnet synchronous motor with 48 stator poles. Motor is fitted with maintenance-free sintered bronze bearings encased in a plastic housing to protect the bearings from dirt and prevents leakage of bearing lubricant by capillary action. Applications include HVAC, and time-synchronized drive in recording, medical, laboratory, and analyzing devices and apparatus.

UDR 1 (AMY 9)...an electrically-reversible motor of heavy duty design and wide running range. Applications include valve actuators, phono-units, copying machines, assembly robots, medical devices, registering instruments.

UFR 1/3/4 (AMY 12/13/14)...these reversible motors are especially suitable for power drives featuring long life and silent running. Applications include actuating valves, ring-type transformers, pumps, label printing machines, medical and optical instruments, electro-pneumatic converters, antenna drives, machine automation, registering instruments, sound devices.

STEPPER MOTORS

UBB 1/2/5/6...two-phase and four-phase motors with 15 degree step angles; holding torque up to 1.5 cNm.

UBD 1/2/5/6...two-phase and four-phase motors with 7.5 degree step angles; holding torque from 1.0 cNm to 1.5 cNm.

UDB 1/2 (AMA 9)...slightly larger motor with 15 degree step angles; holding torque up to 2.3 cNm; two- and four-phase versions available.

UFB 1/2/3/4 (AMA 12/14)...step angles of 15 degrees; holding torque up to 8.2 cNm and external dimensions up to 51.3 x 56 mm.

UFD 1/2 and **UHD 1/2**...largest 7.5 degree step angle motor; two- and four-phase operation with holding torques up to 16.0 cNm.

Typical applications for SAIA stepping motors are recording instruments, facsimile equipment, peristaltic pumps, as well as printers and electronic typewriters.

REDUCTION GEARS

High quality reduction gears, as modular clip-on gearboxes, are constructed for multistage, spur gear reduction. The gear wheels rotate on hardened and highly-polished steel shafts lubricated for life, and are therefore absolutely maintenance free. Internal roller bearing one-way and two-way slipping clutches allow the output shaft to be rotated while the motor is stationary.

SAIA

SAIA Inc.
An American Electronic Components Co.
1010 N. Main St., P.O. Box 280
Elkhart, IN 46515-0280
Telephone (219) 262-4418
Telefax (219) 264-4681 Telex 25-8482

American Electronic Components

SYNCHRONOUS MOTORS

UNIROTATIONAL	Dimensions (mm) inches	Rotor Speed rpm (50Hz) 60Hz	Running Torque at 60Hz (cNm) oz.in.	Power Input Watts/Volts-Amps (50Hz) 60Hz	Operating Voltages ± 10% at 50/60Hz	Gearboxes Combinable
UBS 1	(35x15) 1.4x.59	(375) 450	(.049) .069	(1.3W/1.4VA) 1.2W/1.3VA	12, 24, 48-50, 110 220, 240V	A, D
UDS 1	(48x18) 1.9x.73	(500) 600	(.414) .586	(2.5W/3.5VA) 2W/2.5VA	6, 12, 24, 36, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UDS 7	(50x45) 2.0x1.8	(500) 600	(3.4) 4.82	(3.5W/5.5VA) 3W/4.2VA	6, 12, 24, 36, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
REVERSIBLE						
UBR 1	(35x21) 1.4x.85	(250) 300	(.41) .586	(1.5W/1.5VA) 2W/2VA	12, 24, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UDR 1	(48x 24) 1.9x.94	(500) 600	(.64) .902	(2.5W/2.5VA*) 2.5W/2.5VA*	12, 24, 48, 110, 120, 220, 240V	A, D, K, B, F, V, J
UFR 1	(53x28) 2.1x1.1	(500) 600	(1.34) 1.90	(3.7W/3.7VA) 4W/4VA	24, 48-50, 110, 220, 240V	A, D, K, B, F, V, J
UFR 3	(53x43) 2.1x1.7	(500) 600	(2.0) 2.8	(6VA/6W) 5.5W/5.5VA	24, 48-50, 110, 220, 240V	F, V, J
UFR 4	(53x55) 2.1x2.2	(500) 600	(2.9) 4.10	(7W/7VA) 7.5W/7.5VA	24, 48-50,110, 220, 240V	F, V, J

STEPPER MOTORS

2-Phase (bipolar)	Dimensions (mm) in.	Holding torque (oz.in.)	Step angle ± 1°	Steps per revolution
UBB 1	(36x21) 1.44x.84	1.704	15°	24
UBB 5	(36x21) 1.44x.84	2.13	15°	24
UDB 1	(48x24) 1.92x.97	3.266	15°	24
UFB 1	(51x28) 2.05x1.12	6.39	15°	24
UFB 3	(51x56) 2.05x2.24	11.644	15°	24
UBD 1	(36x21) 1.44x.84	1.846	7.5°	48
UBD 5	(36x21) 1.44x.84	2.13	7.5°	48
UFD 1	(51x28) 2.05x1.12	7.10	7.5°	48
UHD 1	(59x35) 2.36x1.40	22.72	7.5°	48

4-Phase (unipolar)	Dimensions (mm) in.	Holding torque (oz.in.)	Step angle ± 1°	Steps per revolution
UBB 2	(36x21) 1.44x.84	1.42	15°	24
UBB 6	(36x21) 1.44x.84	1.704	15°	24
UDB 2	(48x24) 1.92x.97	2.84	15°	24
UFB 2	(51x28) 2.05x1.12	4.544	15°	24
UFB 4	(51x56) 2.05x2.24	8.52	15°	24
UBD 2	(36x21) 1.44x.84	1.42	7.5°	48
UBD 6	(36x21) 1.44x.84	1.988	7.5°	48
UFD 2	(51x28) 2.05x1.12	5.112	7.5°	48
UHD 2	(59x35) 2.36x1.40	18.46	7.5°	48

REDUCTION GEARS

	Dimensions [mm] in.	Maximum running torque (cNm)	Maximum running torque (oz.in.)	Running times (per revolution)	Characteristic
A	[55(62)x12] 2.2(2.4)x.47	32	45	5/12S to 24h	Metal gear
D	[55(65)x13] 2.2(2.6)x.51	32	45	5/12S to 403-1/5h	Plastic gear
K	[55(62)x24] 2.2(2.4)x.94	140	198	1-2/3S to 96h	Power gear
B	[58(82)x17] 2.3(3.2)x.67	250	354	4-1/6S to 23-11/15h	Power gear
V	[70(70)x17] 2.8(2.80)x.68	500	709	5/6S to 8M	Power gear
F	[58(82)x17] 2.3(3.2)x.67	500	709	5/12S to 20m	Power gear
J	[65(107)x28] 2.6(4.3)x1.12	1500	2126	5/12S to 100 days +	Power gear

DPi 13536

Tachometers, Encoders, Brushless Tach/Commutators.

dc tach generators

Servo-Tek 1.135" OD tachometer generators are built to last. With silver-alloy commutators, stainless-steel shafts and bearings, brushes rated for 100,000-hour life, temperature compensation, and full factory run-in, our tachs deliver stable, long-term performance. A complete line with a variety of mechanical and electrical characteristics is available from stock. Output ratings from 1 to 45 V/1000 rpm.

incremental encoders

These high-resolution (100 to 512 pulses/revolution) optical encoders are offered both as options on 1.135" Servo-Tek rotating components (pictured) and as stand-alone feedback devices. All configurations provide 3-channel (2 in quadrature and 1 index) LSTTL logic output. Combination units give position, speed, and direction feedback.

5 Vdc supply; 3.2 mA output standard; 16 mA with standard amplifier, others available, STTL.

For inexpensive single-pulse-train feedback, Servo-Tek Pulsers are your best bet. 4 to 12 pulses/revolution; 4.5 to 15 Vdc supply; stand-alone and add-on models.

tachsyn® brushless tach/ commutators

Does your brushless dc drive require

- High-accuracy commutation?
- Linear, low-noise tach signal?
- Elevated-temperature operation?
- No electronics in the motor?
- Low-inertia rotor?

The new patented Tachsyn tach/commutator from Servo-Tek may be the ideal transducer for your exacting requirements.

The Tachsyn brushless three-phase transducer is available in 4-, 6-, and 8-pole configurations to match your motor. With remote signal conditioning electronics, it provides accurate 6-step Hall-equivalent or sine-wave signals plus a low-ripple analog dc tachometer output.

The rotor is a low-inertia, passive component suitable for high speeds. Overhung mounting eases addition to your motor–no extra bearings or couplings are required.

1086 Goffle Road • Hawthorne, NJ 07506
(201) 427-3100 • FAX (201) 427-4249

SERVO-TEK®

SERVO-TEK PRODUCTS COMPANY

8554

SKC

SHINANO KENSHI CORP.

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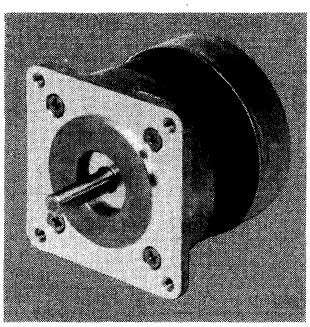
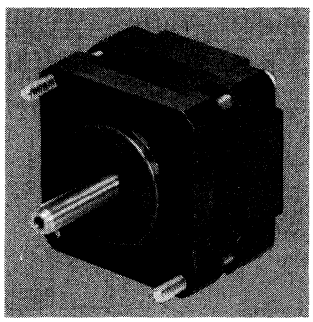
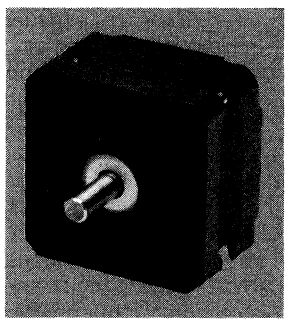
LOOK TO SKC FOR VALUE ENGINEERED MOTORS AND TECHNICAL SUPPORT

STEPPING MOTORS

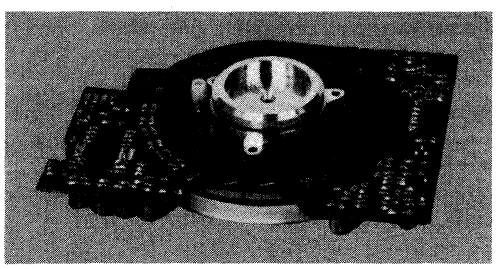
Sizes 15 (35mm), 17 (39mm) & 23 (56mm) **Step Angles:** 0.9°, 1.8°, 3.6° & 3.75°. Hybrid, unipolar or bipolar, precision ball bearings 3% accuracy, state-of-the-art performance. **Applications:** Disk drive, tape streamer, printers, plotters, medical equip., office automation machines.



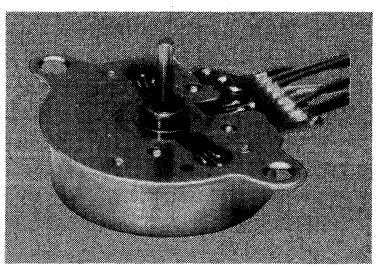




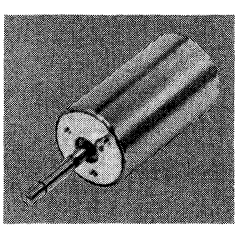
BRUSHLESS DC MOTORS

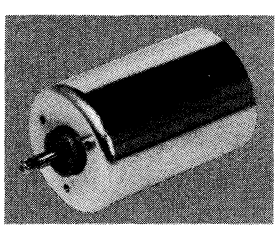


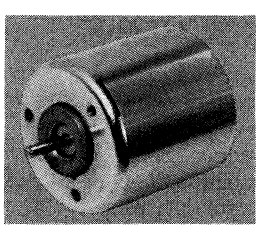
Inner & outer rotor types, 3 phase radial gap types, 42mm to 90mm dia, rare earth magnet, ball bearings, hall sensors. **Options:** Tachometer, encoder, integral driver. **Applications:** Disk drives, streamers, medical equip., computer peripheral equip., fan & blower drives.



CORELESS DC MOTORS

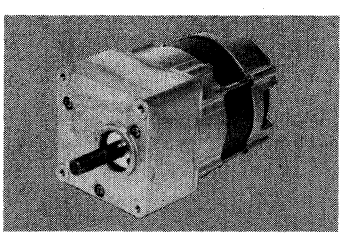






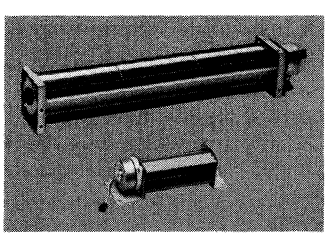
Ironless rotor, 12mm to 50mm dia., 8.5 to 1400 GM-CM starting torque. **Options:** Ball bearings, tachometer, terminals. **Applications:** Medical equip., office equip., recorders, small printers, plotters.

AC MOTORS



Induction motors: 120 or 220 VAC, 50 OR 60 HZ, frame sizes of 60, 70, 80, 90 & 102mm dia. **Options:** Gearheads, cooling fans, capacitor run or shaded pole. **Applications:** Copy machines, print press, fan & blower drives, conveyors.

TANGENTIAL BLOWERS



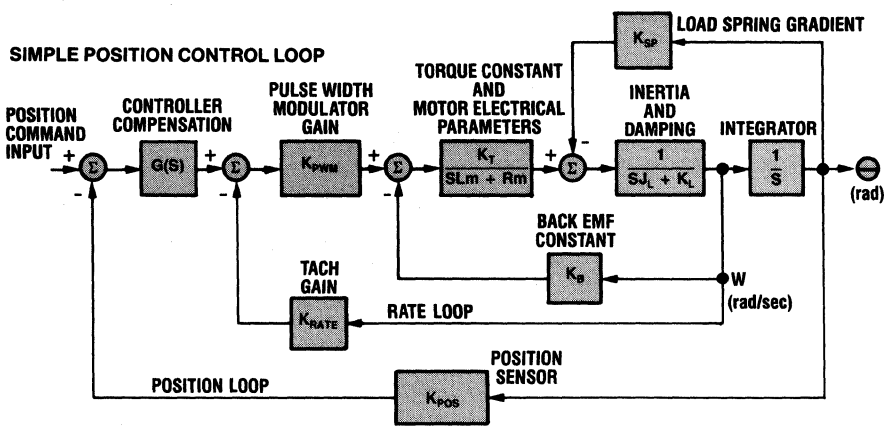
Brushless DC motor with integral driver, rugged steel construction, quiet operation, air flow up to 2.0 CMM. **Applications:** Small computers, copiers, office equip., audio equip., printers, space heaters.

FOR COMPLETE INFORMATION CALL OR WRITE FOR OUR CATALOG
FOR IMMEDIATE DELIVERY OF STANDARD STEPPERS CALL STOCKING DISTRIBUTOR DDI, 818-764-9777

Sierracin/Magnedyne

Complete Solutions in ELECTRONIC MOTION CONTROL

Sierracin/Magnedyne leads in the development of sophisticated motion control devices. We have over 20 years of experience in all phases of development, design, applications engineering and manufacturing. From large, powerful devices for military applications, to the smallest, most precise medical applications, Sierracin/Magnedyne has successfully developed innovative motion control solutions to the most exacting requirements. Additionally, our products include brushless and brush type motors, tachometers, and the entire range of electronic positioning, drive, and motion control devices. We work with our customers, identifying their needs, selecting and designing systems to meet their needs, and engineering and producing cost-saving solutions.



APPLICATIONS ASSISTANCE

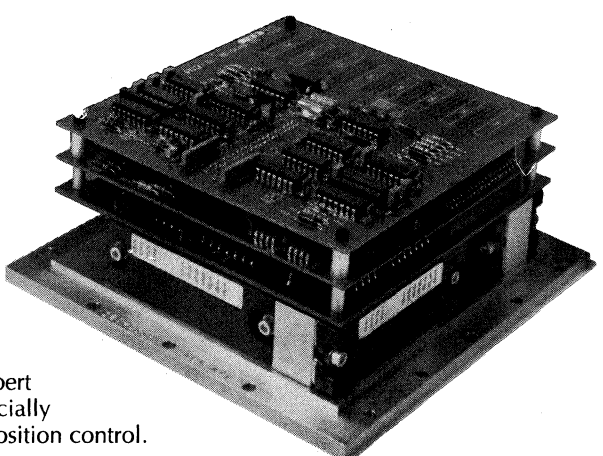
Contact Sierracin/Magnedyne early in your system design process. Our experienced applications engineers can usually help you save money by participating in the motion control aspects of your design process. The experience we have gained in thousands of applications can become part of your design team. The result: shorter design and development time for high reliability motion control systems, a more integrated design for your product, and the assurance that the Sierracin/Magnedyne system we specify will optimize the performance of your product.

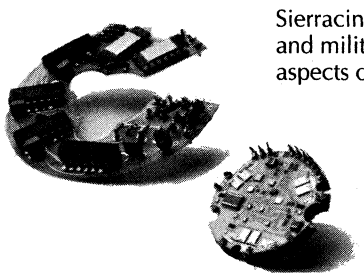
Call or write for the Sierracin/Magnedyne Design Guide to learn the range of motion control products and applications we make available. The Design Guide includes a tutorial on motion control devices and a product guide/specification section that illustrates just what we can do for you.

Motion Control Systems

INTEGRATED MOTION CONTROL MEANS IMPROVED SYSTEM PERFORMANCE

When Sierracin/Magnedyne participates in your design process, you realize significant performance improvements on your products. Motion control devices frequently involve design trade-offs throughout your system, and our engineers know how to integrate motion control devices to provide optimum performance. Your benefits include reduced cost in design and redesign, improved product performance, and motion control solutions that reflect years of expert engineering. High performance motors can be integrated with specially tailored electronics to provide high reliability torque, speed and position control.





Sierracin/Magnedyne has worked with commercial, industrial and military applications in both the electronic and mechanical aspects of system integration. We provide integrated motion control from concept through manufacturing within your performance and packaging requirements. The design cycle is computer-aided and includes:

- System and control conceptual design
- System and module detailed design
- Servo loop analysis and design
- Detailed electronic design
- Prototype fabrication
- System integration
- Testing

DRIVE ELECTRONICS

The systems Sierracin/Magnedyne designs range from simple drives to complex hybrid electronics with microprocessor programmability, so we can help your products reach their highest potentials in terms of integrated design and motion control. We can house the drive electronics separately or integrate them into your package.

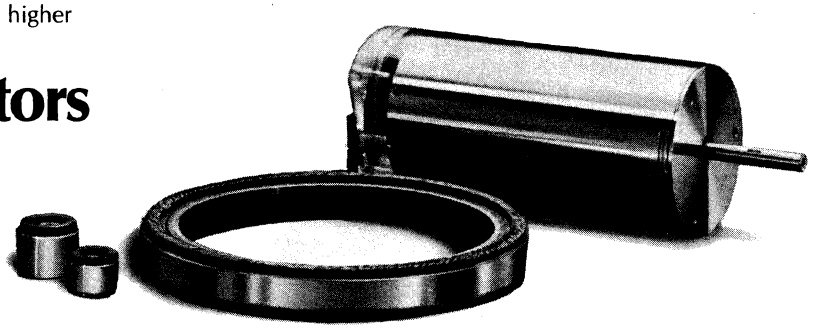
STATE-OF-THE-ART MOTOR DESIGN

Sierracin/Magnedyne continues to apply the latest, proven materials to improve motor performance factors. Through the use of Samarium Cobalt, Neodymium, and other materials, we are able to produce motors with higher torque, lower sensitivity to overcurrent, and greater flexibility in concentricity mounting tolerances. Our on-going development programs provide superior reliability and operational life at higher performance.

CONTROLLER FEATURES INCLUDE:

- Unidirectional or bidirectional
- Current limiting
- Short circuit protection
- Reverse polarity protection
- Speed control
- Digital or analog servo control

DC Brushless Motors



DC brushless motors make possible equipment and applications that previously had been beyond reach. They are able to operate at infinitely variable speeds with high torque; to have speed settings that can be exactly duplicated; and can start, stop and reverse countless times without ill effects. Brushless motors come in a variety of sizes and power ratings, and they can be adapted to the harshest environmental conditions. They include the following characteristics:

- Long operational life
- Low maintenance
- Effective heat dissipation
- Low EMI
- High torque
- Low inertia

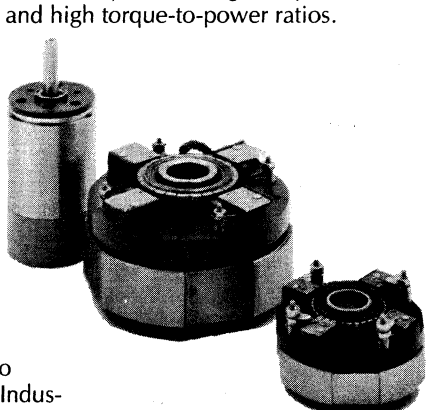
Sierracin/Magnedyne has qualified motors in a wide variety of applications, and they can be built to the most exacting specifications of any industry or use. Sierracin/Magnedyne has probably solved applications problems very close to yours. When your motion control problems are unique, our staff of engineers is ready to design a brushless DC motor and control system to your specific needs.

Brush Type Motors

Sierracin/Magnedyne designs and manufactures direct drive DC torque motors in an especially wide range of sizes and ratings. Our motors range from less than 1" in diameter to over 60", so the possibilities for applications are virtually unlimited. Existing models can be adapted to meet most specifications, or our engineering staff can design a motor for your requirements.

Sierracin/Magnedyne's ongoing development program assures that our products use the latest materials for operational reliability and for high torque-to-weight and high torque-to-power ratios.

DC Tachometer Generators



Extremely low ripple and high sensitivity Sierracin/Magnedyne tachometers are the standard for the machine tool control industry. Small, frameless units offer you flexibility for use in many applications. A variety of mounting and connecting arrangements can be tailored to your needs including housed tachometers and housed DC torque motor/tachometer combinations on a common shaft.

Sizes range to 12.5" O.D., with fully encapsulated designs that meet MIL-SPECs. Also available are reduced axial length and light weight units for aerospace applications. Industrial, military, and process control applications are served by these high reliability units.

Sierracin/Magnedyne

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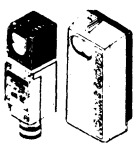
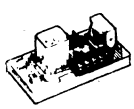
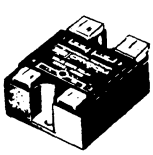
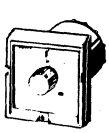

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

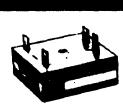
TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

PADDLE SWITCHES

TRANSFORMERS

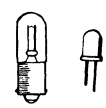

TIMERS

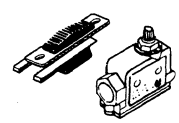
COUNTERS

FANS

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

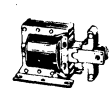
KNOBS

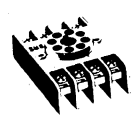

LAMPS & LEDS


SWITCHES

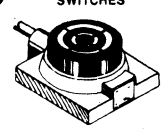
RELAYS

INDICATOR LIGHTS


SOLENOIDS


SOCKETS

PUSHBUTTON SWITCHES


PROXIMITY CONTROLS

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Linemaster
Master Specialties
McGill
Microswitch
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IDI
IEE
JKL
Leecraft
Lumex
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Skan-A-Matic

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Eagle Signal
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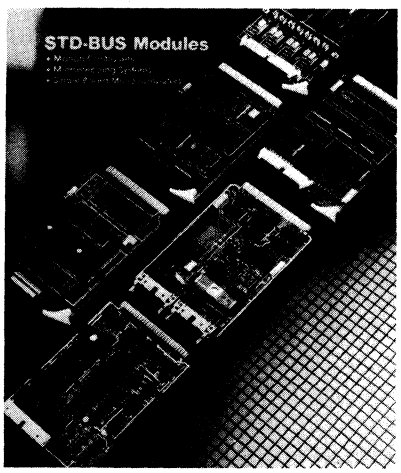
Stock Drive Products—founded by engineers provides unique application assistance in the form of detailed handbooks and catalogs. In keeping with SDP traditions, this material provides very complete details on SDP products to help design engineers choose the products most applicable to their needs. It is an accepted industry fact that SDP product quality is of the highest order as is SDP engineering assistance. Wherever possible, SDP encourages the use of standard products detailed in the catalogs. However, expert advice is available for your special or custom requirements by calling 516/328-0200. Ask for Application Engineering.

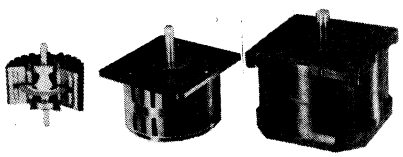
Send for your free copy of the extensive catalog of over 1,000 standard motion control products including DC and AC motors (both direct and reduction drive), steppers, tachometers, gearheads and fans and off-the-shelf STD-BUS cards and motion control modules. Call 516/328-0200 or 328-3300.

STD-BUS MOTION CONTROL MODULES



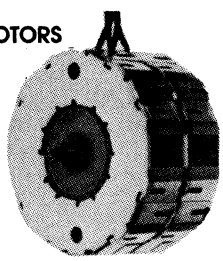
Control motor position, velocity or torque via RS-232, STD-BUS or local switch. Digital filtering. Ideal for robotics/automation. Commands in ASCII. Stepper control, linear or circular interpolation. Microstep to 12,800 steps/rev. 8031 microprocessors. Microstep DAC controls 4 dc motors. A complete family of control modules, cards and boards available off-the-shelf. Catalog TI-822.

THIN DISC PM STEPPER MOTORS



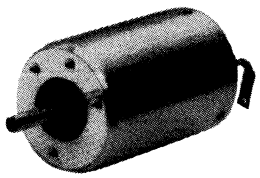
New technology stepper motors with samarium/cobalt permanent disc rotors. Up to 100KW/S power rate in 30, 50 & 70 mm diam. and step angles of 1.8° & 3.6° with peak holding torque up to 90 oz. in. Superior power rate to weight ratio. Weigh 50% less than comparable motors.

"TIN-CAN" PM STEPPER MOTORS



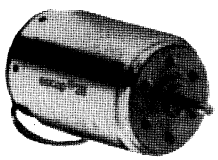
Permanent magnet motors for two and four phase operation. Step angles 7.5° & 15°. Holding torque from 1.0 up to 7.7 Ncm. Operate at 6, 12 or 24 Vdc and from −15°C to +55°C. Mount in any fixed position by means of expandable snap-on clip or screw clip. Available with a wide range of gearheads.

IRONLESS ROTOR DC MOTORS



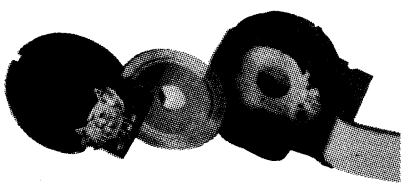
Permanent magnet ironless rotors provide up to 90% efficiency and high power/volume ratios. Many standard models from 16 to 36 mm diam. for 1.2 to 36 Vdc and up to 25.5 oz. in.

DC TACHOMETERS & MOTORS/TACHOMETERS



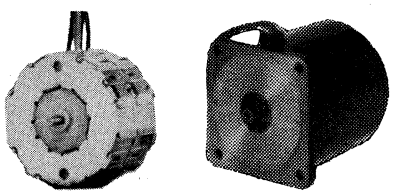
Ironless rotor construction ensures maximum reliability and performance. EMF constant 0.84 to 13.5 V/1000 rpm. Typ. ripple (pk-pk): 6–10%. Linearity & reversion error ±0.1%. Motor/tachs available with speed reducers.

OPTICAL ENCODERS



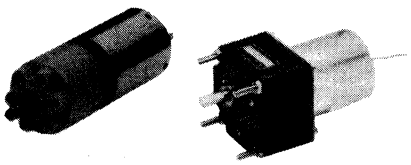
Available in two standard sizes: 28 mm O.D. with 100–512 cycles/rev.; 56 mm O.D. with 192–1024 cycles/rev. Digital output compatible with LSTTL logic, two and three channels. Also available with integral motor.

AC MOTORS



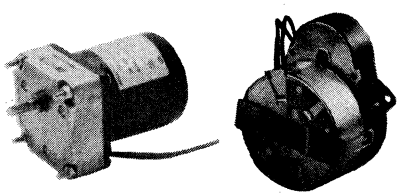
Available as synchronous reversing or unidirectional types. Also hysteresis or induction types. A wide variety of standard sizes and torques up to 1600 Ncm are available. For either 50 or 60 Hz operation and with UL, VDE and CSA approval.

DC GEARMOTORS



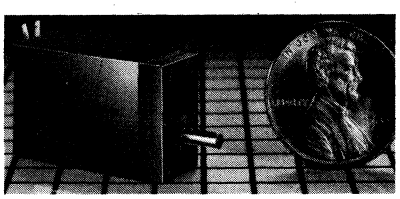
Supplied in either of two basic styles either with integral ironless rotor dc motors and gearheads or as assembled motors and gearbox components. A very wide range of torque and gear ratios.

AC GEARMOTORS



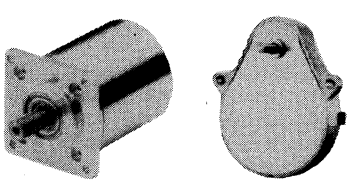
Available in wide range of reduction ratios to fit all standard AC motors and with precision gears and permanently lubricated bearings to ensure quiet long life. With or without one or two way slipping clutches.

MINIATURE DC GEARMOTORS



Tiny precision ironless rotor dc motors with an integral gearbox with a choice of reduction of 3.67 to 2430; 1 of the 7200 rpm 2 or 4 Vdc motors. Motor torque is 0.072 oz. in. @ 2V (0.068 @ 4V). Max. size is 9 mm wide × 15 mm high × 21.8 to 34.7 long. Wt.: 10 to 13 grams.

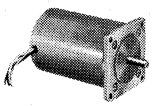
GEARHEADS/SPEED REDUCERS

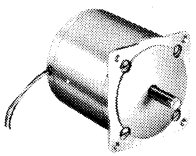


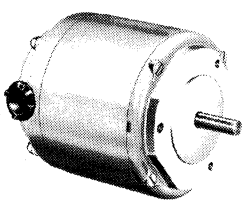
Precision construction in a variety of styles and ratios to fit most standard ac or dc motors. Ratios range from as little as 4.0625:1 up to 360,000:1. A wide range of output torques are available. See catalog SDP-823.

SLO-SYN® DC Stepping Motors

Permanent magnet type stepping motors that provide high torque-per-pound and torque-to-inertia ratios. Can be driven to speeds above 20,000 steps/second with low power input. Motors have Class B insulation and can be operated at an ambient temperature range of −40°C to +65°C. Continuous duty temperature is 65°C. Standard 1.8 degree step angle motors can be half-stepped or microstepped with accuracies of ± 5% or ± 3% noncumulative. Holding torque ratings from 53 to 5000 oz-in. To simplify installation and connections, new quick-connect, plug-in types are available. Motors have no brushes, ratches or gear and use shielded ball bearings to ensure reliability and long life.



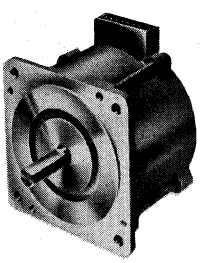


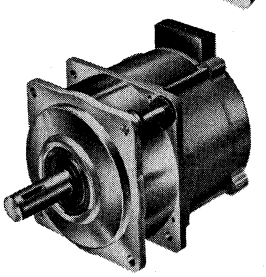


BASIC MOTOR SERIES	MINIMUM HOLDING TORQUE,(2)(5) OZ-IN(6) (kg-cm)	MINIMUM RESIDUAL TORQUE,(5) OZ-IN (kg-cm)	NOMINAL ROTOR INERTIA, LB-IN² (kg-cm²)	TYPICAL TORQUE TO INERTIA RATIO (RAD/SEC²)	SHAFT DIAMETER, INCHES (mm)	MAXIMUM OVERHANG LOAD, LBS (kg)	MAXIMUM THRUST LOAD, LBS (kg)
M061	53 (3,8)	1 (0,07)	0.04 (0,12)	$32x10^{3}$ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M062	100 (7,2)	1.4 (0,1)	0.08 (0,23)	$30x10^{3}$ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M063	150 (10,8)	2.5 (0,18)	0.11 (0,32)	$33x10^{3}$ (3)	0.250 (6,35)	15 (6,8)	25 (11,3)
M091	150 (10,8)	2 (0,14)	0.23 (0,67)	$15.6x10^{3}$ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M092	300 (21,6)	3.9 (0,28)	0.42 (1,23)	$17.2x10^{3}$ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M093	450 (32,4)	6.9 (0,5)	0.64 (1,87)	$16.8x10^{3}$ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M111	625 (45)	6 (0,43)	1.34 (3,93)	$11.2x10^{3}$ (3)	0.375 (9,53)	25 (11,3)	50 (22,7)
M112-FD	1125 (81)	12 (0,86)	2.75 (8,06)	$9.8x10^{3}$ (3)	0.500 (12,7)	25 (11,3)	50 (22,7)
M112-FJ	1125 (81)	12 (0,86)	2.75 (8,06)	$9.8x10^{3}$ (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M113	1550 (112)	20 (1,44)	4.1 (12,0)	$9.1x10^{3}$ (3)	0.625 (15,88)	25 (11,3)	50 (22,7)
M172	2700 (194,4)	50 (3,6)	21 (61,5)	$3.1x10^{3}$ (3)	0.625 (15,88)	50 (22,7)	100 (45,4)

(2) Both windings energized at rated current.
(3) Calculated from holding torque in oz-in and rotor inertia in oz-in-sec^2 (lb. in^2/24).
(5) Values are subject to change without notice. Parameters used as part of a specification should be verified with the factory.
(6) Operation below rated current will reduce torque and may degrade step accuracy.

SLO-SYN® AC Synchronous & Gearmotors





Provide slow basic shaft speed synchronous with line frequency. Allow direct load coupling without gearing. Instantaneous starting, stopping and reversing eliminate clutching and braking. Simple single-pole, 3-position switch provides complete forward, reverse and off control. Will not overheat or be damaged if stalled. Starting and running currents nearly identical. Conventional motors have speeds of 72 and 200 rpm at 60 Hz and torque ratings from 25 to 1800 oz-in.

New **high torque models** provide more power per frame size than any other synchronous motors. Types offered in NEMA frame size 23 and 34 with minimum running torque ranging from 60 to 420 oz-in. Shaft speed is 72 rpm at 60 Hz, 60 rpm at 50 Hz. **AC gearmotor models** offer torque ratings to 5000 oz-in and shaft speeds as low as 0.72 rpm at 60 Hz. All are designed for quick-connect, plug-in connection with optional mating connectors having 36 in. minimum length leads.

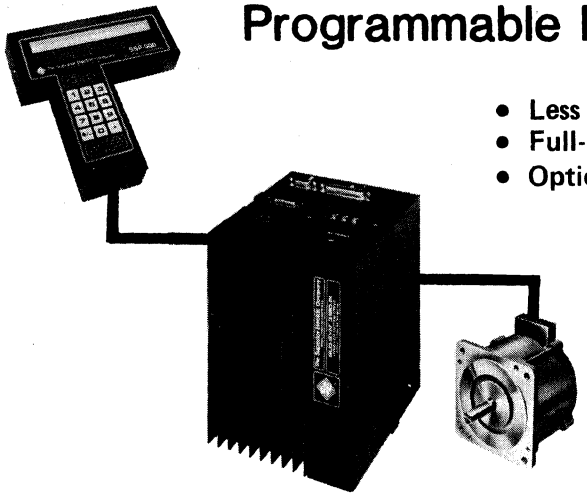
Write or call for complete information.

1-800-447-7171 (In Connecticut 1-800-446-6262)

Superior Electric 383M Middle Street Bristol, Connecticut 06010 USA

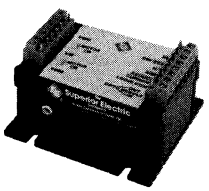
TEL:203/582-9561 TELEX:96-2446 TWX:710-454-0682 CABLE:SUPELEC FAX:203/584-1483

SLO-SYN® Micro Series Step Motor Drives & Programmable Motion Controls

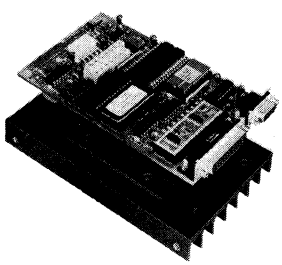


- Less than 1/8 the size of conventional controllers
- Full- or half-stepping plus microstepping in the 3180 Series
- Optional switch interface panels or hand-held programmers
- Full- or half-stepping in the 230 and 430 Series
- Standard pulse and direction interface
- Pulses may be either sourcing or sinking
- Optically isolated inputs protect against noise
- Optional heat sinks for heat dissipation
- Greater performance, increased flexibility

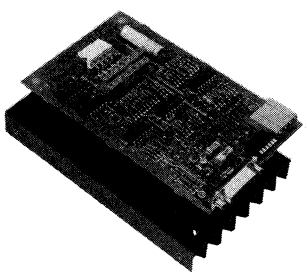
3180 Series Packaged Translators and Indexers — Provide maximum power to SLO-SYN® DC Stepping Motors. Translators have unique, proprietary current control method that improves speed/torque characteristics of many motors. Outperforms existing drives for microstepping, full- or half-stepping. Available with optional oscillator/pulse generator for manual control. Oscillator can be used as a digital pulse source for speed control, manual set-up or final positioning. Indexers are capable of full- or half-step, 1/10 or 1/125 microstep. Store up to 400 lines of program using industry standard motion language (RS274). May be programmed or edited through parallel switch panel ports or RS232 serial ports. Have 2 programmable inputs and outputs, overtravel limit switches and integral power supply.



Drive Modules — Optically isolated 20kHz chopper drives available in 2A and 3.5A per phase, 30VDC types. Can be operated at less than rated current. Use alone or as integral component on a PC board. Also available with heat sinks to dissipate heat and maintain drive integrity or packaged with power supply.

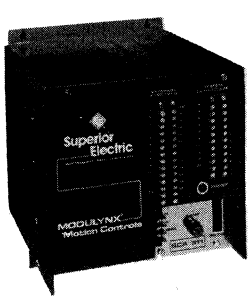


Programmable Indexer/ Drive Modules — Operate applications from single repetitive index to 400 lines. Up to 99 units can be daisy chained. Use industry standard motion language (RS274). Have 2 programmable inputs and outputs, overtravel limit switches. Programmed, edited and manipulated through parallel switch port or RS232 serial port. Also packaged with power supply.

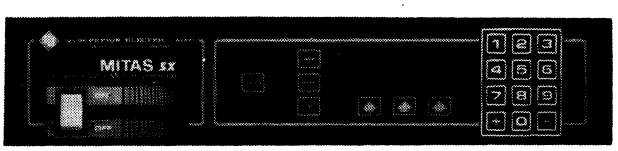


Oscillator/Pulse Generator Drive Modules — Oscillators serve as an alternate pulse source for manual setup and final positioning or as multiple range variable or constant speed drives. Can be remotely operated. All signal inputs optically isolated for maximum protection; have integral heat sinks. Also available as fully enclosed packaged units with integral power supply. Easy connections.

MODULYNX® & MITAS® Motion Controls



MODULYNX® Motion Controls — Permit user to select the appropriate circuit cards suited to individual needs. Up to 6 axes can be operated from each controller with up to 3.5HP available power. Controllers permit SLO-SYN DC Stepping Motors to be run at speeds to 20,000 steps/second with minimum power input. User selectable TTL levels and types of interface needed from RC232C or IEEE488 to simple switches.



MITAS® Programmable Motion Controllers — Available in packaged single- or two-axis systems. Controllers can be operated from the front panel, a remote device or from an RS232 terminal. Units with or without drives are also available housed in enclosures that comply with NEMA 12 specifications for use in industrial environments. Single-axis systems have nonvolatile memory for storage of multiple programmed operations. User controls speed, move distance and acceleration/deceleration rates. Two-axis systems are capable of up to 3.5HP. Controllers have nonvolatile memory that permits programming in feet, inches, meters and degrees and allow storage of multiple programs.

MINIGLOSSARY OPTO SEMICONDUCTORS

Avalanche Photodiode: A photodiode that takes advantage of avalanche multiplication of photocurrent. It is particularly suited to low noise and/or high speed applications.

Contrast: A noticeable difference in color, brightness, or other characteristics in a side-by-side comparison.

Chrominance Contrast: The color contrast between two adjacent surfaces of identical area, shape, texture, and luminance. The human eye is more sensitive to differences in color than it is to differences in brightness.

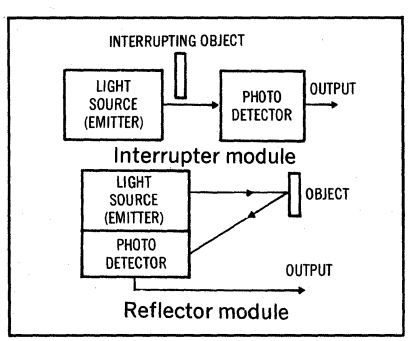
Current Transfer Ratio: The ratio of an optocoupler's output current to input current at a specified bias.

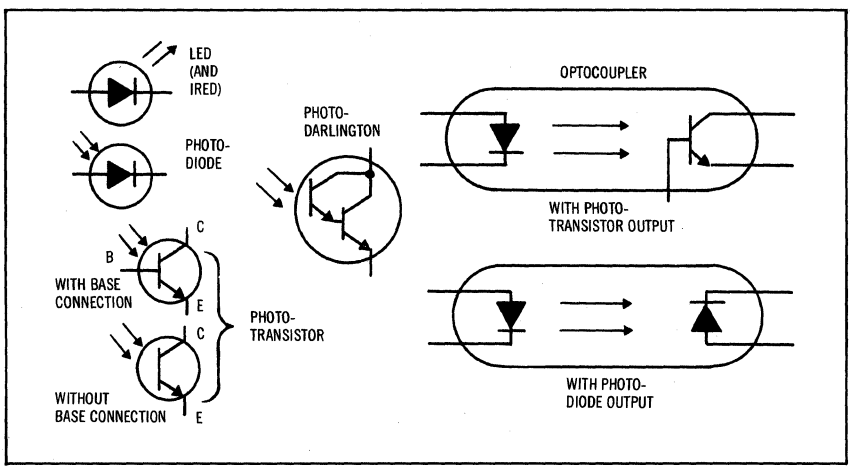
Dark Current: The leakage current of a photodetector with no incident light.

Dominant Wavelength: The wavelength that is a quantitative measure of apparent color of light as perceived by the human eye.

Infrared Radiation: The electromagnetic wavelength region between approximately 0.75 and 100 micrometers longer than the wavelength of visible light.

Interrupter (module): A device that produces an electrical output signal when an object breaks the light (visible or invisible) between a light source and a photodetector.





IRED: An infrared-emitting diode. See light-emitting diode.

Light Current: The current that flows through a photodetector when it is exposed to radiant energy.

Light-Emitting Diode (LED): A semiconductor diode that emits incoherent light at its PN junction when forward biased. The light can be in the visible or invisible (infrared) wavelength region.

Luminance Contrast: The observed brightness of a light-emitting element compared to the brightness of the "surround," an integral part of the device and inseparable from it.

Optocoupler: A device that transmits electrical signals, without electrical connection, between a light source (input) and the receiver (output). The input is generally an LED; the output might be a photodiode, phototransistor, a photo–Darlington, etc. Sometimes referred to as optoisolator.

Peak Wavelength: The wavelength at the peak of the radiated spectrum of an emitter.

Photo–Darlington: A light-sensitive Darlington-connected transistor pair. The photo–Darlington has a very high sensitivity to illumination or radiation.

Photodetector: A device that provides an electrical output signal when subjected to radiation in the visible, infrared, or ultraviolet regions of the electromagnetic spectrum. Photodiodes, phototransistors, and photo–Darlingtons are the most common type of photodetectors.

Photodiode: A junction diode that is responsive to radiant energy. Photodiodes have a high degree of linearity between the input radiation and the output current, and faster switching speeds than phototransistors.

Photothyristor: A thyristor whose switching action is controlled by light applied to the thyristor gate.

Phototransistor: A light-sensitive transister that delivers an electrical output proportional to the light intensity at its input. The low-level photocurrent that is generated is amplified by the current gain of the transistor. The base region (or gate in a FET) may or may not be brought out as an external terminal.

Point Source: A source with a maximum dimension less than one-tenth the distance between sources and detector.

Reflector (module): A device containing a light source and a photodetector that detects any object that reflects light produced by the source back to the detector.

SUPER VEXTA®

A NEW GENERATION OF HIGH PERFORMANCE EASY-TO-USE MOTION CONTROL PRODUCTS

UMD STEP MOTOR DRIVER PACKAGE SERIES

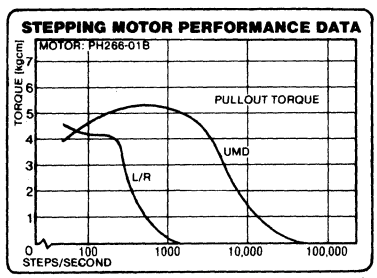
UMD ⟶ Unit=Motor+Driver

Each of the UMD motor/drivers includes a self-contained compact chopper driver and precision stepping motor integrated into one convenient high performance package. The UMD driver is a stepping motor translator, driver and power supply all-in-one, which has been factory adjusted to match the motor included in the package. This all-in-one design and factory motor driver matching makes installation and hook up a snap.

FEATURES:

- Highly efficient chopper driver maintains high torque at high speeds
- UMD Motor/Driver packages come in Holding torques from 25 to 300 ozin.
- User-friendly driver is factory pre-adjusted to match the motor included in the package for fast and easy set up.
- Compact high-tech design uses custom ICs and MOSFET technology for high power from a small package.

Excellent High Speed Performance!



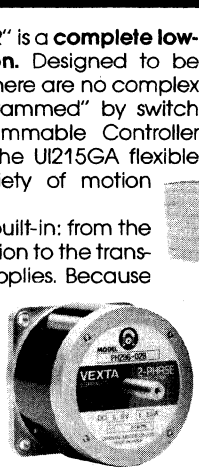
AVAILABLE UMD MOTOR/DRIVER PACKAGES

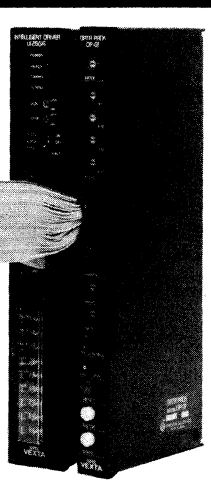
Model Number		Step Angle	Holding Torque	
Single Shaft	Double Shaft	deg.	oz-in	N-cm
UMD264-01	**UMD264-01B**	1.8	40.3	28.4
UMD266-01	**UMD266-01B**		83.8	58.8
UMD268-21	**UMD268-21B**		125	88.2
UMD264M-31	**UMD264M-31B**	0.9	25.0	17.6
UMD266M-E1.2	**UMD266M-E1.2B**		80	56.4
UMD268M-E1.5	**UMD268M-E1.5B**		118	83.3
UMD926H-AA	**UMD296H-BA**	1.8	150	106
UMD299H-AA	**UMD299H-AA**		300	212

INTELLIGENT DRIVER-UI215GA

The **UI215GA** "INTELLIGENT DRIVER" is a **complete low-cost single-axis motion solution.** Designed to be easy-to-hook up – easy-to-use, there are no complex languages to learn. It is "programmed" by switch closures, which means Programmable Controller compatibility, and yet makes the UI215GA flexible enough to meet a wide variety of motion control applications.

The UI215GA has everything built-in: from the microprocessor for pulse generation to the translator and motor/logic power supplies. Because everything is contained in a single package, the UI215GA and DP-01 can be out of the box and **up and running in minutes.**





The DP-01 Data Pack converts the UI215GA into a preset-indexer, repeating the same movement with each "start" signal. The "start" signals can be issued by a PLC or a switch, or the UI215GA/DP-01 pair can be used as a stand-alone unit.

The UI215GA is probably the best price/performance single-axis motion solution available. It is available from your local member of our nation-wide network of stocking SUPER VEXTA distributors. And best of all, it's backed by Oriental Motor's award winning quality and century of manufacturing experience.

FOR MORE INFORMATION CALL ORIENTAL MOTOR AT (213) 515-2264.

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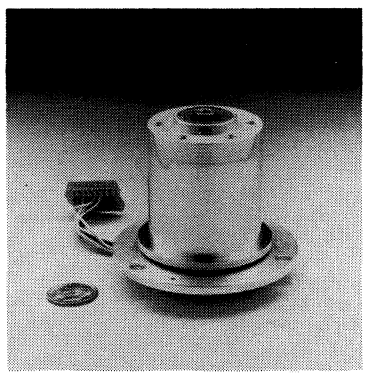
FOR MORE INFORMATION CALL: LOS ANGELES (213) 515-2264; SAN JOSE (408) 988-2655; CHICAGO (312) 577-0310; NEW YORK (201) 882-0480

SYNEKTRON
THE MOTION CONTROL COMPANY

Spindle Motors



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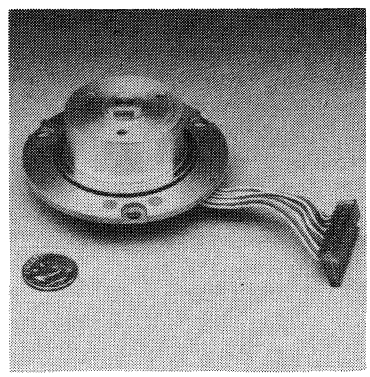

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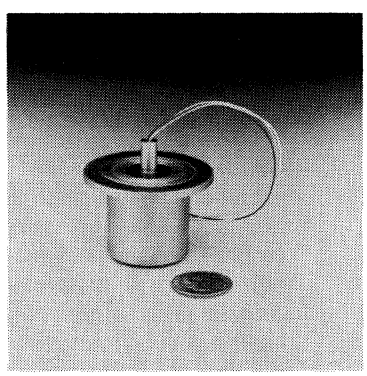
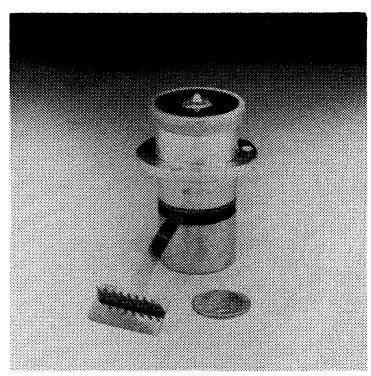


P/N 501007



P/N 501008

Synektron D.C. Brushless Motors offer low acoustical noise, exacting runouts and ceramic or rare earth magnet material. In addition, you get U.S. engineering support and Far East manufacturing.

Custom designs available.

Applications include computer peripherals (magnetic and optical), laser scanners and printers.

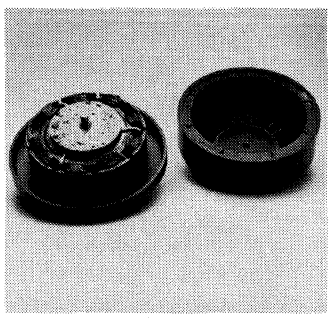
P/N	SUPPLY VOLTAGE (V)	STALL TORQUE (oz - in)	START CURRENT (A)	EMF CONSTANT (V/krpm)	MOTOR CONSTANT $\left(\frac{\text{oz - in}}{\sqrt{\text{W}}}\right)$	ROTOR INERTIA (oz - in s^2)	D.C. RESISTANCE (ohm)	INDUCTANCE (mH)	NO-LOAD SPEED (rpm)	DIAMETER (in)	HEIGHT (in)
501005	12	8.5	3.5	2.20	2.0	0.010	1.5	0.3	4700	1.5744	2.39
501006	12	3.4	1.5	2.34	1.5	0.003	2.5	0.5	4300	1.5744	1.31
501007	12	3.0	1.8	1.45	0.8	0.002	4.0	1.1	7000	0.9833	1.09
501008	12	0.7	0.5	1.22	0.6	0.002	5.0	0.4	6880	0.9833	1.54

For more information about Synektron Spindle Motors and drives, write or call:

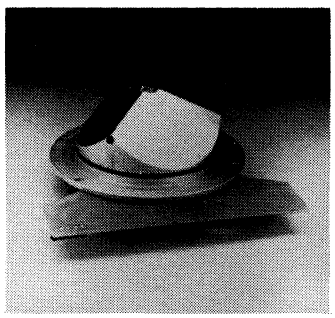
SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

SYNEKTRON
THE MOTION CONTROL COMPANY

Variable-Speed Brushless Motors and Drives



P/N 501009



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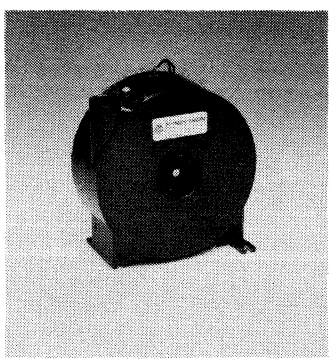

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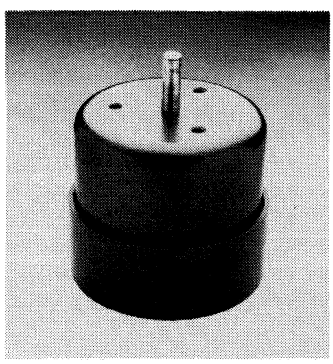


P/N 501012

Synektron variable-speed, brushless motors and drives save valuable space and reduce noise while increasing reliability and performance over brush motors. The control electronics are inside the motor package.

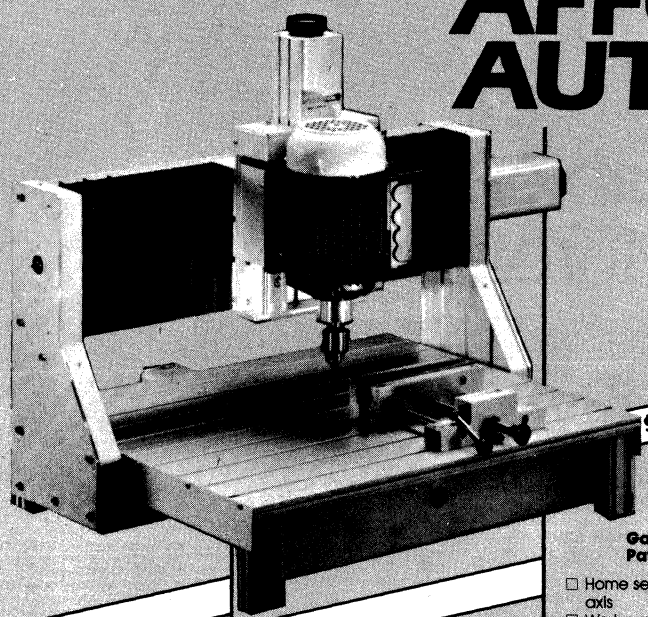
A variety of control schemes are available to optimize speed/torque requirements for various applications. Synektron motors feature outer-rotating rotors. This provides a positive means of magnet retention and increases flexibility in motor design and packaging.

P/N	PEAK OUTPUT POWER (W)	SPEED RANGE (rpm)	MAX. TORQUE (oz - in)	SUPPLY VOLTAGE (V)	RATED CURRENT (A)	MOTOR CONSTANT $\left(\frac{\text{oz - in}}{\sqrt{\text{W}}}\right)$	TORQUE CONSTANT $\left(\frac{\text{oz - in}}{\text{A}}\right)$	EFFICIENCY	CONTROL METHOD	MOTOR LENGTH (in)	MOTOR DIAMETER (in)	SHAFT DIAMETER (in)
501009	132	0-3000	92	9-20 DC	18	19.1	5.8	60-70%	VOLTAGE	2.75	5.55	.31
501010	6.5	5800-6200	2.3	20 DC	.55	1.6	2.6	30%	SPEED	1.65	3.30	.24
501011	50	4000-9000	10	115 AC	1.3	2.43	14.6	55%	SPEED	2.45	5.90	.31
501012	180	0-1200	300	115 AC	1.0	64.0	405	80-90%	CURRENT	4.82	5.60	.50

For more information, write or call:

SYNEKTRON
THE MOTION CONTROL COMPANY
12000 Southwest Garden Place
Portland, Oregon 97223
Phone: 503•684•3090

AFFORDABLE AUTOMATION



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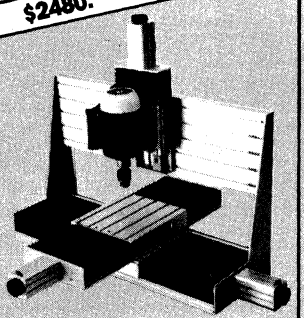
$2230.

Gantry Type XYZ Table with Patented Linear Bearings

- ☐ Home sensing switches on each axis
- ☐ Work surface with "T" slots
- ☐ Stepper motor and ball screw drives

$2480.



X/Y Tables with Bridge Mounted Z Axis and Patented Linear Bearings

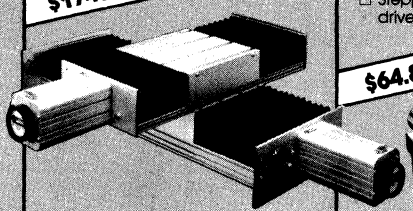
- ☐ Home sensing switches on each axis
- ☐ Work surface with "T" slots
- ☐ Stepper motor and ball screw drives

$2800.

Modular Automation Controller

- ☐ Control up to 16 motors
  8 axes full/half step
  8 axes microstep
- ☐ 8 axes linear interpolation
- ☐ 4 axes circular interpolation
- ☐ Up to 56 outputs and 32 inputs
- ☐ RS232 communication port for complete integration of 256 controllers

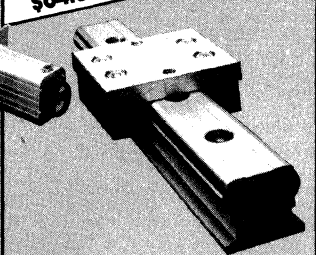
$1748.



Precision X/Y Table with Patented Linear Bearings

- ☐ Home sensing switches on each axis
- ☐ Work surface with "T" slots
- ☐ Stepper motor and ball screw drives

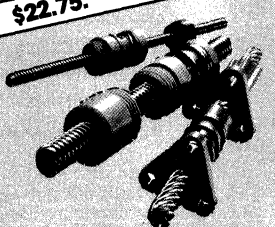
$64.80



Double Rail Linear Slides

- ☐ Patented design with unique proprietary features
- ☐ Available in standard lengths up to 56 inches
- ☐ Recirculating ball bearing unit available as single unit
- ☐ Bearing blocks with adjustable clearance also available

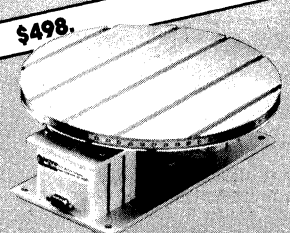
$22.75.



Lead Screw Drive Components

- ☐ Stainless acme screws
- ☐ Self-lubricating SUPERNUTS™
- ☐ Spring loaded anti-backlash nuts
- ☐ Metric ball screws and nuts

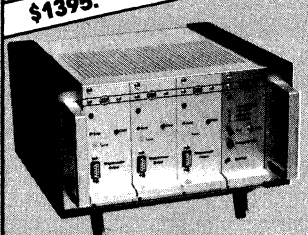
$498.



Rotary Table

- ☐ Stepper motor driven with 1:4 timing belt drive ratio
- ☐ Up to 13.5 minutes of arc accuracy per pulse
- ☐ 9.45" dia. top plate with "T" slots

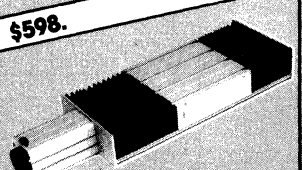
$1395.



Three Axes Controller with Computer Interface

- ☐ RS232C serial interface, 9600 baud transmission
- ☐ Two axes linear interpolation
- ☐ Optional battery back-up
- ☐ Full and half step drive max. 10,000 steps/sec.
- ☐ Bi - polar stepper motor output 40V, max. 2.0A per phase

$598.



Single Axis Table with Patented Linear Bearings

- ☐ Home sensing switch installed
- ☐ Work surface with "T" slots
- ☐ Stepper motor and ball screw drive

Prices shown are typical within each product group. Pleated protective covers optional. Repeatability for all tables is .0004". Accuracy is .0003" per inch.

Techno
a DSG company

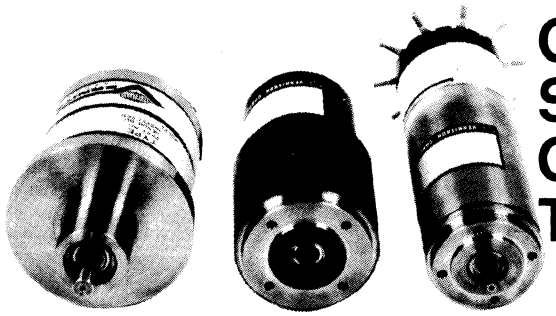
2101 Jericho Turnpike, New Hyde Park, NY 11040 Phone: (516) 328-3970 TWX: 510-223-0642 FAX: 516-326-8827

VERNITECH

Division of VERNITRON CORPORATION

"TECHNOLOGY IN MOTION"

MOTORS/MOTOR GENERATORS



OVER 1500 STANDARD DESIGNS OR CUSTOM DESIGNED TO YOUR REQUIREMENTS

HYSTERESIS SYNCHRONOUS MOTORS FOR LASER OPTICAL SCANNING POLYGON APPLICATIONS

VARIABLE FREQUENCY/SPEED
300 RPM To 48,000 RPM

BALANCED ROTORS
.0001 oz. inch

SHAFT RUNOUT & FLATNESS
.0001″

EXTENDED LIFE
10 Years without Relubrication

VOLTAGE RANGE
2.0 Volts to 280 Volts

THRU-BORE CONSTRUCTION
Precision Rotor Bore

ALL UNITS WITH AND WITHOUT GEARHEADS

Servomotors Viscous Damped Motors Inertially Damped Motors Hysteresis Synchronous Motors*	Stepper Motors Motor Generators Rate Motor Tachometers	Computing Motor Tachometers Integrating Motor Tachometers Spin (Gyro) Motors

SIZES
BuOrd Size 5 (0.5″ Dia.) to BuOrd Size 33 (3.250″ Dia.)

SPEEDS
300 RPM to 48,000 RPM (Stepper Motors in Steps of 7.5°, 15°, 45°, and 90°)

FREQUENCY
30, 50, 60, 80, 400, 420, 800, 1000, and 1200 (Sine or Square Wave) Variable Frequency Motors are also standard at Vernitech

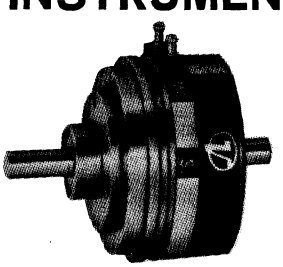
Poles — 2, 4, 6, 8, 12

VOLTAGES
2.0 Volts to 280 Volts

PHASES
1, 2, and 3
2, 3, and 4 (in Stepper Motors)

CLUTCHES AND BRAKES

PRECISION INSTRUMENT



These units are manufactured primarily to satisfy the high standards of Military requirements. Their above-standard quality is further emphasized by a high efficiency-to-size ratio. If precision is the need — then these are the instruments for you.

PERMANENT MAGNET HYSTERESIS CLUTCH

PMC Series

Designed for applications requiring repeatable torque and long life. Units can be utilized to comply with OSHA safety regulations and as a fail-safe device to protect other expensive components. In the 1.5 in. diameter frame size—torque is factory adjustable up to 8.5 oz. in. and can be held within 10% max., from unit to unit in speeds up to 10,000 R.P.M. Repeatability of torque level can be maintained within ±1%.

The PMC series will operate over a temperature range of −65°F to 260°F.

FAIL SAFE BRAKES (SBF SERIES)

DESIGN FEATURES

- ☐ Braking action occurs when coil is de-energized, or power fails.
- ☐ Unit is adjustable to compensate for wear.
- ☐ Zero backlash armature with spring release.
- ☐ Clamp-Lock hub for positive retention.
- ☐ Stationary field coil — no slip rings or brushes.
- ☐ Fast response time.

MANY INDUSTRIAL TYPES AVAILABLE

Refer to sections 2440, 4750, 5500 for additional product listings.

VERNITECH
300 Marcus Blvd., Deer Park, NY 11729
516-586-5100 • TWX 510-227-6089 • FAX 516-242-7940

VERNITRON CONTROLS

1601 Precision Park Lane • San Diego, CA 92073 • (619) 428-5581 TWX: 910-322-1862 FAX: 619-428-5090

Vernitron Controls is a leading supplier of Mil-Spec synchros and resolvers, and is a primary source for the more sophisticated, ultra-high-accuracy single, dual and multi-speed pancake-type componentry consistent with today's state of the art.

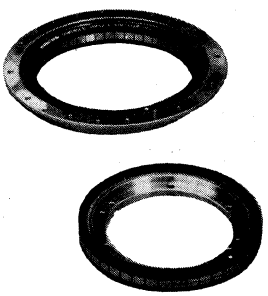
Vernitron Controls operates from a modern 60,000 square foot facility located on 4.6 acres in San Diego, California, specifically designed for the manufacture of electromagnetic devices.

Vernitron Controls has supplied products for such programs as Harpoon, TOW/-Cobra, FVS, A-6, Trident, Phalanx, Leopard II, DD963, CG47, and many more. Vernitron Controls' products are also found in many areas of industrial applications, including robotics, automatic machine tools, and computer disk drives.

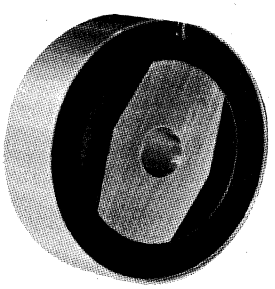
Product Lines from Vernitron Controls

Standard Mil-Spec Synchros and Resolvers Size 8 – Size 45

Hi-Accuracy Multispeed Pancakes

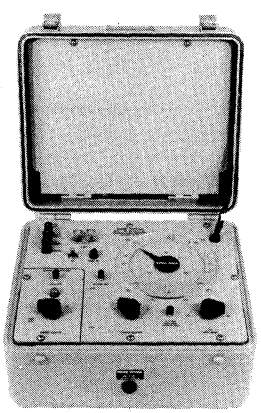


Limited Angle Brushless Torque Motors

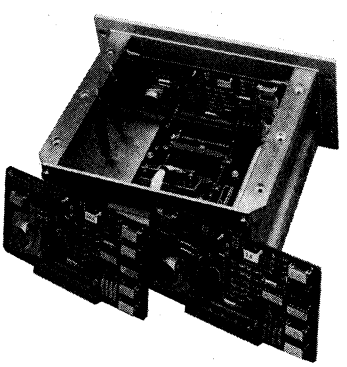


Torqsyn Remote Positioners Analog or Digital Input

Custom Subsystem Designs



Custom Electronics



Other Products:

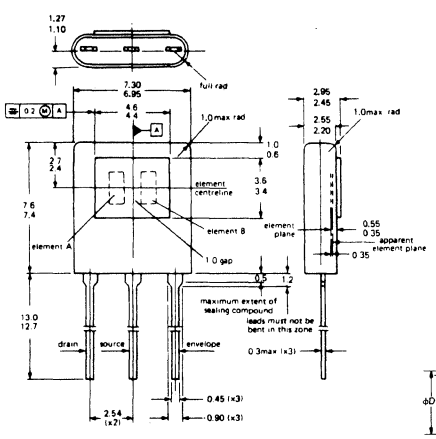
- **Digital Resolver (single turn absolute encoder, 16-bit output)**
- **50 VA Solid State Synchro Amplifier**
- **RVDT**
- **Segment Resolver**

Amperex®

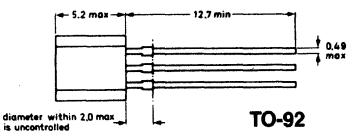
A NORTH AMERICAN **PHILIPS** COMPANY
SLATERSVILLE DIVISION

PHILIPS SEMICONDUCTORS

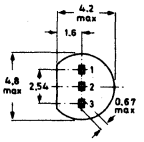
OPTOCOUPLERS, INFRARED SENSORS, & TEMPERATURE SENSORS

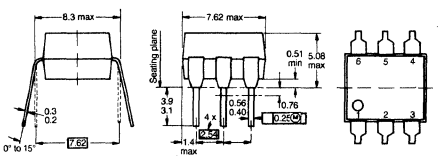


MO-81

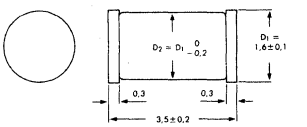


TO-92

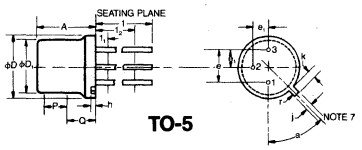




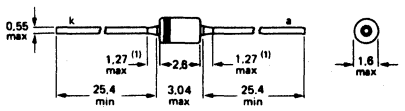
SOT-90B



SOD-80



TO-5



(1) Lead diameter in this zone uncontrolled.

DO-34

OPTOCOUPLERS—Case Style SOT-90B

Type	CTR % min	@ I_F mA	@ V_{CE} V	V_{ISO} V_{AC}	V_{CE} (Sat) max V	@ I_F mA	@ I_C mA	t_{ON}/t_{OFF} µS @	I_C mA	@ V_{CC} V	@ R_L Ω	V_{BR} min V
General Purpose Transistors												
4N25	20	10	10	2,500	0.5	50	2.0	3/3	2	10	100	30
4N25A	20	10	10	1,775[1]	0.5	50	2.0	3/3	2	10	100	30
4N26	20	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N27	10	10	10	1,500	0.5	50	2.0	3/3	2	10	100	30
4N28	10	10	10	500	0.5	50	2.0	3/3	2	10	100	30
4N35	100	10	10	3,550	0.3	10	0.5	7/5	2	10	100	30
4N36	100	10	10	2,500	0.3	10	0.5	7/5	2	10	100	30
4N37	100	10	10	1,500	0.3	10	0.5	7/5	2	10	100	30
H11A1	50	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A2	20	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A3	20	10	10	2,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A4	10	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
H11A5	30	10	10	1,500	0.4	10	0.5	3/3[3]	2	10	100	30
MCT26	6	10	10	4,400[2]	0.5	60	1.6	3/3[3]	2	10	100	30
MCT2	20	10	10	4,400[2]	0.4	16	2.0	5/10	note 4			30
CNY57U	20	10	0.4	4,300	0.4	10	2.0	3/3	2	5	100	30
CNY57AU	40	10	0.4	4,300	0.4	10	4.0	3/3	2	5	100	30
CNX35U	40-90	10	0.4	4,400[2]	0.4	10	2.0	3/3	2	5	100	30
CNX36U	80	10	0.4	4,400[2]	0.4	10	4.0	7/5	2	5	100	30
CNX39U	60-90	10	0.4	4,400[2]	0.4	10	2.0	5/4	2	5	100	30
CNX62	40	10	4	4,400[2]	0.4	10	4.0	3/3	2	5	100	50
High Voltage Transistors												
4N38	10	10	10	1,500	1.0	20	4.0	5/5	2	10	100	80
4N38A	10	10	10	2,500	1.0	20	4.0	5/5	2	10	100	80
CNY17-1	40-80	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-2	63-125	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNY17-3	100-200	10	5.0	4,400[2]	0.3	10	2.5	5/5	2	10	100	70
CNX38U	70-210	10	10	4,400[2]	0.4	16	2.0	5/5	4	5	100	80
Darlingtons												
H11B1	500	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B2	200	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
HB11B3	100	1	5.0	2,500	1.0	1	1	125/100	10	10	100	25
H11B255	100	10	5.0	1,500	1.0	50	50	125/100	10	10	100	55
MCA230	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	30
MCA231	200	1	5.0	3,500	1.2	10	50	5/100	10^5	5	100	30
MCA255	100	10	5.0	3,550	1.0	50	50	5/100	10^5	5	100	55
CNX48U	500	1	1.0	4,400[2]	1.0	5	10	5/30		note 6		30
4N29	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N30	100	10	10	4,400[2]	1.0	8	2	.7/25		note 7		30
4N31	50	10	10	4,400[2]	1.2	8	2	.7/25		note 7		30
4N32	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30
4N33	500	10	10	4,400[2]	1.0	8	2	.7/35		note 7		30

Note: 1 = V_{RMS}; 2 = V_{DC}; 3 = t_{RISE}/t_{FALL}; 4 = I_F (15 MA, V_{CC}5V, R_B100kΩ, R_L2kΩ); 5 = I_F; 6 = I_F (1mA, V_{CC}5V, R_{BE}1MΩ, R_L100Ω). (Note); 7 = I_F (200mA; V_{CC} = 10V, R_L = 180Ω).

PYROELECTRIC INFRARED SENSORS (CERAMIC)
Oper. Voltage: 3-10, Freq. Range: 0.1-20Hz

Type	Pkg	Spectral Response µm	Noise Peak/ Peak µV	Peak Sgnl µV	Field of View (deg)
RPW100* Dual Series Opposed	TO-5	6-14 Daylite Filter Silicon Window	25	800	135
RPY222* Series Conn. Inter-digitated pairs	TO-5	6-14 Daylite Filter Silicon Window	26	890	115
KRX10*# Dual Element Series Opposed	Low Profile MO-81	6-14 Daylite Filter Silicon Window	25	930	140
KRX11# Dual Element	Low Profile MO-81	6-14 Optim. Uncoated Silicon Window	30	850	140
Single element types					
RPY109#	TO-5	1-15	15	385	110
P5062#	TO-5	8-14	20	480	110

*For passive IR intruder alarms & critical motion sensing.
#For passive IR sensing (light sw., etc.)

PTC (Positive Temp Coefficient) SILICON PLANAR TEMPERATURE SENSORS

Type	Pkg	Tol ±%	Temp Range °C	R @ 25°C Ω	Thermal Time Cnst (Seconds) Air	Liquid	TC %/°C
KTY81-110	TO-92	1	−55+150	1k	50	5	0.75
KTY81-120	TO-92	2	−55+150	1k	50	5	0.75
KTY81-210	TO-92	1	−55+150	2k	50	5	0.75
KTY81-220	TO-92	2	−55+150	2k	50	5	0.75
KTY83-110	DO-34	1	−55+175	1k	40	1	0.75
KTY83-120	DO-34	2	−55+175	1k	40	1	0.75
KTY84-130	DO-34	3	0+300	1k	40	1	0.75
KTY84-150	DO-34	5	0+300	1k	40	1	0.75
KTY85-110	SOD-80	1	−25+125	1k	20	1	0.75
KTY85-120	SOD-80	2	−25+125	1k	20	1	0.75
KTY85-150	SOD-80	5	−25+125	1k	20	1	0.75
KTY86-205	VO-69	5	−55+175	2k	30	1	0.75

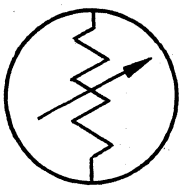
See Philips Power Semiconductors in Vol. A, Section 4800 and Liquid Crystal Displays (LCDs) in Vol. B, Section 2450.

GEORGE WASHINGTON HWY., SMITHFIELD, RI 02917, 401/232-0500, FAX 401/232-0505, TWX 710-381-8808.

OPTOELECTRONIC DEVICES
CLAIREX MAKES THEM ALL!

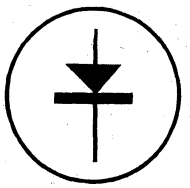
PHOTOCONDUCTIVE CELLS

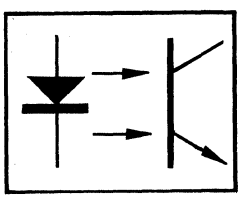
Clairex offers a complete line of cells with spectral response in the visible and near infrared ranges. Units are available in a variety of sizes, in plastic, metal or glass packages with varying resistance and voltage combinations.



PHOTODIODES

A series of silicon planar photodiodes that may be operated in either the diode or voltaic mode as well as a series of monolithic integrated circuits for use as silicon digital output detectors.



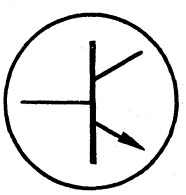


OPTOISOLATORS - OPTOCOUPLERS - PHOTOMODS ®

These three terms are used interchangeably to describe a device that utilizes a high quality, long-life light source with a photodetector in a single, light-tight encapsulated or hermetic package. Variations in output of the light source produce changes in the output of the photodetector. Thus the input and output circuits are isolated from each other electrically. Clairex offers a line of standard units with a variety of electrical characteristics in a variety of packages, as well as engineering assistance to produce custom units.

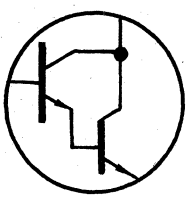
PHOTOTRANSISTORS

Clairex manufacturers several generic series of phototransistors in plastic and hermetically sealed packages that can be produced with or without lenses. In addition, custom units can be produced to meet your specific requirements.



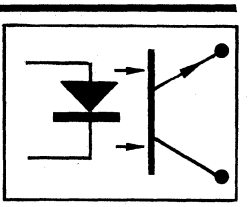
PHOTODARLINGTONS

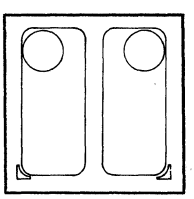
Standard and custom photodarlingtons are also available in the same variety of packages as transistors.



OPTICAL INTERRUPTERS

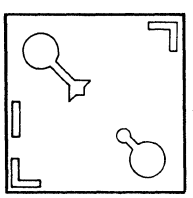
Optical interrupters are similar to optoisolators in that they contain a photodetector and a light source with an air gap between the two so that a light beam can be interrupted by a mechanical device. Clairex offers a wide variety of packages, mountings, and configurations with a variety of electrical characteristics in each package. Custom units available too.





OPTO ARRAYS

Clairex welcomes inquires for custom designed arrays of emitter and sensor chips. We supply arrays positioned in precise patterns or multiple chip patterns designed with close and precise spacing and with multiple lead headers, ceramic or PC board substrate or with molded boards and housings.

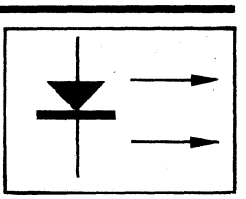


OPTO CHIPS

Clairex offers a broad range of standard designs of photovoltaic, photodoide phototransistor, and photodarlington chips. Custom chip design capabilities also exist. All chips have gold backing suitable for either eutectic or conductive epoxy ohmic die attachment.

LIGHT EMITTING DIODES

Clairex supplies a series of LED's that are designed for a variety of optoelectronic applications. Some units are designed to emit light in the visible red spectrum, some at 800 nanometers and others at 940 nanometers. Selection of the proper unit depends upon the application.



CLAIREX ELECTRONICS, A Division of Clairex Corporation
560 South Third Avenue, Mount Vernon, NY 10550
Telephone (914) 664-6602 Fax: (914) 664-6449

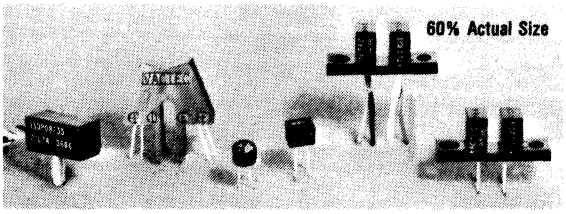
- Photoconductive Cells
- Interrupter Switches
- Phototransistors and Photodarlingtons
- Selenium Photovoltaic Cells
- Vactrols (Opto-Isolators)
- Standard Silicon and Blue-Enhanced Photovoltaic Cells, Blue-Enhanced Photodiodes, and PIN Photodiodes

EG&G VACTEC

INDUSTRY'S BROADEST OPTOELECTRONIC LINE

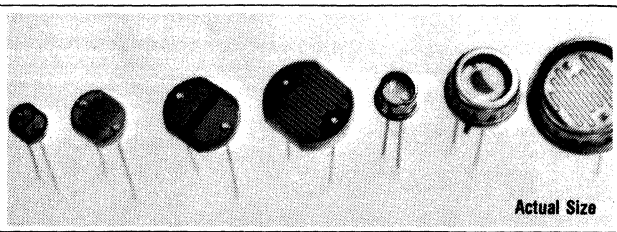
RETROREFLECTIVE & INTERRUPTER SWITCHES (SLOTTED)

Standard and custom optical switches—infrared GaAs LED and silicon phototransistor interrupters available in sealed housing of I-R transmitting plastic or opaque plastic with open apertures. Three retro styles: arrow, TO-18, and cubic.



PHOTOCONDUCTIVE CELLS

Vactec light dependent resistors (LDR's) are available in three hermetic enclosures (TO-18, TO-5, TO-8) and 4 ceramic types. Ceramic types have automatically inserted wires which insure perfect contact integrity. Six materials of CdS, CdSe and CdSeS-CdS mixtures with spectral response peaks from 565-735 nm. Each material has a variety of sensitivities to satisfy all requirements.

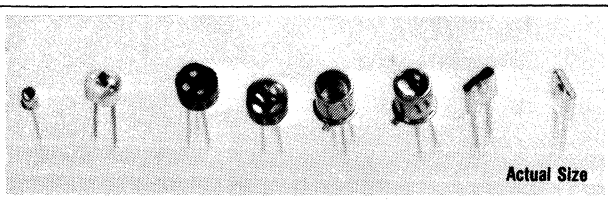


SILICON PHOTOVOLTAIC CELLS

Three processes: BLUE ENHANCED, LOW CAPACITANCE, STANDARD SOLAR. All available in a variety of hermetic, ceramic, as chips, or with flying leads. The BLUE ENHANCED cells are unique large area detectors with high U-V sensitivity to as low as 200 nm. Almost non-existent U-V enhancement effect with stability equivalent to high quality photodiodes. LOW CAPACITANCE cells have fast response less than 15μS with 10KΩ load. The high shunt impedance is desirable for driving amplifiers. SOLAR cells have high V_{oc} at low illumination (typ 200mV at .05mW/cm²). Linear over wide illumination range.

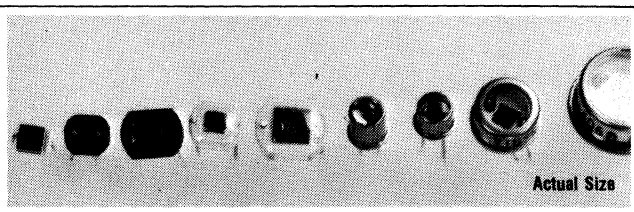
PHOTOTRANSISTORS — LED'S — PHOTODARLINGTONS — LIGHT ACTIVATED SWITCHES (LAS)

Phototransistors and photodarlingtons are NPN passivated—4 chip sizes of 25, 40, 50, and 60, mil square in TO-18, ceramic, coaxial, and lateral (side looking) packages. High light current at very low drive current ideal for instrumentation applications. GaAs I-R LED's with excellent stability in TO-18, T-1, T-1¾, lateral packages. LAS (light activated switches) have high sensitivity with Schmitt Trigger output. New—high power GaAlAs I-R LED's in TO-18, T-1, T-1¾ packages.



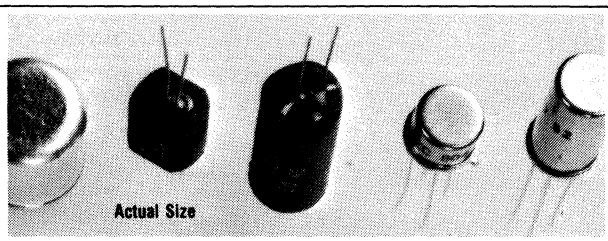
PHOTODIODES

BLUE ENHANCED photodiodes are extremely low dark current devices with excellent response in the U-V. Less than 10pA (I_D) for small chips. Large area diodes (VTB5051) 14.8mm² active area with 1.2A/(W/cm²) at 365nm and I_D of 250pA max. FAST photodiodes have low capacitance. Use with reverse bias for fast response time and excellent linearity. Ideal for remote I-R sensor digital controls.



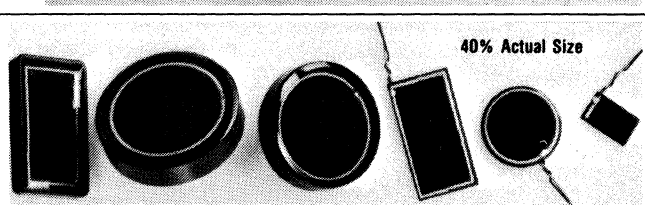
VACTROLS

Optical couplers using LED's, neons, or incandescent lamps as the emitter and Vactec photoconductive cells (LDR's) as the detector. For noiseless switching and signal monitors for audio. Neon types to sense telephone ring. LED types for triac gate control. Incandescent types for low cost true RMS sensor as voltage regulator or control of constant wattage heater. Five package types include 2 hermetic.



SELENIUM PHOTOVOLTAIC CELLS

Large area detectors for direct meter drive or in conjunction with amplifier. Spectral response peaks at 575 nm and is close to visible response. Available with integral #102 filter to match standard observer curve (CIE). Available in many flat or round cells with or without leads—also in 9 package styles including 2 hermetic.



WRITE FOR CUSTOM DETECTORS OR ASSEMBLIES ALL PRODUCTS

EG&G VACTEC 10900 Page Blvd. • St. Louis, Mo. 63132 • (314) 423-4900 • TWX 910-764-0811 • FAX (314) 423-3956

HEI inc.
HYBRID ELECTRONICS DIVISION

OPTICAL SWITCHES

Box 5000
1495 Steiger Lake Lane
Victoria, MN 55386
Phone: 612-443-2500
FAX: 612-443-2668

HEI has been designing and building optical switches and assemblies to the strictest industrial and military standards for 20 years. Today HEI produces standard optical switches in seventeen basic configurations with over 100 variations, including direct replacement parts for most industry standard switches.
The company is also a leader in designing and building custom optical switches for special application requirements. Compact, accurate and dependable HEI optical switches are suitable for any optical switching application.

OPTICAL SWITCH APPLICATIONS

- Optical Encoding
- Limit Switching
- Paper Tape Readers
- Paper Passage Detector
- Rotational Speed Monitoring
- Counter Circuits
- Flow Metering
- Precision Position Detection
- End-of-Tape Detection

OPTICAL SWITCH FEATURES

- Over 100 packaging and electrical variations
- TTL, DTL, CMOS and Analog Outputs
- Pin or Wire Leads (12-in. standard)
- Variety of Gap Sizes
- Special Aperture Designs

CUSTOM OPTICAL SWITCHES

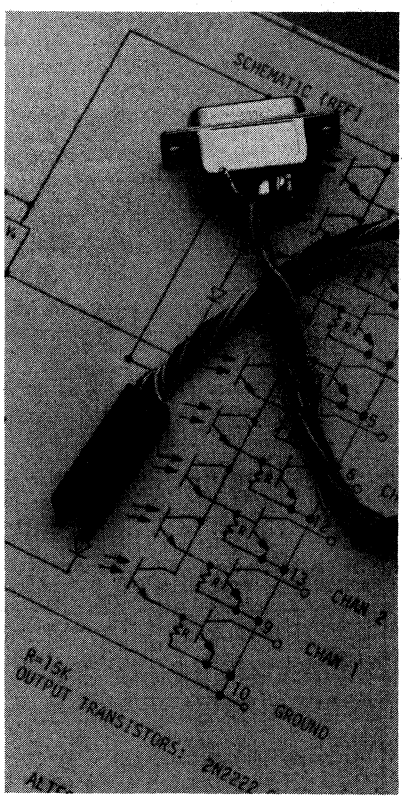
HEI also offers complete custom design and build services. From prototype to final production, HEI engineers assist customers in development of reliable and economical designs. The HEI custom optical switch process offers design options to customers in four categories. HEI engineers assist in setting specifications, and then develop prototypes for application testing.

Mechanical—
selection of housing size and format, mounting detail

Electrical—
signal characteristics, input/output requirements

Optical—
number of channels, light frequency, aperture size, sensor distance

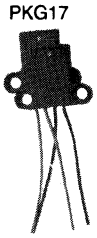
Interface—
lead length-pin, wire or connector



HEI CUSTOM APPLICATION EXPERIENCE

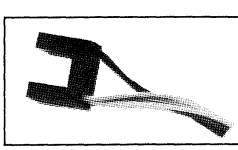
- Photo Arrays
- Vertical Format Readers
- Optical Encoders
- End-of-Tape Sensors
- Ribbon Edge Sensors
- Card and Tape Readers
- Drip Sensors
- Precision Position Sensing
- Indexing
- Linear Measurement

PARTIAL LIST OF 100 SWITCHES

Characteristic		I_C ON				I_C OFF		t ON	t OFF	$V_{CE(SAT)}$		$V_{F(LED)}$		BV_{CEO}	BV_{ECO}	I_C	GAP	Schematic	Output
Test Conditions		V_{CE} / I_F As Shown, $R_L = 0$				V_{CE} As Shown, $I_F = 0$		$I_F = 20mA$, $R_L = 1k\ \Omega$		I_C As Shown, $I_F = 35mA$		I_F As Shown							
Units		mA			V	nA	V	μS		V (SAT)	mA	V	mA	V		mA	IN.		
	HEI	MIN	TYP	I_F	V_{CE}	TYP	V_{CE}	(t_d+t_r) TYP	$(t_{st}+t_f)$ TYP	MAX	I_C	MAX	I_F	MIN	MIN	MAX	NOM		
PKG13	10501	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.060	12	Transistor
	*10503	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.060	12	Transistor
	10509	1.5	2.0	35	5	<100	5	350	350	1.0	.5	1.5	40	20	5	5	.060	13	Darlington
	*10511	1.0	2.0	35	5	<100	5	350	350	1.0	.5	1.5	40	20	5	5	.060	13	Darlington
	10513	3.0	4.5	35	5	<100	5	20	120	<.1	.5	1.5	40	25	5	10	.060	14	Amplifier
	*10515	3.0	4.5	35	5	<100	5	20	120	<.1	.5	1.5	40	25	5	10	.060	14	Amplifier
PKG14	10502	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.200	12	Transistor
	*10504	.5	1.0	35	5	<100	5	200	300	.4	.5	1.5	40	20	5	5	.200	12	Transistor
	10510	1.0	2.0	35	5	<100	5	100	250	1.0	.5	1.5	40	20	5	5	.200	13	Darlington
	*10512	1.0	2.0	35	5	<100	5	100	200	1.0	.5	1.5	40	20	5	5	.200	13	Darlington
	10514	3.0	4.5	35	5	<100	5	15	150	<.1	.5	1.5	40	25	5	10	.200	14	Amplifier
	*10516	3.0	4.5	35	5	<100	5	15	150	<.1	.5	1.5	40	25	5	10	.200	14	Amplifier
PKG15	10517		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	15	Schmitt Trigger
	*10519		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	15	Schmitt Trigger
	10529		N1	4.5	5	<100	5	20	120	<.1	.5	1.5	40	25	5	50	.060	16	Dual Amplifier
	*10531		N1	4.5	5	<100	5	20	120	<.1	.5	1.5	40	25	5	50	.060	16	Dual Amplifier
	*10535		N1	2.0	5	N2	5	10	50	<.1	.5	1.5	40	30	5	50	.060	17	Dual Schmitt
PKG16	10518		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	15	Schmitt Trigger
	*10520		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	15	Schmitt Trigger
	10530		N1	4.5	5	<100	5	15	150	<.1	.5	1.5	40	25	5	50	.200	16	Dual Amplifier
	*10532		N1	4.5	5	<100	5	15	150	<.1	.5	1.5	40	25	5	50	.200	16	Dual Amplifier
	*10536		N1	3.0	5	N2	5	15	40	<.1	.5	1.5	40	30	5	50	.200	17	Dual Schmitt
PKG17 	10701	1.0 / .5	2.5 / 1.0	35	5	<100	5	20 / 150	250 / 250	.5	.5	1.5	40	25	5	15	.125 / .500	12	Transistor N3
	10702	2 / 2	4.5 / 3.0	35	5	<100	5	25 / 250	350 / 300	1.0	.5	1.5	40	20	5	30	.125 / .500	13	Darlington N3
	10703	4.5 / 2	4.5 / 4.5	35	5	<100	5	10 / 40	80 / 80	.1	.5	1.5	40	25	5	100	.125 / .500	14	Amplifier N3
	10704	N1	2.0 / 3.0		5	N2	5	50 / 50	25 / 35	.1	.5	1.5	40	30	5	50	.125 / .500	15	Schmitt Trigger N3
	10710											1.55	50						LED

THE HEI QUALITY COMMITMENT

HEI has instituted a statistical process manufacturing control system to insure that each component meets performance specifications dependably and consistently. The company performs 100-percent electrical inspection of every device before shipment. As a result of these quality assurance processes HEI has been qualified as a dock-to-stock supplier by a number of original equipment manufacturers.



* 12-inch 28-AWG wires custom lengths available

N1 Schmitt trigger typical switch threshold ($I_{F(ied)}$) mA
N2 Schmitt trigger quiescent current = 1.2mA TYP.
N3 10710 was used as the light source $I_F = 35mA$ $V_{CE} = 5V$
Standard Aperature .060 GAP .010 x .040"
Standard Aperature .200 GAP .020 x .040"

ENVIRONMENTAL SPECIFICATIONS
Operating Temperature 0—70°C
Storage Temperature -40—+80°C

HEI inc.
HYBRID ELECTRONICS DIVISION

BOX 5000 • 1495 STEIGER LAKE LANE • VICTORIA MN 55386 • PHONE: 612-443-2500 • FAX: 612-443-2668

Rehlander Associates

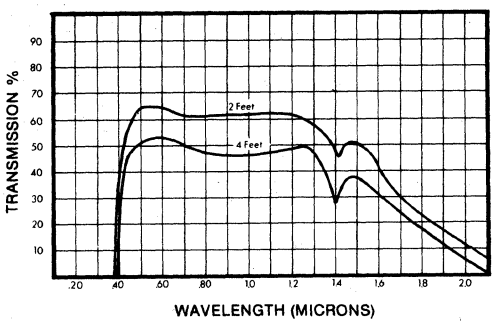
P.O. BOX 550
STANDISH, ME 04084
(207) 727-3248

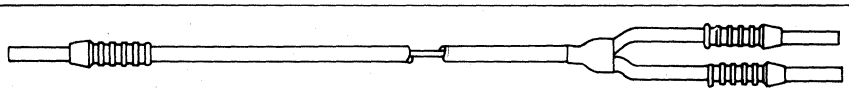
FIBER OPTIC PHOTOELECTRIC SENSOR CABLES

New line of fiber optic sensor cables allow photoelectric sensing in confined areas where space prohibits conventional emitters and detectors. Electrical isolation is provided for access into explosive or wet environments. Fiber optic sensor cables are compatible to standard PC board active device mounts and bulkhead receptacles allowing all electronic components to be mounted on the PC board. Proximity type sensors combine emitter and detector into a homogenous .032″ or .062″ active diameter.

Specifications:
Transmission: 600 to 700 dB/Km
Numerical Aperture: 0.56NA
Acceptance Angle: 68°
Operating Temperature: -40°F to +225°F
Outside Diameter of Cable: .125″
Minimum Bend Radius: .25″

TRANSMISSION VS WAVELENGTH



REFLECTIVE TYPE	Common Bundle Diameter	Part Number (length)
	.032	P032-XX-PSC
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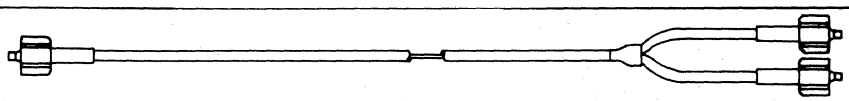
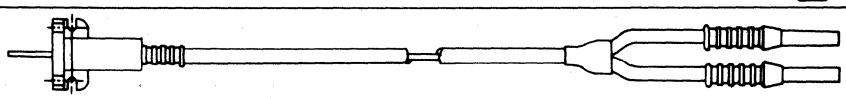
	.032	S032-XX-SASC
	.062	S062-XX-SASC
	.032	HM032-XX-PSC
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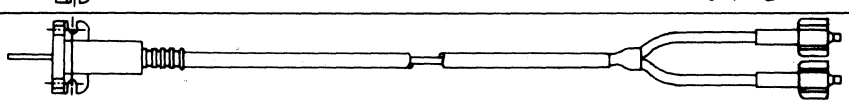	.032	HM032-XX-SASC
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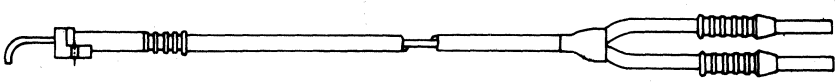	.032	HLM032-XX-PSC
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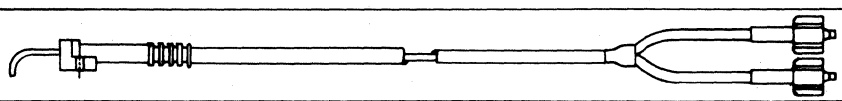	.032	HLM032-XX-SASC
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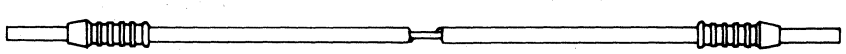
OPPOSED TYPE		
	.032	P032-XX-P
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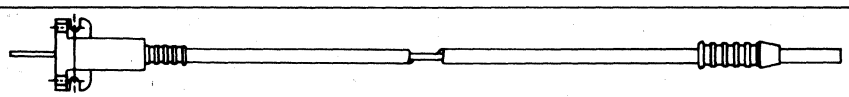	.032	HM032-XX-P
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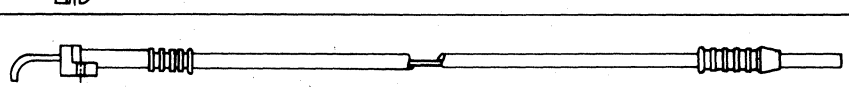	.032	HLM032-XX-P
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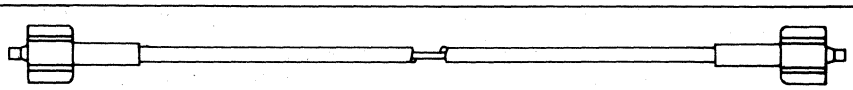	.032	S032-XX-SA
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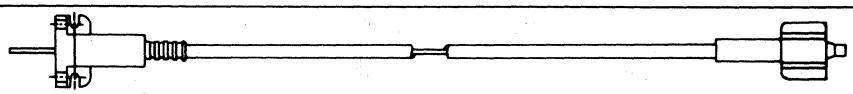
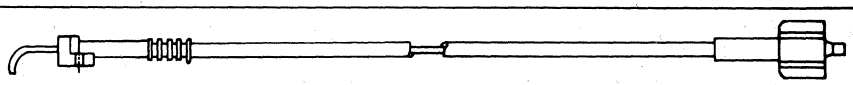
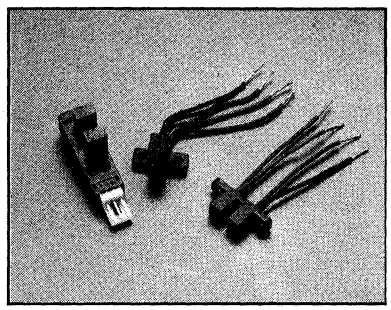
	.032	HM032-XX-SA
	.062	HM032-XX-SA
	.032	HLM032-XX-SA
	.062	HLM062-XX-SA

OPTOELECTRONIC ASSEMBLIES



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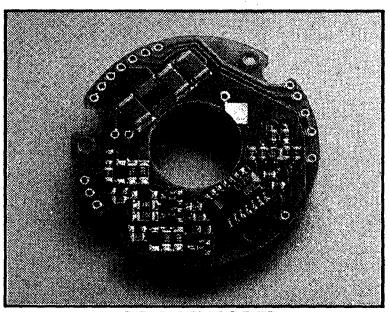

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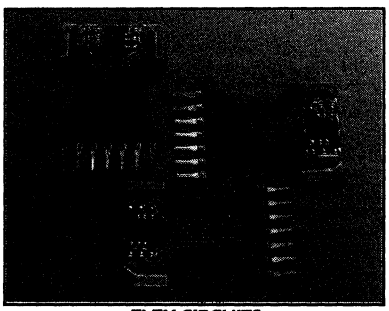

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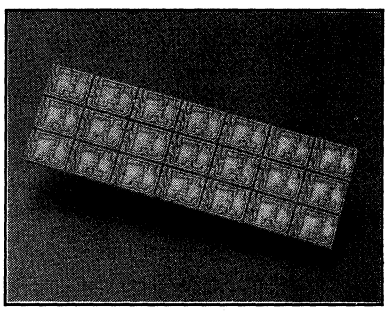
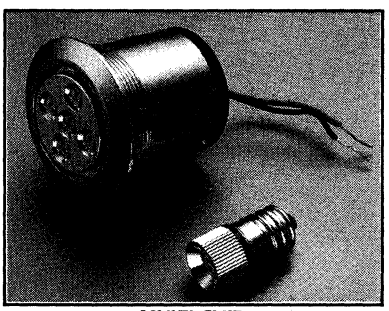
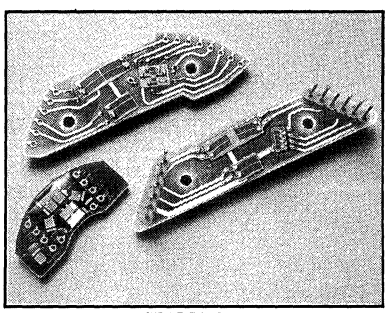


CERAMIC PCB'S

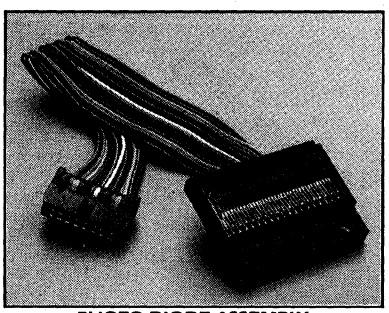


MULTI-CHIP
INCANDESCENT REPLACEMENT

PHOTO DIODE PCB ASSEMBLY



ENCODERS



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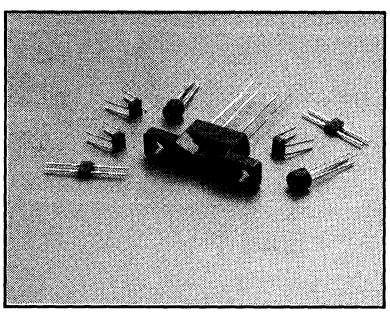
WITH RIBBON CONNECTOR



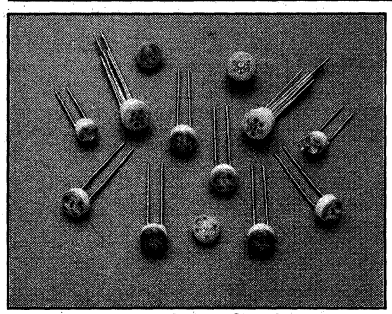
REFLECTIVE SWITCHES

ASSEMBLIES

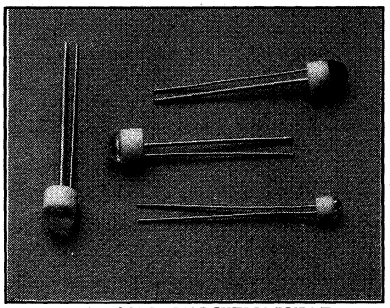
Emitting Materials			Detector/Solar Cells	Package Styles
Materials	Wavelength* nm typ.	Colour		
GaP/GaP	555	Pure green	Photo Diodes	(General Category Types)
GaP/GaP	568	Yellow green (Standard or Ultra)	Photo Transistors	Flex Circuits
			Photo Darlingtons	Glass FR4 Types
GaAsP/GaP	585	Pure Yellow	Solar Cells	PCB Ceramic
GaAsP/GaP	610	Orange		Plastic Assemblies
GaAsP/GaP	635	High Efficiency Red		
GaA1As/GaAs	660	Ultra Red		
GaA1As/GaA1As	660	Super Ultra Red		
GaP/GaP	700	Red		
GaA1As	820	Infrared		
GaA1As	830	Infrared		
GaA1As	880	Infrared		
GaAs	940	Infrared		

*Sorting for Additional Wavelengths Available.

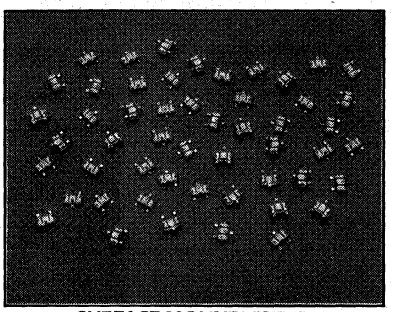
OPTOELECTRONIC EMITTERS



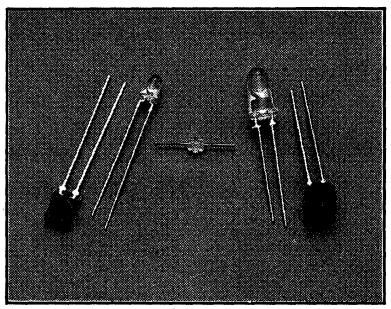
MULTI-CHIP VISIBLE AND INFRARED EMITTERS



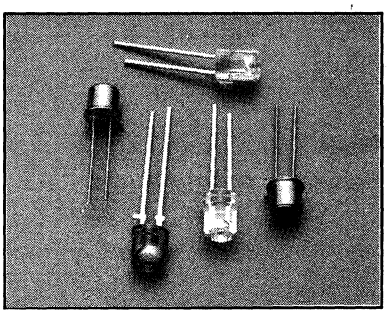
RESIN/CERAMIC STEM VISIBLE AND INFRARED EMITTERS



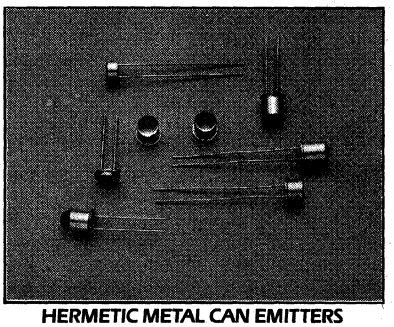
SURFACE MOUNT VISIBLE AND INFRARED EMITTERS



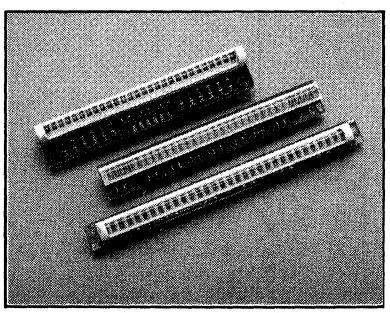
PLASTIC PACKAGED VISIBLE AND INFRARED EMITTERS



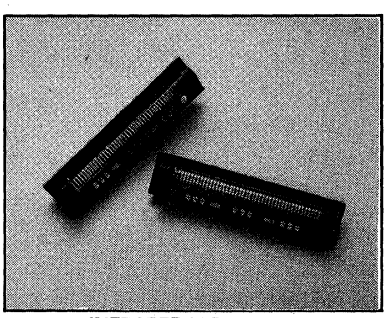
FIBER OPTIC EMITTERS



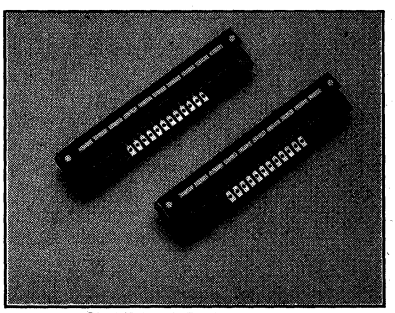
HERMETIC METAL CAN EMITTERS



VISIBLE LED ARRAYS



INFRARED LED ARRAYS



VISIBLE BAR GRAPH ARRAYS

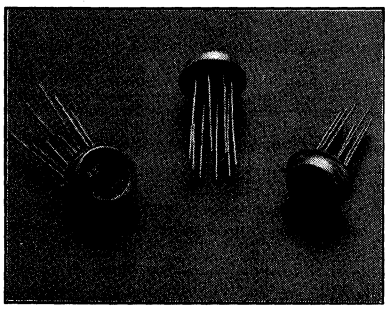
EMITTERS

Emitting Materials			Package Styles
Materials	**Wavelength* nm typ.**	**Colour**	
GaP/GaP	555	Pure green	Plastic Epoxy (All Variations Including) T-1, T-1¾, Axial, Side View, Truncated, Flat Top, Rectangular, Tapered, Concave
GaP/GaP	568	Yellow green (Standard or Ultra)	
GaAsP/GaP	585	Pure Yellow	
GaAsP/GaP	610	Orange	Metal Can (All Variations Including) TO-18, TO-46, (Hermetically Sealed or Drip Lens), Pill Package
GaAsP/GaP	635	High Efficiency Red	
GaA1As/GaAs	660	Ultra Red	Arrays—All Variations
GaA1As/GaA1As	660	Super Ultra Red	Ceramic—(All Variations Including) 3mm, 4mm
GaP/GaP	700	Red	
GaA1As	820	Infrared	Surface Mount—SOT-23, SOT-89
GaA1As	830	Infrared	
GaA1As	880	Infrared	
GaAs	940	Infrared	

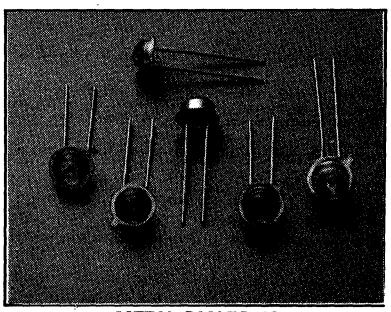
*Sorting for Additional Wavelengths Available.

PHOTO DETECTORS/SOLAR CELLS

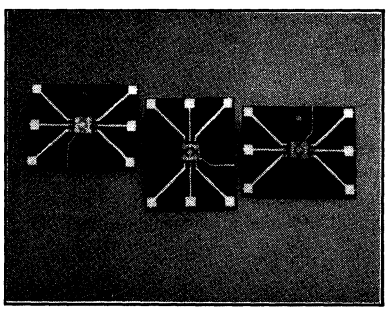
HERMETIC METAL
CAN TO-18 AND TO-46



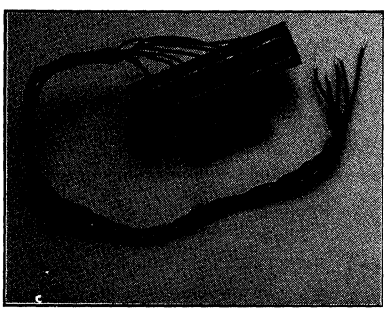
MULTI-CHANNEL
PHOTO DETECTORS



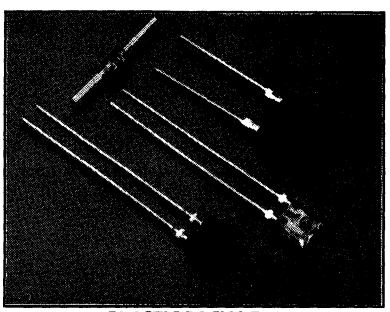
METAL CAN TO-18
AND TO-46 DRIP LENS



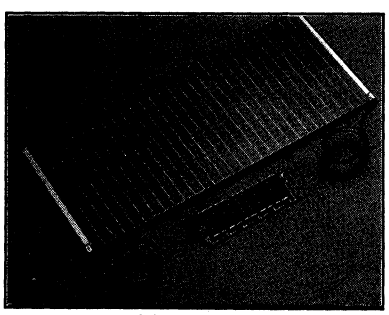
PCB PHOTO DIODE ASSEMBLIES



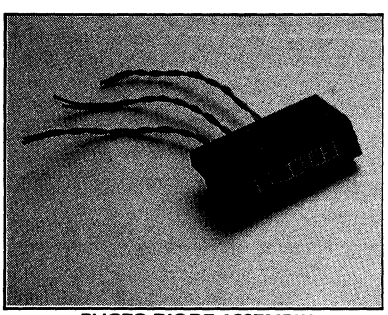
SOLAR CELL ASSEMBLY



PLASTIC PACKAGED
PHOTO DETECTORS



SOLAR CELLS



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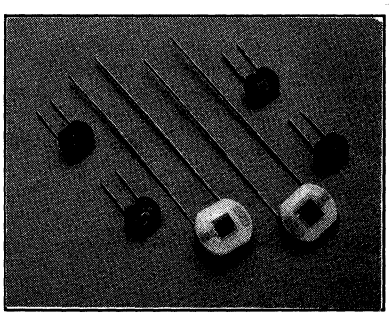


CERAMIC STEM PHOTO DIODES

AVAILABLE IN:

PHOTO DIODES □ PHOTO TRANSISTORS
PHOTO DARLINGTONS □ PHOTO IC'S □ SOLAR CELLS

PHOTO DETECTORS/SOLAR CELLS

Package Styles

Plastic Epoxy Package (All Variations Including T-1, T-1¾, Axial, Side View, Truncated, Concave, Rectangular, Tapered, Flat Top

Metal Can—(All Variations Including) TO-5, TO-18, TO-46, TO-39, TO-56, TO-92

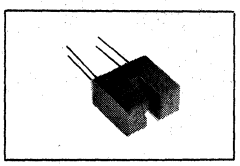
Arrays—All Variations

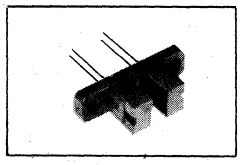
Ceramic (All Variations Including) 3mm, 4mm

DIP Package—All Variations

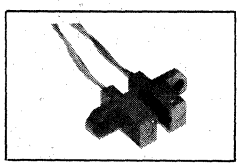
Pill Package

OPTEK
345 Industrial Blvd.
McKinney, Texas 75069
(214) 542-9461

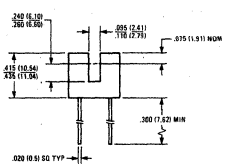


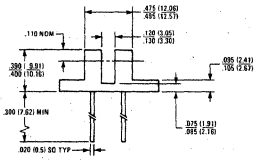


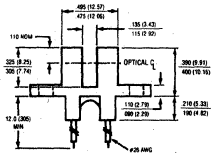
K-8102



K-8170



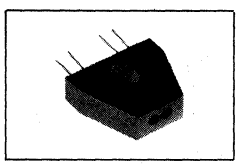




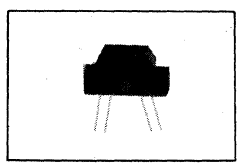
Coupled Electrical Characteristics

Device	On State Output Current I_F = 20mA, V_{CE} = 10.0V		
	MIN	TYPICAL	UNIT
K-8105	500	1300	μA
K-8102	500	1400	μA
K-8170	200	1500	μA

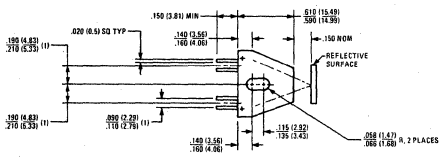
Available with wires attached and various apertures on sensor.

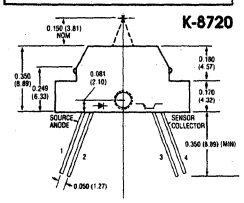


K-8710



K-8720

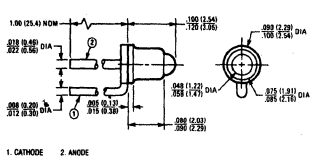




Coupled Electrical Characteristics

Device	On State Output Current I_F = 40mA V_{CE} = 5.0V, d = 0.15"		
	MIN	TYPICAL	UNIT
K-8710	200	500	μA
K-8720	100	350	μA

Available with wires attached.



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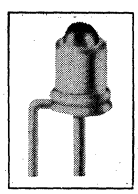
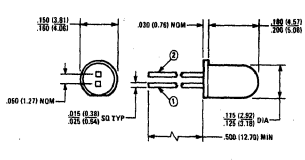
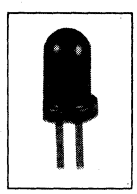


K-5100



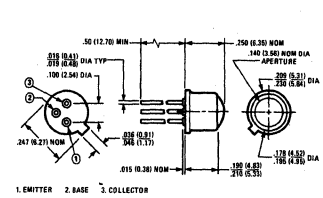
1. EMITTER 2. COLLECTOR



K-6500 K-5500

Phototransistors

Device	Light Current	@V_{CE} = 5.0V
	MIN	H = mW/cm²
K-5100	1.5mA	5
K-5250	4.0 mA	5
K-5500	0.5 mA	20
K-5550	1.0 mA	20



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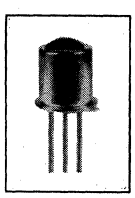
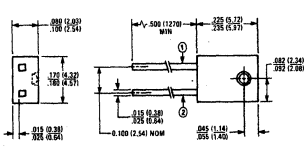
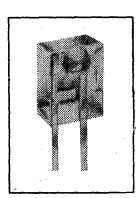


K-5250



1. CATHODE 2. ANODE

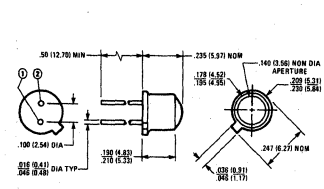
1. EMITTER 2. COLLECTOR



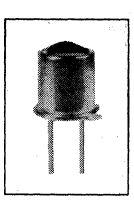
K-6550 K-5550

Infrared Light Emitting Diodes

Device	Output Power	Forward Current
	MIN	I_F
K-6100	0.35mW	50mA
K-6250	3.00 mW	100 mA
K-6500	0.5 mW	20 mA
K-6550	0.5 mW	40 mA



1. CATHODE 2. ANODE



K-6250

Other electrical and mechanical devices available as standard products from Optek. Write for the Optek catalog for other standard products.

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

OPTOELECTRONIC PRODUCTS—LED/PHOTO COUPLERS, TRANSISTORS, INTERRUPTERS AND DIODES

Acousto-Optic Modulators

Devices	Description	Wavelength (nm)	Active Aperture (mm)	Center Carrier Frequency (MHz)	Rise Time (Typ.)*	DC Contrast Ratio
OD8802	Driver	442/633/488	2	80	170 ns	1000:1
OD8810	Acousto-Optic Modulator	442/633/488	2	80	< 170 ns	> 1000:1
OD8811	Acousto-Optic Modulator	442/633/488	1	80	< 40 ns	> 1000:1
OD8813	Acousto-Optic Modulator	442/633/488	1	140	< 15 ns	> 1000:1
OD8823	Acousto-Optic Modulator/Driver	442/633/488	2	80	< 50 ns	> 1000:1

*Contact Manufacturer

Gas Lasers

Type	Wave Length	Polarization	Model Number	Power (mW)	Beam Diameter (mm)	Beam Divergence (mrad)	Applicable Power Supply
He-Ne Tubes	632.8 mm	Random	GLT172B	0.5	0.66	1.22	GLS5230/GLS5245
			GLT2390	0.5	0.34	2.4	GLS9900
			GLT179	0.5	0.52	1.54	GLS5230
			GLT172	0.8	0.66	1.22	GLS5230/GLS5245
			GLT2310	1.0	0.65	1.23	GLS5246
			GLT2320	2.0	0.65	1.23	GLS5246
			GLT2150	5.0	0.83	0.96	GLS5270/GLS5290
		Linear	GLT2330	1.0	0.65	1.23	GLS5246
			GLT2340	1.5	0.65	1.23	GLS5246
			GLT2080	2.0	0.75	1.08	
			GLT2140A	5.0	0.83	0.96	GLS5290
		Multi Mode	GLT2180	5.0	1.2	8.0	GLS5230/GLS5246
			GLT2350	7.0	0.9	4.0	GLS5270/GLS5290
		Multi Mode	GLT2460	12.0	1.1	3.7	GLS5400
He-Ne Integrated Heads		Random	GLG5091	0.5	0.66	1.22	Self-contained
			GLG5031	1.0	0.65	1.23	Self-contained
			GLG5041	2.0	0.65	1.23	Self-contained
		Linear (V)	GLG5071	1.0	0.65	1.23	Self-contained
		(V)	GLG5081	1.5	0.65	1.23	Self-contained
He-Ne Cylindrical Heads		Random	GLG5230	1.0	0.65	1.23	GLS5371
			GLG5240	2.0	0.65	1.23	GLS5371
			GLG5260	5.0	0.83	0.96	GLS5361
			GLG5400	10.0	0.7	1.2	GLS5411
		Linear (V)	GLG5370	1.0	0.65	1.23	GLS5371
		(V)	GLG5380	1.5	0.65	1.23	GLS5371
		(V)	GLG5360	5.0	0.83	0.96	GLS5361
		Multi Mode	GLG5270	7.0	0.9	4.0	GLS5361
He-Ne High Power Systems		Linear (H)	GLG5600	15.0	1.1	0.73	GLS5601
		(H)	GLG5730	25.0	1.2	0.7	GLS5721/GLS5731
		(H)	GLG5740	35.0	1.2	0.7	GLS5731
		(H)	GLG5800	50.0	1.7	0.47	GLS5801
	1.15 μm	(H)	GLG5610	5.0	1.5	1.0	GLS5601
		(H)	GLG5732	7.0	1.7	1.0	GLS5721/GLS5731
		(H)	GLG5810	15.0	2.3	0.6	GLS5801
	1.53 μm	(H)	GLG5820	1.5	2.7	0.8	GLS5801
Ar ION Air Cooled	488.0 mm	(V)	GLG3050	15.0	0.65	1.0	
		(V)	GLG3051	5.0	0.65	1.0	GLS3021/GLS3051
	514.5 mm	(V)	GLG3055	5.0	0.65	1.0	
	Multi Line	Random	GLG3026	15.0	0.67	1.0	
		Linear (V)	GLG3027	15.0	0.67	1.0	
		Random	GLG3040	25.0	0.67	1.0	

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OPTOELECTRONIC PRODUCTS—LED/PHOTO COUPLERS, TRANSISTORS, INTERRUPTERS AND DIODES

Infrared Light Emitting Diodes (IR LEDs)

NEC Part Number	Max. P_D (mW)	Max. I_F (mA0	Typical V_F/I_F (V/mA0	Typical I_R (μA)	Typical P_O (mW)	Typical Wavelength
SE301A	150	100	1.2/50	0.01	6	940 nm
SE302A	75	50	1.2/50	0.01	1.5	940nm
SE303A-C	150	100	1.25/50	0.01	6.5	940 nm
SE306	100	50	1.1/10	10	0.5	940 nm
SE307-C	150	100	1.45/50	N/A	15	940 nm
SE308	100	50	1.14/20	10	0.85	940 nm
SE1003-C	150	50	1.25/50	0.01	20	950 nm

Note: V_F: Measured at I_F = 10 mA, except SR106 I_F = 20 mA. I_R: Measured at V_R = 4.5V, except SR106 V_R = 3V. I_V: Measured at I_F = 10 mA, except SR106 I_F = 20 mA. Wavelength measured at I_F = 10 mA. I_R tested at V_R = 3V. P_O tested at I_F = 30 mA. Wavelength tested at I_F = 30 mA. T_A = 25°C for all data.

Photo Couplers

NEC Part Number	Max. I_F (mA)	Max. I_C (mA)	Max. V_{ISO} (VAC)	V_F/I_F (V/mA)	I_{CEO} (nA)	CTR/I_F (%/mA)	V_{CE}(sat) (I_C=2 mA)	BV_{CEO} (V)
4N25	80	100	2500*	1.4/10	50	20/20	0.3	30
MCT2	80	100	2000	1.4/10	50	20/20	0.3	30
PS2002B	50	50	2500*	1.9/5	400	100/5	1.2	40
PS2004B	50	200	2000	1.4/20	400	1300/5	1.2	30
PS2005B	150	50	2000	2.0/100	200	10/100	0.3 (4 mA)	30
PS2006B	25	8	3000*	1.7/16	N/A	15	N/A	
PS2007B	10	50	3000*	1.7/10	TTL	600	TTL out	
PS2010	80	100	2000	1.4/10	50	20/20	0.3	30
PS2021	80	100	4000	1.4/10	50	50/10	0.3	40
PS2022	80	100	4000	1.4/10	100	200/10	1.0	40
PS2031	80	100	2000	1.4/10	50	20/20	0.3	200

Note: I_{CEO} measured at V_{CE} = 10V and I_F = 0.
*Denotes DC volts; all others in AC volts.

Photo Couplers—SCR Type

NEC Part Number	Max. V_{DRM} (V)	Max. I_T (mA)	Max. V_{ISO} (V_{RMS})	V_F/I_F (V/mA)	I_{DRM}* (μA)	V_{TM} (V)	I_{FT}* (mA)
PS3001(1)	200	300	2500	1.4/20	100	1.3	12
PS3002(1)	400	11	2500	1.4/20	100	1.3	12

Note: I_{DRM} with R_{GK} = 27 kΩ and T_A = 100°C. V_{TM} with I_T = 300 mA.
I_{FT} with V_D = 6V and R_{GK} = 27Ω.
*Maximum Value

Photo Transistors

NEC Part Number	Max. P_C (mW)	Max. I_C (mA)	Max. V_{CEO} (V)	I_{CEO} (nA)	V_{CE}(sat) (V)	I_L* (mA)
PH101	100	50	20	500	1.5	4
PH102	100	40	30	200	0.3	.050
PH103	100	50	30	400	1.5	2
PH104	100	40	30	100	0.3	.020
PH106	100	40	30	100	0.3	.060
PH108	100	40	30	100	0.3 (I_C=0.5 ma) (H=5.0 mW/cm²)	0.3 (V_{CE}=5V) (H=0.5 mW/cm²)

Note: I_{CEO} tested at V_{CE} = 10V — L = 0.
V_{CE}(sat) tested at L = 1000ix.
I_L tested at V_{CE} = 2V — L = 100ix.
*Minimum Value

Photo Interrupters

NEC Part Number	Max. I_F (mA)	Max. V_{CEO} (V)	Max. I_C (mA)	V_F (V)	I_{CEO} (nA)	V_{CE}(sat) (V)	CTR (%)
PS4001	50	30	50	1.1	400	1.2	20
PS4003	50	30	50	1.1	400	1.2	15
PS4005	50	30	50	1.1	400	1.2	20
PS4007	50	30	50	1.1	400	1.2	20
PS4008	50	30	40	1.1	100	0.3	0.5
PS4009	50	30	50	1.1	400	1.2	20
PS4010	50	30	50	1.1	400	1.2	20
PS4011	50	30	50	1.1	400	1.2	20
PS4014	50	30	40	1.1	100	0.3	0.5

Note: V_F tested at I_F = 20 mA, except PC6001A I_F = 30 mA.
I_{CEO} tested at V_{CE} = 10V and I_F = 0.
V_{CE}(sat) tested at I_F = 10 mA — I_C = 0.5 mA.
CTR tested at I_F = 10 mA — V_{CE} = 2V.
PS4008 V_{CE} (sat) tested at I_F = 10 mA — I_C = 50 μA.

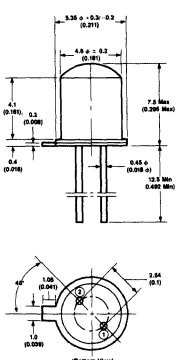
Photo Diodes

NEC Part Number	Max. V_R (V)	Max. P_C (mW)	Max. I_F (mA)	Sensitivity (nA)/lx	I_D* (pA)	t_r (nS)
PH302	32	150	N/A	50	30	50
PH302B	32	150	N/A	32	30	50
PH309	20	150	N/A	50	30	30

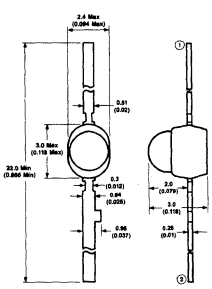
Note: t_r tested at R_L = 1 KΩ.
I_D tested at V_R = 10V
Sensitivity in units of nA/lx
Wavelength of maximum sensitivity is 940 nm.
*Maximum Value

OUTLINE DRAWINGS/PACKAGING

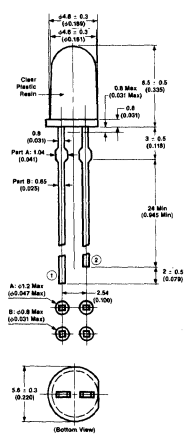
SE301A



SE302A



SE303A, SE307, SE1003



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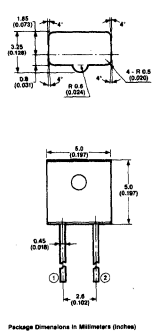

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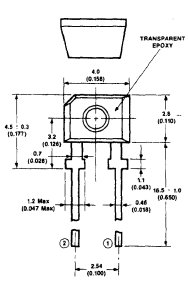

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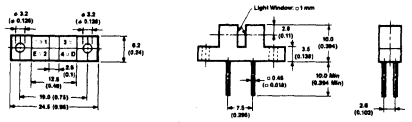
OPTOELECTRONIC PRODUCTS—OUTLINE DRAWINGS/PACKAGING

PS4001



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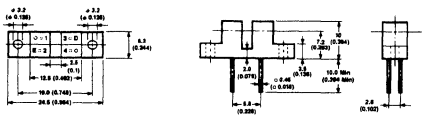

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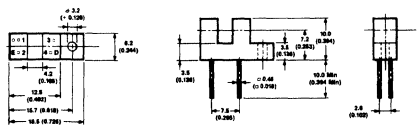
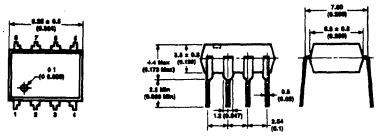
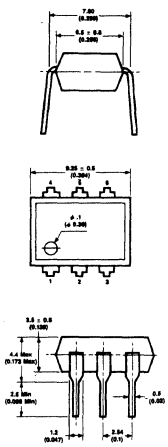


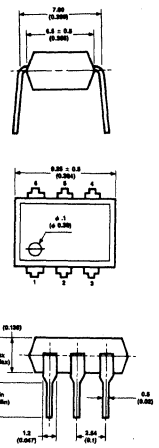
6N136/7, PS2006B/B(1), PS2007B



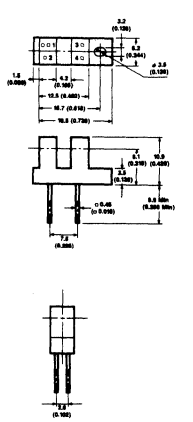
4N25, PS2002B, PS2010



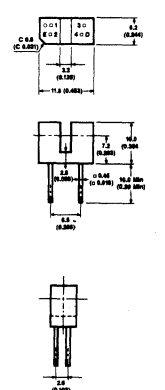
MCT2, PS2004B/15B, PS2021/2, PS3001(1)/2(1)



PS4009



PS4010



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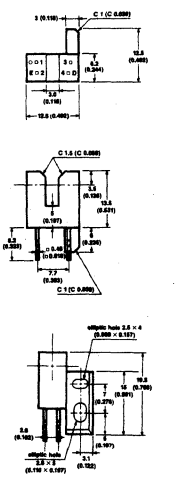
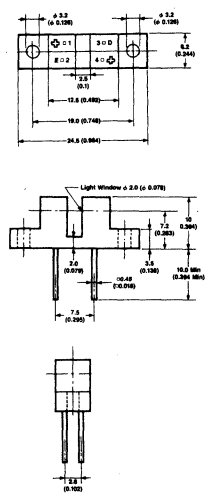
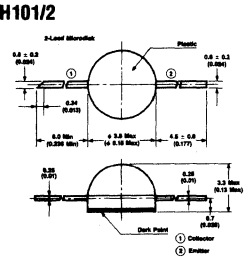


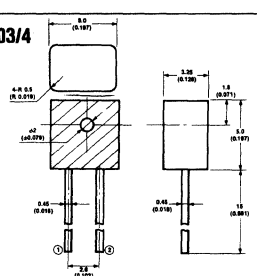
PS4008, PS4014



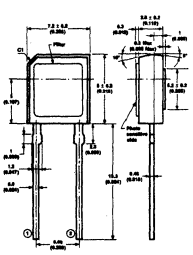
PH101/2



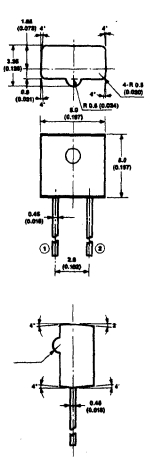
PH103/4



PH302



PH106



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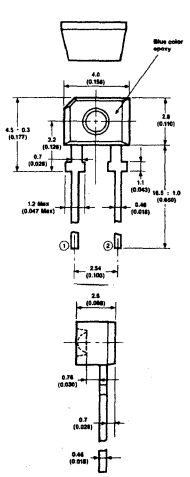

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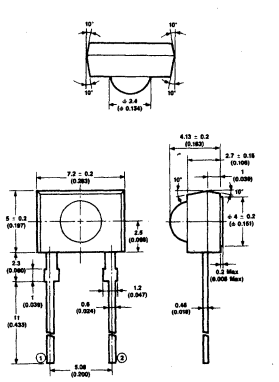


SHARP® Optoelectronics

Photocouplers

Photocouplers

Features

Various output methods:
- Single phototransistor
- Darlington phototransistor
- OPIC*
- Bidirectional output transistor
- Phototriac
- Photothyristor

Various package formats:
- Standard dual-in-line package
- Flat package
- Mini-flat package
- Dual-in-line package for long creepage distance

Wide line-up of products approved by overseas safety standards: UL, VDE, TÜV, BS, SEMKO, DEMKO, EI
High isolation voltage: PC100/PC700/PC800 series, etc.

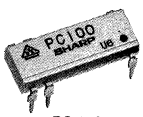
Classification chart

Photocouplers
- PC100 series — VDE approved (long creepage distance type)
- PC200 series — Mini-flat package type
- PC300 series — Opaque mini-flat package type
- PC700 series — DIP 6-pin, Viso:5kVrms
- PC800 series — Opaque 4-pin x N (N = 1,2,3,4), Viso: 5kVrms
- PC900 series — OPIC*
- PC4N series — Standard 4N series
- 6N series — Standard 6N series (OPIC*)

Phototriac couplers

Photothyristor couplers

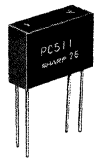
*OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip
**In PC4N series, PC700 series, and PC800 series, the flat package products are also available in a wide variety.



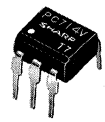
PC 100 (PC101)

PC110 (PC111, PC112, PC113)

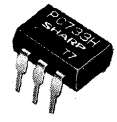
PC213 (PC219)



PC511



PC714V /PC4N25V ~ 30V, PC4N32V, PC4N33V PC4N35V ~ 37V, PC702V, PC703V PC713V, PC723V, PC715V, PC716V PC724V, PC725V



PC733H (PC733, PC619)

Lead forming product (e.g. PC818I)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard: UL	TÜV	VDE	Package	Absolute maximum ratings: Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Current transfer ratio: CTR (%) MIN.	I_F (mA)	Response time: tr (μs) TYP.	R_L (Ω)
Single phototransistor	PC100		High isolation voltage long creepage distance *2	○		○	DIP 6-pin (Special)	50	5,000	25	10	6	100
	PC101		High isolation voltage, long creepage distance *2	○		○		50	5,000	25	10	6	100
	PC110		High isolation voltage, long creepage distance *2	○		○	DIP 6-pin	50	5,000	50	5	4	100
	PC112		High isolation voltage, long creepage distance, high collector-emitter voltage *2	○		○		50	5,000	40	10	4	100
	PC111		High isolation voltage, long creepage distance *2	○		○		50	5,000	50	5	4	100
	PC113		High isolation voltage, long creepage distance, high collector-emitter voltage *2	○		○		50	5,000	40	10	4	100
	PC213		Mini-flat package type				Mini-flat package, 5-pin	50	2,000	50	5	4	100
	PC511		High isolation voltage, long creepage distance	○	○		PWB-mounted 4-pin	50	5,000	10	20	3	100
	PC714V*1		High isolation voltage	○	○		DIP 6-pin	50	5,000	50	5	4	100
	PC724V		High isolation voltage, large input current	○				150	5,000	20	100	4	100
	PC702V*1		High isolatin voltage, high collector-emitter voltage (70V)	○	○			60	5,000	40	10	2	75
	PC703V*1		High isolation voltage, high collector-emitter voltage (70V)	○	○			50	5,000	40	10	4	100
	PC713V*1		High isolation voltage	○	○			50	5,000	50	5	4	100
	PC723V*1		High isolation voltage, high collector-emitter voltage (80V)	○	○			50	5,000	50	5	6	100
	PC733*1		High isolation voltage, AC input response	○				±50	5,000	15	±1	4	100
	PC733H		High isolation voltage, large input current drive, AC input response	○				±150	5,000	20	±100	4	100

★ 1 Lead forming type (I type) is also available. ★ 2 BS, SEMKO, DEMKO, EI approved: PC110, PC111, PC112, PC113, PC100, PC101

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard: UL	TÜV	Package	Absolute maximum ratings: Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Turn-on, Turn-off: ton, toff (μs) MAX.	I_F (mA)	V^*_{DS} (V)	R_L (Ω)
Bi-directional output	PC219		Bi-directional high output resistant			Mini-flat package 4-pin	50	2,000	50	16	5	50
	PC619		Bi-directional linear output	○		DIP 6-pin	60	2,000	15	16	5	50

★ I_F = 200mA (tw ≈ 1.0ms)

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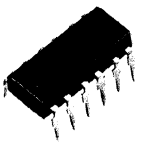
SHARP Optoelectronics

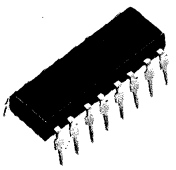
Photocouplers

PC817
(PC810, PC812, PC813, PC814, PC815, PC816, PC818, PC851, PC852, PC865)

PC827
(PC823, PC824, PC829, PC825, PC826, PC875, PC8D52)



PC837
(PC835)



PC847
(PC843, PC844, PC849, PC845, PC846, PC895, PC8Q52)

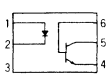
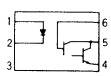
PC317Z
(PC314Z, PC315Z, PC316Z)

PC3D17
(PC3D14, PC3D15, PC3D16)

PC3Q17
(PC3Q14, PC3Q15, PC3Q16)

Photocouplers

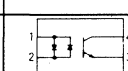
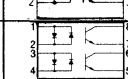
(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		Electrical characteristics			
									Current transfer ratio		Response time	
				UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	tr (μs) TYP.	R_L (Ω)
Single phototransistor	PC4N25V*1		General purpose	○	○	DIP 6-pin	80	2,500	20	10	3	100
	PC4N26V*1		General purpose	○	○		80	1,500	20	10	3	100
	PC4N27V*1		General purpose	○	○		80	1,500	10	10	3	100
	PC4N28V*1		General purpose	○			80	500	20	10	3	100
	PC4N35V*1		General purpose	○	○		60	3,550	100	10	ton3	100
	PC4N36V*1		General purpose	○	○		60	2,500	100	10	ton3	100
	PC4N37V*1		General purpose	○	○		60	1,500	100	10	ton3	100
Darlington phototransistor	PC4N29V*1		High sensitivity, general purpose	○	○	DIP 6-pin	80	2,500	100	10	ton5*2	*3
	PC4N30V*1		High sensitivity, general purpose	○	○		80	1,500	100	10	ton5*2	*3
	PC4N32V*1		High sensitivity, general purpose	○	○		80	2,500	500	10	ton5*2	*3
	PC4N33V*1		High sensitivity, general purpose	○	○		80	1,500	500	10	ton5*2	*3

Opaque mini-flat package type

Employs double transfer mold technology

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Package	Absolute maximum ratings		Electrical characteristics						
							Current transfer ratio			Response time			
					Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	V_{CE} (V)	tr (μs) TYP.	I_C (mA)	R_L (Ω)	V_{CE} (V)
Single phototransistor	PC314Z*5		Opaque mini-flat package type, AC input response	Mini-flat package, 4-pin	±50	2,500	20	±1	5	4	2	100	2
	PC3D14		Opaque mini-flat package type, AC input response (2-ch)	Mini-flat package, 8-pin	±50	2,500	20	±1	5	4	2	100	2
	PC3Q14		Opaque mini-flat package type, AC input response (4-ch)	Mini-flat package, 16-pin	±50	2,500	20	±1	5	4	±2	100	2
	PC316Z*5		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)	Mini-flat package, 4-pin	50	2,500	50	5	5	4	2	100	2
	PC3D16		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)(2-ch)	Mini-flat package, 8-pin	50	2,500	50	5	5	4	2	100	2
	PC3Q16		Opaque mini-flat package type, high collector-emitter voltage (V_{CEO}: 120V)(4-ch)	Mini-flat package, 16-pin	50	2,500	50	5	5	4	2	100	2
	PC317Z*5		Opaque mini-flat package type, general purpose	Mini-flat package, 4-pin	50	2,500	50	5	5	4	2	100	2
	PC3D17		Opaque mini-flat package type, general purpose (2-ch)	Mini-flat package, 8-pin	50	2,500	50	5	5	4	2	100	2
	PC3Q17		Opaque mini-flat package type, general purpose (4-ch)	Mini-flat package, 16-pin	50	2,500	50	5	5	4	2	100	2
Darlington phototransistor	PC315Z*5		Opaque mini-flat package type, high sensitivity	Mini-flat package, 4-pin	50	2,500	600	1	2	60	2	100	2
	PC3D15		Opaque mini-flat package type, high sensitivity (2-ch)	Mini-flat package, 8-pin	50	2,500	600	1	2	60	2	100	2
	PC3Q15		Opaque mini-flat package type, high sensitivity (4-ch)	Mini-flat package, 16-pin	50	2,500	600	1	2	60	2	100	2

*1 Lead forming type (I type) is also available. *2 MAX. *3 I_F = 200mA (tw ≈ 1.0ms) *4 Vcc = 10V
*5 The versions for taping package specification are also available.
Model Nos. PC314, PC315, PC316, PC317 : Diameter of Reel φ370mm, Tape Width 12mm, Min. Increments 3000 pcs
PC314T, PC315T, PC316T, PC317T : Diameter of Reel φ178mm, Tape Width 12mm, Min. Increments 750 pcs

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Photocouplers

Photocouplers

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		Electrical characteristics			
									Current transfer ratio		Response time	
				UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	tr (μs) TYP.	R_L (Ω)
Single phototransistor	PC810		High isolation voltage, high speed at high load	○		DIP 4-pin	50	5,000	60	1	10	1,000
	PC812		High isolation voltage, high noise resistivity				50	5,000	90	5	4	100
	PC816		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC817*3		High isolation voltage	○	○		50	5,000	50	5	4	100
	PC818*3		High isolation voltage, high speed at high load	○	○		50	5,000	10	1	7	1,000
	PC851		High isolation voltage, high collector-emitter voltage (300V)	○			50	5,000	40	5	4	100
	PC813		High isolation voltage, AC input response, (high noise resistivity)	○			±50	5,000	20	±1	4	100
	PC814*3		High isolation voltage, AC input response	○								
	PC823		High isolation voltage, AC input response, (high noise resistivity)	○		DIP 8-pin	±50	5,000	20	±1	4	100
	PC824		High isolation voltage, AC input response	○								
	PC826		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC827*1		High isolation voltage, AC input response, high isolation voltage (2-ch)	○	○		50	5,000	50	5	4	100
	PC829		High isolation voltage, symmetrical terminal configuration	○	○		50	5,000	50	5	4	100
	PC837*1		High isolation voltage (3-ch)	○	○	DIP 12-pin	50	5,000	50	5	4	100
	PC843		High isolation voltage, AC input response	○		DIP 16-pin	±50	5,000	20	±1	4	100
	PC844		High isolation voltage, AC input response, high noise resistivity	○								
	PC846		High isolation voltage, high collector-emitter voltage (70V)	○			50	5,000	50	5	4	100
	PC847*1		High isolation voltage (4-ch)	○	○		50	5,000	50	5	4	100
	PC849		High isolation voltage, symmetrical terminal configuration	○	○		50	5,000	50	5	4	100
Darlington phototransistor	PC715V*3		High isolation voltage, high sensitivity	○	○	DIP 6-pin	50	5,000	600	1	60	100
	PC716V*3		High isolation voltage, high sensitivity, high power	○	○		50	5,000	1,000	1	130	100
	PC725V*3		High isolation voltage, high sensitivity, high collector-emitter voltage (300V), high power	○	○		50	5,000	1,000	1	100	100
	PC852		High isolation voltage, high sensitivity, high collector-emitter voltage (300V), high sensitivity			DIP 4-pin	50	5,000	1,000	1	100	100
	PC8D52		High isolation voltage, high collector-emitter voltage (300V), high sensitivity (2-ch)			DIP 8-pin	50	5,000	1,000	1	100	100
	PC8Q52		High isolation voltage, high collector-emitter voltage (300V), high sensitivity (4-ch)			DIP 16-pin	50	5,000	1,000	1	100	100
	PC815*3		High isolation voltage, high sensitivity	○	○	DIP 4-pin	50	5,000	600	1	60	100
	PC825*2		High isolation voltage, high sensitivity (2-ch)	○	○	DIP 8-pin	50	5,000	600	1	60	100
	PC835*2		High isolation voltage, high sensitivity (3-ch)	○	○	DIP 12-pin	50	5,000	600	1	60	100
	PC845*2		High isolation voltage, high sensitivity (4-ch)	○	○	DIP 16-pin	50	5,000	600	1	60	100
	PC865		High isolation voltage, high sensitivity, low dark current	○		DIP 4-pin	50	5,000	1,000	1	100	100
	PC875		High isolation voltage, high sensitivity, low dark current (2-ch)	○		DIP 8-pin	50	5,000	1,000	1	100	100
	PC895		High isolation voltage, high sensitivity, low dark current (4-ch)	○		DIP 16-pin	50	5,000	1,000	1	100	100

*1 UL, TÜV approved as multi-channel of PC817 respectively. *2 UL, TÜV approved as multi-channel of PC815 respectively. *3 Lead forming type (I type) is also available.

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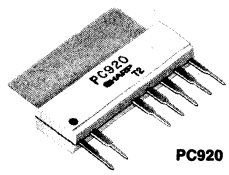
Photocouplers

PC900V
(PC901V)

PC902
(PC904)

PC910
(PC921, 6N135, 6N136
6N137, 6N138, 6N139
PC9D10, PC9D17)

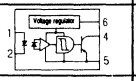
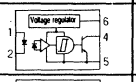
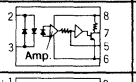
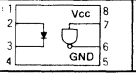


PC920

OPIC Photocouplers

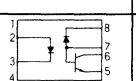
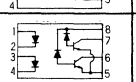
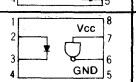
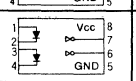
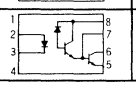
(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.

(Ta = 25°C)

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		*2Electrical characteristics						
								Low level output voltage				Threshold input current		
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	V_{OL} (V) MAX.	Ta (°C)	I_{OL} (mA)	I_F (mA)	I_{FHL} (mA) MAX.	I_{FLH} (mA) MAX.	R_L (Ω)
PC900V*1		Digital output, normal-off	○	○	DIP 6-pin	50	5,000	0.4	0 ~ +70	16	4	2.0	—	280
PC901V		Digital output, normal-on	○		DIP 6-pin	50	5,000	0.4	0 ~ +70	16	0	—	2.0	280
PC902		Built-in integration circuit, AC input response	○		DIP 8-pin	±20	5,000	0.4	0 ~ +70	6.4	±2	1.5	—	680
PC910		High speed (10Mb/s)	○		DIP 8-pin	20	2,500	0.6	0 ~ +70	13	5	5.0	—	350

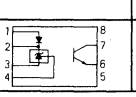
*1 Lead forming type (i type) is also available. *2 Each measurement: Vcc = 5V * Ta = 0 ~ 70°C

(Ta = 25°C)

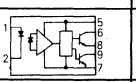
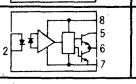
Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings		Electrical characteristics							
								Current transfer ratio				Propagation time*3			
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	CTR (%) MIN.	I_F (mA)	Vo (V)	Vcc (V)	t_{PHL} (μs) TYP.	t_{PLH} (μs) TYP.	R_L (Ω)	I_F (mA)
6N135		High speed (1Mb/s)	○		DIP 8-pin	25	2,500	7	16	0.4	4.5	0.4	0.7	4,100	16
6N136			○			25	2,500	19	16	0.4	4.5	0.3	0.5	1,900	16
PC9D17		High speed (1Mb/s) 2 channels				25	2,500	19	16	0.4	4.5	0.8 (MAX.)	0.8 (MAX.)	1,900	16
6N137		High speed (10Mb/s)	○			20	2,500	TYP. 700	5	(R_L = 100Ω)	5	0.045	0.045	350	7.5
PC9D10		Ultra high speed (10Mb/s) 2 channels				15	2,500	TYP. 700	5	(R_L = 100Ω)	5	0.075 (MAX.)	0.075 (MAX.)	350	7.5
6N138		High speed, high sensitivity	○			20	2,500	300	1.6	0.4	4.5	1	4	2,200	1.6
6N139			○			20	2,500	400	0.5	0.4	4.5	5	5	4,700	0.5

*3 Vcc = 5V

(Ta = 25°C)

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings			Electrical characteristics					
									Current dark current	Current transfer ratio				
			UL	TÜV		Anode current I_A (mA)	Isolation voltage (AC) Viso (Vrms)	Collector-emitter voltage V_{CEO} (V)	I_{CEO} (A) MAX.	V_{CE} (V)	CTR (%) MIN.	V_K (V)	I_A (mA)	V_{CE} (V)
PC904		Built-in voltage deviation detection circuit	○		DIP 8-pin	50	5,000	35	1×10^{-7}	35	50	V_{REF}	10	5

(Ta = 25°C)

Model No.	Internal connection diagram	Features	Approved by overseas safety standard		Package	Absolute maximum ratings			Electrical characteristics					
									Propagation delay time					
			UL	TÜV		Forward current I_F (mA)	Isolation voltage (AC) Viso (Vrms)	Vo_1 Ouput current Io_1 (A)	t_{PHL} (μs) TYP.	t_{PLH} (μs) TYP.	Vcc (V)	I_F (mA)	R_{L1} (Ω)	R_{L2} (Ω)
PC920		For inverter-controlled air conditioner	○		SIP 7-pin	50	1,500	–0.8	3	3	Vcc_1 = 6	2	15	18
PC921		For inverter-controlled air conditioner	○		DIP 8-pin	25	2,000	0.5	2	2	6	5	5	10

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SHARP Optoelectronics

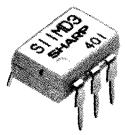
Phototriac Couplers/ Photothyristor Couplers

S12MD2

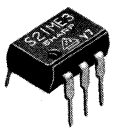
S12MD22

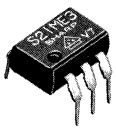
S22MD2

S21MM4
(S11MM4)
(S11MM5)
S21MM3)

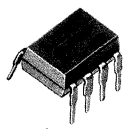

S11MD3

S11MD5V
(S12MDIV, S22MDIV
S21MD3V, S21MD4V)
S11MD4V


S21ME3
(S21ME4)

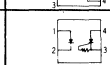
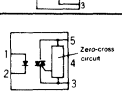
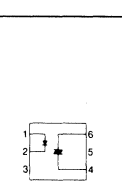
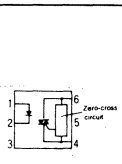

S21ME3F
(S21ME4F)

S12MD3


S22MD3

Phototriac Couplers/ Photothyristor Couplers

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features		Approved by overseas safety standard UL	Approved by overseas safety standard TÜV	Package	Absolute maximum ratings: On-state current I_T (Arms)	Absolute maximum ratings: Repetitive peak off-state voltage V_{DRM} (V)	Absolute maximum ratings: Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Minimum trigger current I_{FT} (mA) MAX.	Electrical characteristics: Minimum trigger current V_D (V)	Electrical characteristics: Minimum trigger current R_G (kΩ)
For triggering	S12MD1V*2		Half wave control	120V line	○		DIP 6-pin	0.2	400	5,000	15	6	20
	S22MD1V*2			240V line	○	○	DIP 6-pin	0.2	600	5,000	10	6	20
	S12MD2			120V line, high noise resistivity (built-in gate resistor)	○		DIP 4-pin	0.2	400	1,500	10	6	—
	S12MD22				*1 ○		DIP 8-pin	0.2	400	1,500	10	6	—
	S22MD2			240V line			DIP 7-pin	0.2	600	5,000	8	6	20
	S11MM5		Full wave control	120V line			Mini-flat package, 4-pin	0.1	400	2,000	10	6	—
	S21MM3			240V line		○		0.1	600	2,000	15	6	—
	S11MM4			120V line, Built-in zero-cross circuit				0.1	400	2,500	10	6	—
	S21MM4			240V line, Built-in zero-cross circuit		○		0.1	600	2,000	15	6	—
	S11MD3			120V line, high noise resistivity (built-in gate resistor)	○		DIP 6-pin	0.1	400	2,500	10	6	—
	S11MD5V*2			120V line, high isolation voltage	○			0.1	400	5,000	10	6	—
	S21MD3V*2			240V line, high noise resistivity (built-in gate resistor)		○		0.1	600	5,000	15	6	—
	S21ME3			240V line, low input current Conforms to overseas safety standard	VDE, BS, SEMKO, DEMKO, EI, UL			0.1	600	5,000	7	6	—
	S21ME3F			240V line, low input current Conforms to overseas safety standard				0.1	600	5,000	7	6	—
	S11MD4V			120V line, Built-in zero-cross circuit				0.1	400	5,000	10	6	—
	S21MD4V*2			240V line, Built-in zero-cross circuit	○	○		0.1	600	5,000	15	6	—
	S21ME4			240V line, low input current Conforms to overseas safety standard	VDE, BS, SEMKO, DEMKO, EI, UL			0.1	600	5,000	7	6	—
	S21ME4F			240V line, low input current Conforms to overseas safety standard				0.1	600	5,000	7	6	—
	S12MD3			120V line	○		DIP 8-pin	0.2	400	1,500	15	6	20
	S22MD3			240V line				0.2	600	2,500	10	6	20

*1 S12MD22 is approved as multi-channel type of S12MD2. ★2 Lead forming type is also available.
✻ Topr: −30 ~ +100°C

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SHARP Optoelectronics

Photointerrupters

Photointerrupters

Features

- Various output methods
  - Single phototransistor
  - Darlington phototransistor
  - OPIC
    - Single-phase digital output
    - Two-phase digital output (transmissive type)
- Various mounting methods
  - Snap-in mounting type
  - PWB mounting type
  - Both-side mounting type
  - Either-side mounting type (transmissive type)
  - Side-mounting type (transmissive type)
- Transmissive type — Line-up of products with a detecting accuracy of slit width ranging from 0.15 to 2.5mm.
- Reflective type — Line-up of products with detecting distance ranging from 1 to 7mm (optimum).
- Transmissive type — Line-up of products having an object passing width ranging from the light emitter and detector gap of 0.9 to 13.2mm.

Versions with cover case, 3-pin connector terminal, and super-compact products are available to meet a variety of customer needs.

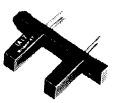
Classification chart

Photointerrupters	Transmissive type	GP1S series	Single phototransistor output
		GP1L series	Darlington phototransistor output
		GP1A series	OPIC
	Reflective type	GP2S series	Single phototransistor output
		GP2L series	Darlington phototransistor output
		GP2A series	OPIC or amplier built-in type

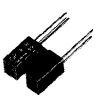
GP1A08

GP1A14

GP1A15


GP1A17

GP1A20


GP1A18 (GP1A18LR, GP1A18LC)

GP1A19

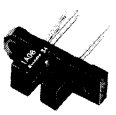
GP1A40

GP1A50HR

GR1A51HR

GP1A52LR (GP1A52HR)

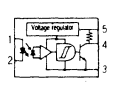
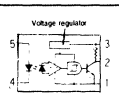
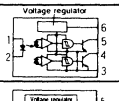
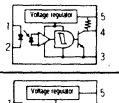
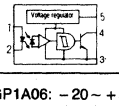
GP1A53HR


GP1A06

Transmissive type OPIC type

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Detecting and emitting gap (mm)	Slit width of resolution (mm)	Electrical characteristics: Threshold input current I_{FLH} (mA) MAX.	Threshold input current I_{FHL} (mA) MAX.	Threshold input current Vcc (V)	Propagation time t_{PLH} (μS) TYP.	Propagation time t_{PHL} (μS) TYP.	I_F (mA)	R_L (Ω)	Vcc (V)
OPIC	GP1A08		Both-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A14		PWB mounting type	5.0	0.5	8	—	5	3	5	8	280	5
	GP1A15			3.0	0.25	10	—	5	3	5	10	280	5
	GP1A17		Both-side mounting type	10.0	2.0	7	—	5	3	5	7	280	5
	GP1A18		PWB mounting type	3.2	0.5	5	—	5	3	5	5	280	5
	GP1A19		Side mounting type	3.2	0.5	5	—	5	3	5	5	280	5
	GP1A20		PWB mounting type with cover case	3.0	0.5	9.5	—	5	3	5	10	280	5
	GP1A50HR		Both-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A51HR		Either-side mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A52HR		PWB mounting type	3.0	0.5	5	—	5	3	5	5	280	5
	GP1A53HR		PWB mounting type	5.0	0.5	8	—	5	3	5	8	280	5
	GP1A06		Two-phase digital output, both-side mounting type	3.0	2.5	—	15	*1 5	2	1	20	280	5
	GP1A18LR		PWB mounting type	3.2	0.5	—	5	5	5	3	5	280	5
	GP1A52LR		PWB mounting type	3.0	0.5	—	5	5	5	3	5	280	5
	GP1A18LC		PWB mounting type	3.2	0.5	—	5	*1 5	5	3	5	280	5

* Topr: −25 ~ +85°C (GP1A06: −20 ~ +85°C) *1 R_L = 280Ω

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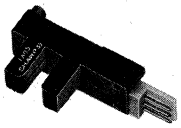
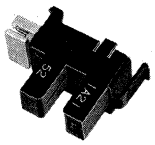
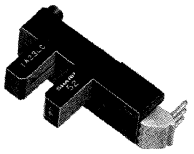
Photointerrupters



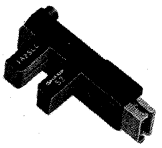
GP1A05
(GP1A05HR, GP1A31LC)



GP1A21

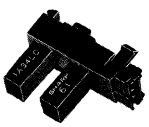


GP1A23LC

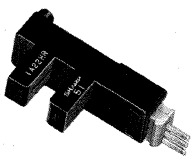


GP1A25LC

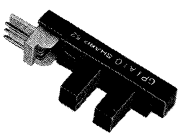
GP1A27LC



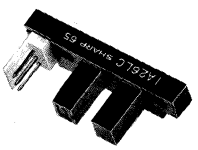
GP1A34LC



GP1A22HR
(GP1A22LC)



GP1A10

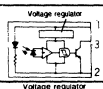
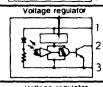
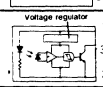
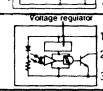
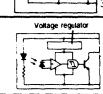
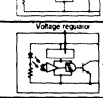
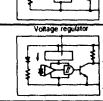
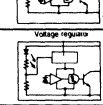


GP1A26LC

Transmissive Photointerrupters

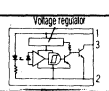
OPIC type with 3-pin connector terminal

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features		Detecting and emitting gap (mm)	Slit width or resolution (mm)	Electrical characteristics					
							Operating supply voltage Vcc (V)		Low level output voltage			
							MIN.	MAX.	V_{OL} (V) MAX.	Light cut-off	I_{OL} (mA)	Vcc (V)
OPIC	GP1A05		with 3-pin connector	Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A21			Snap-in mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A22LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A23LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A25LC			Either-side mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A27LC			Snap-in mounting type	5.0	0.5	4.5	5.5	0.35	No	16	5
	GP1A31LC			15V line, both-side mounting type	5.0	0.5	13.5	16.5	0.35	No	16	15
	GP1A34LC			Snap-in mounting type	5.0	0.8	4.5	5.5	0.4	No	2.5	5
	GP1A05HR			Either-side mounting type	5.0	0.5	4.5	5.5	0.4	Yes	16	5
	GP1A22HR				5.0	0.5	4.5	5.5	0.4	Yes	16	5
	GP1A10			24V line, both-side mounting type	5.0	0.5	21	26	0.6	No	16	24
	GP1A26LC				5.0	0.5	21	26	0.6	No	16	24

* Topr: −20 ~ +75°C (GP1A10, GP1A26LC: 0 ~ +80°C)

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Absolute maximum ratings		Electro-mechanical characteristics								
				Supply voltage V_{CC} (V)	Output current I_O (mA)	Actuator lever operating load	Low level output voltage V_{OL} (V)	Low level dissipation current I_{CCL} (mA)	High level output voltage V_{OH} (V)	High level dissipation current I_{CCH} (mA)	Response time t_H (μA)	Response time t_L (μA)	Response time R_L (Ω)	Response time V_{CC} (V)
OPIC	GP1A40		With lever type actuator With connector	7	50	0.5 or more	0.4 MAX.	3.0 MAX.	100×0.9 MIN.	30 MAX.	166 MIN.	166 MIN.	280	5

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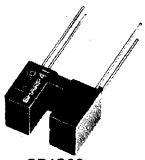
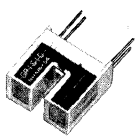
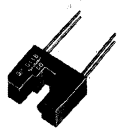
Photointerrupters

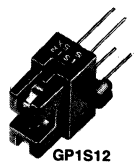
GP1S01
(GP1L01)

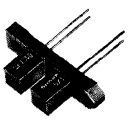
GP1S05
(GP1L06)

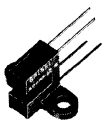

GP1S06

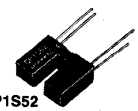

GP1S10

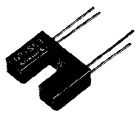

GP1S11

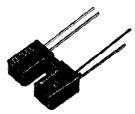

GP1S12
(GP1L12)

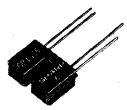

GP1S50
(GP1L50)


GP1S51
(GP1L51)


GP1S52
(GP1L52)


GP1S53
(GP1L53)


GP1S54
(GP1L54)


GP1S55
(GP1L55)

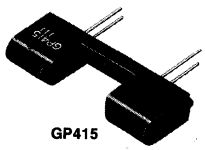
GP1S07
(GP1L07
GP1S18)

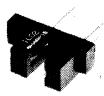
GP1S17

GP1S20

GP1S40

GP1S09

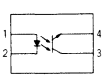
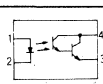

GP415


GP1L02

GP1L03

Transmissive Photointerrupters

(Ta = 25°C)

Type	Model No.	Internal connection diagram	Features	Detecting and emitting gap (mm)	Slit width or resolution (mm)	Electrical characteristics						
						Current transfer ratio			Response time			
						CTR (%) MIN.	I_F (mA)	V_{CE} (V)	tr (μS) TYP.	I_C (mA)	R_L (Ω)	V_{CE} (V)
Single transistor	GP1S01*1		High speed detecting, both-side mounting type	3.0	2.0	10	20	5	3	2	100	2
	GP1S05		High resolution, PWB mounting, wide gap	5.0	0.5	2.5	20	5	3	2	100	2
	GP1S06		High resolution, PWB mounting type	3.0	0.25	0.5	20	5	38	0.5	1,000	2
	GP1S10		With cover case	3.0	0.5	2	20	5	3	2	100	2
	GP1S11		Holder with lens	3.0	—	11.5	20	5	3	2	100	2
	GP1S12		PWB mounting type with positioning pin	3.5	2.0	10	10	5	3	2	100	2
	GP1S50		High resolution, both-side mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S51		High resolution, side-mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S52		High resolution, PWB mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S53		High resolution, PWB mounting type	5.0	0.5	2.5	20	5	3	2	100	2
	GP1S54		High resolution, PWB mounting type	3.0	0.5	2.5	20	5	3	2	100	2
	GP1S55		High resolution, PWB mounting type	2.0	0.15	3	20	5	5	2	100	2
	GP1S07		Compact, PWB mounting type	0.9	0.8	4.3	1.5	5	50	0.1	1,000	5
	GP1S21		With mounting hole	1.0	0.8	1.8	1.5	5	50	0.1	1,000	5
	GP1S17		Compact, PWB mounting type	2.0	0.8	1	3	5	50	0.1	1,000	5
	GP1S18		Compact, high resolution, PWB mounting type	0.9	0.3	1.6	1.5	5	50	0.1	1,000	5
	GP1S22		With mounting hole, high resolution	1.0	0.3	2	5	5	50	0.1	1,000	5
	GP1S20		With positioning pin, high resolution, PWB mounting type	1.1	0.3	1.6	1.5	5	50	0.1	1,000	5
	GP1S40		With lever type actuator & connector	—	—	2.5	20	5	3	2	100	2
	GP1S09		Snap-in mounting type with connector	5.0	0.8	2.5	20	5	3	2	100	2
Darlington transistor	GP415		Wide gap	13.2	2.5	5	20	24	500	2	100	2
	GP1L01*1		High sensitivity, both-side mounting type	3.0	2.0	300	1	2	80	10	100	2
	GP1L02		High sensitivity, either-side mounting type	4.2	2.0	20	10	2	130	10	100	2
	GP1L03		Wide gap, both-side mounting type	10.0	2.0	100	1	2	80	10	100	2
	GP1L06		High resolution, PWB mounting type	5.0	0.5	30	1	2	130	2	100	2
	GP1L12		PWB mounting type with positioning pin	3.5	2.0	300	1	2	80	10	100	2
	GP1L50		High resolution, both-side mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L51		High resolution, side-mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L52		High resolution, PWB mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L53		High resolution, PWB mounting type	5.0	0.5	30	1	2	130	2	100	2
	GP1L54		High resolution, PWB mounting type	3.0	0.5	50	1	2	80	2	100	2
	GP1L55		High resolution, PWB mounting type	2.0	0.15	30	2	2	80	2	100	2
	GP1L07		Compact, PWB mounting type	0.9	0.8	50	1	2	80	10	100	2
	GP1L21		With mounting hole	1.0	0.8	40	1	2	80	10	100	2
	GP1L22		With mounting hole high resolution	1.0	0.3	20	1	2	80	10	100	2

✻ Topr: −25~+ 85°C ★1 Built-in visible ligh cut-off filter type (F-type) is also available.

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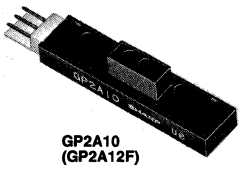
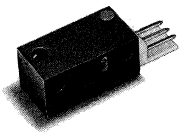
SHARP Optoelectronics

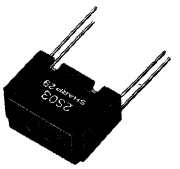
Photointerrupters

GP2A01

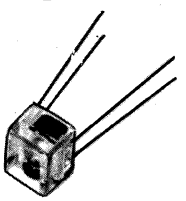

GP2A10 (GP2A12F)


GP2A11

GP2S01 (GP2L01)


GP2S03

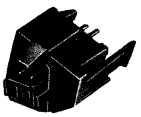
GP2S04 (GP2L04)

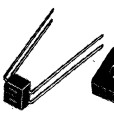

GP2S15

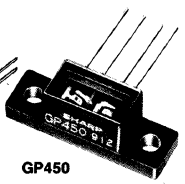
GP2S06 (GP2L06)

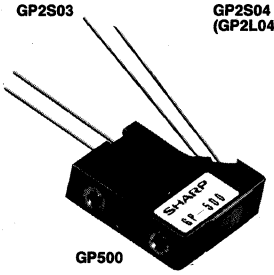
GP2S10

GP2S07


GP2S08D


GL2S09 (GP2L09)


GP450

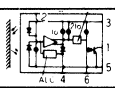
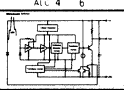
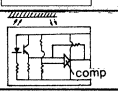
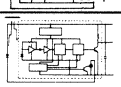

GP500

GP2L20(L)(R)

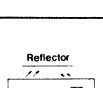
GP2S05

Reflective Photointerrupters

OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.

Type	Model No.	Internal connection diagram	Features	Optimum detecting distance	Electrical characteristics: Operating voltage Vcc (V) MIN.	Operating voltage Vcc (V) MAX.	Dissipation current Icc (mA) MAX.	Dissipation current Vcc (V)	Low level output voltage V_{OL} (V) MAX.	Low level output voltage Vcc (V)
OPIC	GP2A01		Built-in ALC circuit, low voltage drive	2	1.7	5.5	13	3	0.4	3
OPIC	GP2A11		Multiple types of paper detectable, light modulation type, with connector	2~7	4.5	5.5	✻ 100	5	0.4	5
OPIC	GP2A10		High accuracy, multiple types of paper detectable, with connector	2~7	4.5	5.5	50	5	0.4	5
OPIC	GP2A12F		Long focal distance, dust-proof visible light cut-off, detectable paper on platen, with connector	4~5	4.5	5.5	50	5	0.4	5

✻ Topr: −25~+70°C

Type	Model No.	Internal connection diagram	Features	Focal distance (mm)	Electrical characteristics: Current transfer ratio CTR (%) MIN.	I_F (mA)	V_{CE} (V)	Response time tr (μs) TYP.	Ic (mA)	R_L (Ω)	V_{CE} (V)
Single transistor	GP2S01*1	Reflector	High speed detection	5	1	20	5	30	0.2	1,000	2
Single transistor	GP2S03		Compact, visible light cut-off	5	0.8	20	5	30	0.2	1,000	2
Single transistor	GP2S04		Compact (DIP), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
Single transistor	GP2S05		Compact (DIP), with lens visible light cut-off	4	0.5	20	5	20	0.1	1,000	2
Single transistor	GP2S15		Compact (DIP), with lens visible light cut-off type. Long lead	4	0.5	20	5	20	0.1	1,000	2
Single transistor	GP2S06		Compact (flat package), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
Single transistor	GP2S10		Compact (Short lead flat package) visible light cut-off type	1	0.5	4	2	20	0.1	1,000	2
Single transistor	GP2S07		Compact (mini-mold type), visible light cut-off	1	0.5	4	2	20	0.1	1,000	2
Single transistor	GP2S08D		With spacer, visible light cut-off	1	0.85	4	2	20	0.1	1,000	2
Single transistor	GP2S09		Compact (DIP), longer lead version of GP2S04	1	0.5	4	2	20	0.1	1,000	2
Single transistor	GP500		For detecting 0.3mm width penciled mark	1±0.2	0.0016	50	Vcc=10	150	I_F=50	10,000	Vcc=10
Darlington transistor	GP450*1	Reflector 	General purpose	3	5	20	2	130	10	100	2
Darlington transistor	GP2L01*1		High sensitivity	5	30	10	2	80	10	100	2
Darlington transistor	GP2L04		Compact (DIP), visible light cut-off	1	12.5	4	2	80	10	100	2
Darlington transistor	GP2L06		Compact (flat package), visible light cut-off	1	12.5	4	2	80	10	100	2
Darlington transistor	GP2L09		Compact (DIP), longer lead version of GP2L04	1	12.5	4	2	80	10	100	2
Darlington transistor	GP2L20(L)(R)		Prism system conformable type DAT tape-end detection	—	5	20	5	80	2	100	2

✻ Topr: −25~+85°C (GP500: −10~+60°C) *1 Built-in visible light cut-off filter type (F-type) is also available.

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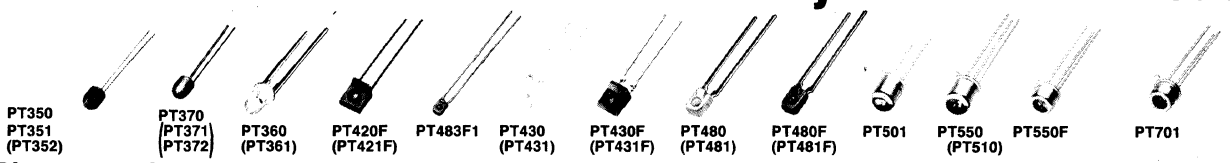
Phototransistors/ Photothyristors/Photodiodes



Phototransistors

(Ta = 25°C)

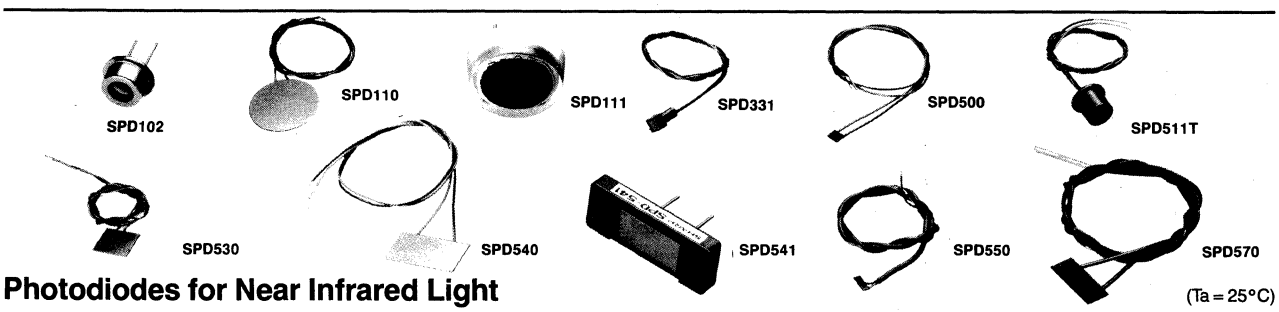
Model No.	Package	Absolute maximum ratings V_{CEO} (V)	Pc (mW)	Topr (°C)	Ic (mA) MIN.	TYP.	V_{CE} (V)	Ee (mW/cm²)	I_{CEO} (A) MAX.	V_{CE} (V)	$\Delta\theta$ (deg.) TYP.	λP (nm) TYP.
PT350	φ3 ceramic	20	50	−25 ~ +100	0.04	—	5	100 lx	1×10^{-7}	20	±28	800
PT351		20	50	−25 ~ +100	0.035	—	5	100 lx	1×10^{-7}	20	±50	800
PT352		35	50	−25 ~ +100	3	—	2	100 lx	1×10^{-6}	10	±50	800
PT370	φ3 resin stem	35	75	−25 ~ + 85	0.1	0.3	5	100 lx	1×10^{-7}	20	±45	800
PT371		35	75	−25 ~ + 85	0.1	—	5	100 lx	1×10^{-7}	20	±65	800
PT372		35	75	−25 ~ + 85	3	—	2	100 lx	1×10^{-6}	10	±70	800
PT360	φ3 resin	35	50	−25 ~ + 85	0.075	0.2	5	100 lx	1×10^{-7}	20	±20	800
PT361		35	50	−25 ~ + 85	0.1	0.2	10	2 lx	1×10^{-6}	10	±20	800
PT420F*1	Resin with lens	35	75	−25 ~ + 85	0.4	—	5	1	1×10^{-7}	20	±40	860
PT421F*1		35	75	−25 ~ + 85	0.8	—	2	0.1	1×10^{-6}	10	±40	860
PT483F1*1		35	75	−25 ~ + 85	1.5	—	2	0.1	1×10^{-6}	10	±13	860
PT430		35	75	−25 ~ + 85	0.4	1.7	5	1	1×10^{-7}	20	±13	800
PT430F*1		35	75	−25 ~ + 85	0.25	0.8	5	1	1×10^{-7}	20	±13	860
PT431		35	75	−25 ~ + 85	2	10.0	2	0.1	1×10^{-6}	10	±13	800
PT480		35	75	−25 ~ + 85	0.4	1.7	5	1	1×10^{-7}	20	±13	800
PT480F*1		35	75	−25 ~ + 85	0.25	0.8	5	1	1×10^{-7}	20	±13	860
PT481		35	75	−25 ~ + 85	1.5	10	2	0.1	1×10^{-6}	10	±13	800
PT481F*1		35	75	−25 ~ + 85	0.9	—	2	0.1	1×10^{-6}	10	±13	860
PT431F*1		35	75	−25 ~ + 85	1.3	8.0	2	0.1	1×10^{-6}	10	±13	860
PT501	TO-18	45	75	−25 ~ +125	2.5	10	5	10	1×10^{-7}	30	± 6	800
PT510		35	75	−25 ~ +125	2.5	20.0	5	10	1×10^{-7}	30	± 6	800
PT550		35	150	−25 ~ +125	3	20.0	5	0.1	1×10^{-6}	10	± 6	800
PT550F		35	150	−25 ~ +125	3	20.0	5	1	1×10^{-6}	10	±50	800

★1 Visible light cut-off type

Photothyristor

(Ta = 25°C)

Model No.	Package	Absolute maximum ratings I_T (Arms)	Isurge (A)	V_{DRM} (V)	Topr (°C)	I_{DRM} (A) MAX.	I_{RRM} (A) MAX.	V_T (V) MAX.	V_{GT} (V) TYP.	I_{GT} (μA) TYP.	H_T (mW/cm²) MAX.	t_{on} (μs) TYP.	$\Delta\theta$ (deg.) TYP.
PT701	TO-18	0.2	2	400	−20 ~ +100	10^{-4}	10^{-4}	1.2	0.6	35	45	10	±40



Photodiodes for Near Infrared Light

(Ta = 25°C)

Model No.	Features	Package material	Element dimension (mm)	Active area (mm²)	Topr (°C)	I_{SC} (μA) MIN.	V_{OC} (V) MIN.	E_V (lx)	Id (A) TYP.	V_R (V)	λp (nm) TYP.
SPD102	Mesa type	Metal	—	44.0	−10 ~ +70	238	0.35	1,000	—	—	850
SPD110		—	20.0DIA	314	−10 ~ +70	1,737	0.35	1,000	—	—	850
SPD111		Acryl resin	—	314	−10 ~ +70	1,600	0.35	1,000	—	—	850
SPD331		ABS (Black)	—	9.0	−10 ~ +70	48	0.35	1,000	—	—	850
SPD500		—	3.0 × 4.5	13.5	−10 ~ +70	75	0.35	1,000	—	—	850
SPD511T		ABS (Black)	—	20.25	−10 ~ +70	112	0.35	1,000	—	—	850
SPD530		—	10.0 × 10.0	100	−10 ~ +70	553	0.35	1,000	—	—	850
SPD540		—	10.0 × 20.0	200	−10 ~ +70	1,105	0.35	1,000	—	—	850
SPD541		Phenol resin (Black)	—	200	−10 ~ +70	995	0.35	1,000	—	—	850
SPD550		—	2.0 × 5.0	10.0	−10 ~ +70	58	0.35	1,000	—	—	850
SPD570		—	4.0 × 10.0	40.0	−10 ~ +70	221	0.35	1,000	—	—	850

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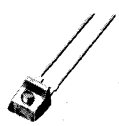
Photodiodes

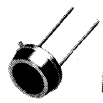
PD41PI


PD43PI

PD49PI (PD481PI)

PD410PI

PD50PI


PD80PI

PD142PI

PD161PI
PD164PI, PD167PI
PD563PI, PD564PI
PD565PI, PD566PI

PD168PI

PD322PI

PIN Photodiodes

Model No.	Features	Package (Material)	Active area (mm^2)	Topr (°C)	Isc (μA) MIN.	E_v (lx)	Id (A) MAX.	V_R (V)	t_r, t_f (μs) MAX.	V_R (V)	R_L (kΩ)	λp (nm) TYP.
PD43PI	PIN type	Transparent epoxy resin	0.53	−25 ~ + 85	1.0	100	1×10^{-8}	10	0.1	10	1	920
PD45PI		Transparent epoxy resin	1.15	−25 ~ + 80	11.5	1,000	3×10^{-8}	5	0.14	5	1	920
PD49PI*1		Visible light cut-off resin	7.73	−25 ~ + 85	2.4	100	3×10^{-8}	10	—	—	—	1,000
PD410PI*1		Visible light cut-off resin with condensor	3.31	−25 ~ + 85	2.5	100	1×10^{-8}	10	0.2	10	1	1,000
PD481PI*1		Visible light cut-off resin	7.73	−25 ~ + 85	3.5	100	3×10^{-8}	10	—	—	—	960
PD50PI		TO-18	0.96	−30 ~ + 100	4	1,000	1×10^{-7}	30	0.08	30	1	700
PD80PI		TO-5	4.39	−30 ~ + 100	18	1,000	1×10^{-8}	10	0.2	30	1	700
PD142PI	4 divisions on a chip for CD player	Transparent epoxy resin	0.25 × 4	−40 ~ + 80	1.2	1,000	1×10^{-9}	15	0.1	10	1	800
PD161PI	6 divisions on a chip for CD, VD players	Transparent epoxy resin	0.16 × 2(A)* 0.04 × 4(B)	−25 ~ + 80	0.8(A) 0.2(B)	1,000	2×10^{-10}(A) 1×10^{-10}(B)	15	0.09	10	1	800
PD164PI			0.032 × 2(A)*3 0.0062 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.09	10	1	800
PD167PI			0.032 × 2(A)*4 0.0062 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.09	10	1	800
PD168PI			0.032 × 2(A)*3 0.0062 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.09	10	1	800
PD563PI	Focus light detecting separation bandwidth .5μm		0.032 × 2(A)*3 0.007 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.22(A) 0.12(B)	15	0.18	800
PD564PI			0.032 × 2(A)*3 0.007 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.22(A) 0.12(B)	15	0.18	800
PD565PI			0.032 × 2(A)*3 0.04 × 4(B)	−25 ~ + 80	0.25(A) 0.045(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.22(A) 0.12(B)	15	0.18	800
PD566PI			0.032 × 2(A)*3 0.007 × 4(B)	−25 ~ + 80	0.25(A) 0.06(B)	1,000	3×10^{-10}(A) 2×10^{-10}(B)	15	0.22(A) 0.12(B)	15	0.18	800
PD322PI	2 divisions on a chip for auto focus	Transparent epoxy resin	1.71 × 2	−25 ~ + 80	1.2	100	2×10^{-8}	10	0.07	10	1	980

★1 Visible light cut-off filter is built-in.

★2 (A)···1, 5 (B)···2,3,6,7

★3 (A)···1,5 (B)···3,4,7,8

★4 (A)···3, 7 (B)···1,4,5,8

★ (OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

Semiconductor Color Sensors

(Ta = 25°C)

Model No.	Package	Topr (°C)	Isc_1 (μA) TYP.	Isc_2 (μA) TYP.	λ (nm)	Ee (μW/cm²)	Isc_2 / Isc_1 TYP.	λ (nm)	Id_1, Id_2 (A) MAX.	V_R (V)	V_{R1}, V_{R2} (V) MIN.	I_R (μA)
PD150	TO-18	0 ~ + 70	0.75	0.19	600	50	0.25	600	1×10^{-8}	1	5.0	1
PD151*2	TO-18	0 ~ + 70	0.65	0.16	600	50	0.25	600	1×10^{-8}	1	5.0	1
PD152	Resin with lens	−25 ~ + 80	1.3	2.5	—	1,000	0.25	600	1×10^{-8}	1	5.0	1
PD153	TO-18	−15 ~ + 70	4.5	10.0	—	1,000	0.24	600	1×10^{-8}	1	5.0	1

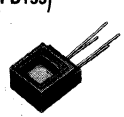
PD150
(PD151
PD153)

PD152

★2 Infrared light cut-filter is built-in.

(Ta = 25°C)

Model No.	Package	Topr (°C)	Isc_R (μA) TYP.	Isc_G (μA) TYP.	Isc_B (μA) TYP.	CIE, A (lx)	TYP. (nm) λp (R)	Δλ (R)	λp (G)	Δλ (G)	λp (B)	Δλ (B)
PD170V1	Resin	−10 ~ + 60	0.38	0.30	0.32	1,000	600	70	530	85	460	80


PD170V1

SBC102

SBC111

SBC255

SBC541

BS112

BS142

BS530UV

BS500A
BS500B
(with filter)

BS100C
(with filter)
BS100D

BS120
(with filter)

BS520
(with filter)
BS521
(with filter)

Blue-sensitive Photodiodes

(Ta = 25°C)

Model No.	Features	Package (material)	Active area (mm^2)	Topr (°C)	Isc (μA) MIN.	V_{OC} (V) MIN.	E_v (lx)	Id (A) MAX.	V_R (V)	λp (nm) TYP.
SBC102	Convert type	Metal	44.0	−10 ~ + 70	15.5	0.18	100	—	—	750
SBC111		Acryl resin	314	−10 ~ + 70	110	0.18	100	—	—	750
SBC255		—	12.5(*32.5 × 5.0)	−10 ~ + 70	4.4	0.18	100	—	—	750
SBC541		Phenol resin (Black)	200	−10 ~ + 70	70.00	0.18	100	—	—	750
BS112	Planar convert type	TO-5	11.9	−10 ~ + 60	5.5	0.25	100	1×10^{-7}	1	800
BS142		TO-8	41.8	−10 ~ + 60	18	0.25	100	1×10^{-7}	1	800
BS530UV		Ceramic	81.0	−10 ~ + 60	35	0.30	100	5×10^{-8}	1	800
BS500A	Planar type	Ceramic	5.34	−10 ~ + 60	3.3	—	100	2×10^{-9}	2	850
BS500B			5.34	−20 ~ + 60	0.4	—	100	1×10^{-11}	1	560
BS100C			1.55	−20 ~ + 60	0.14	—	100	1×10^{-11}	1	560
BS100D			1.55	−10 ~ + 60	0.80	—	100	1×10^{-10}	1	880
BS120		Resin (Black)	1.55	−20 ~ + 60	0.14	—	100	1×10^{-11}	1	560
BS520			5.34	−20 ~ + 60	0.40	—	100	1×10^{-11}	1	560
BS521			5.34	−20 ~ + 60	0.65	—	100	3×10^{-12}	0.01	560

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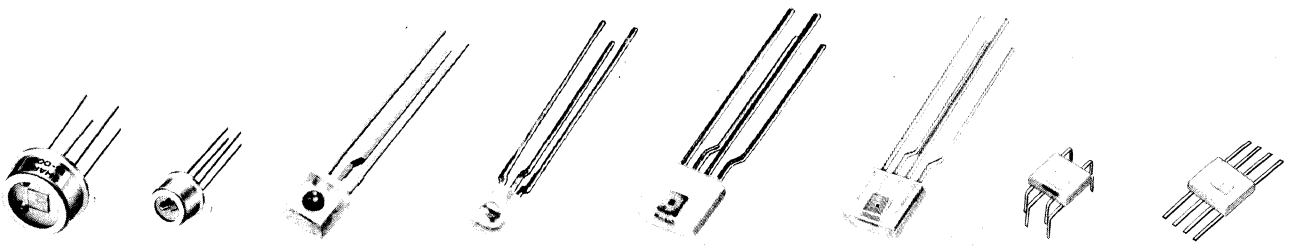
SHARP Optoelectronics

OPICs/OPIC Light Detectors



IS006 IS206 IS435 (IS436, IS438) IS486 IS440 IS441F IS450 IS1601

OPICs

(Ta = 25°C)

Model No.	Constitution of elements		Package	Log. diode				N channel dual MOS FET					
	Log. diode	MOS FET		*3V_R (V)	V_F (V) TYP.	ΔV_{FS} (mV) TYP.	I_R (pA) TYP.	*3V_{GSS} (V)	I_{GSS} (A) MAX.	V_P (V) TYP.	I_{DSS} (mA) TYP.	gm (mΩ) TYP.	ΔI_{DSS} (μA) TYP.
IS001*1	—	1	TO-5	—	—	—	—	±100	$1X10^{-12}$	−1.5	1.5	2	20
IS002*2	1	—	TO-18	50	0.55	2	0.5	—	—	—	—	—	—
IS003*3	2	—	TO-18	50	0.55	2	0.5	—	—	—	—	—	—
Test Conditions				—	$I_F = 10^{-5}$A	$I_F = 10^{-8} \sim 10^{-11}$A	V_R = 3V	—	V_{GS} = 3V	V_{DS} = 10V I_{DS} = 10μA	V_{DS} = 10V V_{GS} = 0V	V_{DS} = 10V V_{GS} = 0V	V_{DS} = 10V

★ 1 Topr: −20 ~ +75°C ★ 2 Topr: −25 ~ +100°C ★ 3 Absolute maximum ratings

OPIC Light Detectors

(OPIC is a registered trademark of Sharp and stands for Optical IC. It has a light detecting element and peripheral circuits integrated onto one chip.)

(Ta = 25°C)

Model No.	Function	Package	Absolute maximum ratings		V_{OH} (V) MIN.	E_{DS} (lx)	V_{OL} (V) TYP.	E_V (lx)	Light sensitivity*4					Light input range (lx)	λp (nm) TYP.
			V_{CC} (V)	P (mW)					E_{VLH} (lx) TYP.	E_{VHL} (lx) TYP.	V_{CC} (V)	R_L (Ω)	R_C (MΩ)		
IS006	ON-OFF operation according to luminosity	TO-5	15	500	11.9	1,000	0.3	MAX.1	60	50	12	300	∞	20 ~ 1,000	650
IS206		TO-18	20	170	11.8	0	0.3	1,000	25	30	12	5,000	0.3	20 ~ 1,000	750

★ 4 Threshold luminosity is variable in a wide range by means of external resistor.

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	E_{VLH} (lx) MAX.	E_{VHL} (lx) MAX.	V_{CC} (V)	t_{PLH} (μS) TYP.	t_{PHL} (μS) TYP.	V_{CC} (V)	E_V (lx)	R_L (Ω)
IS435	Built-in schmitt trigger circuit, amplifier and voltage regulator.	Resin with lens	$-0.5 \sim +17$	250	50	−25 ~ +85	—	35	5	5	3	5	50	280
IS436			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS438			$-0.5 \sim +35$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280
IS486			$-0.5 \sim +17$	250	50	−25 ~ +85	35	—	5	3	5	5	50	280

(Ta = 25°C)

Model No.	Features	Package	Absolute maximum ratings				Electro-optical characteristics						
			V_{CC} (V)	P (mW)	I_{OL} (mA)	Topr (°C)	V_{OL} MAX. (V)	V_{OH} MIN. (V)	t_{PLH} MAX. (μS)	t_{PHL} MAX. (μS)	V_{CC} (V)	R_L (Ω)	External distributing light illuminance E_V(lx)
IS440	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	$-0.5 \sim +16$	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP.
IS441F	Pulse drive circuit and sync. detection circuit are built-in in the light emitting side	Transparent epoxy resin	$-0.5 \sim +16$	250	50	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	4,500 TYP.
IS450	Built-in amp circuit, sync, signal circuit and modification circuit	Epoxy resin	$-0.5 \sim +9$	150	16	−25 ~ +60	0.35	4.97	670	670	4.5 ~ 16	280	7,200 TYP.

(Ta = 25°C)

Model No.	Type	Package	Absolute maximum ratings				Electro-optical characteristics							
			V_{CC} (V)	P (mW)	V_O* (V)	Topr (°C)	Sensitivity Rp (mV/μW) TYP.			Response frequency fc (MHz) TYP.			R_L (KΩ)	C_L (PF)
							$V_A+B+C+D$	V_A+C V_B+D	V_E, V_F	$V_A+B+C+D$	V_A+C V_B+D	V_E, V_F		
IS1601	OPIC light detector Separation bandwidth at focus light detector portion 5μM	Transparent epoxy resin	$-0.5 \sim +7$	100	$-0.5 \sim +7$	−25 ~ +80	4	6	12	20	1	1	1	10

For Infrared LED's, please refer to Section 4800, page A•2142.

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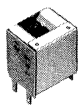
SHARP Optoelectronics

Light Detecting Units/ Automatic White Balance Modules/ Humidity Sensor/Counter Modules

GP1U50X series
GP1U51X series



GP1U52X series

GP1W01
(GP1W02)

GP1W03

Light Detecting Units for Remote Controller

(Ta = 25°C)

Model No.	Absolute maximum ratings			Electrical characteristics				Remarks
	Vcc (V)	Tstg (°C)	Topr (°C)	Icc(mA) MAX.	V_{OH}(V) MIN.	V_{OL}(V) MAX.	fo(kHz) TYP.	
GP1U50X series	6.3	−20 ~ +70	−10 ~ +60	5	Vcc−0.5	0.45	40	In addition, models with fo = 38, 36.7, 32.75, 41.7, 48, 57, and 39kHz are available. Also a 90° foldable type of lead frame (Y type) is available.
GP1U51X series	6.3	−20 ~ +70	−10 ~ +60	5	Vcc−0.5	0.45	40	
GP1U52X series	6.3	−20 ~ +70	−10 ~ +60	5	Vcc−0.5	0.45	40	
GP1U52Y series	6.3	−20 ~ +70	−10 ~ +60	5	Vcc−0.5	0.45	40	

Automatic White Balance Modules

(Vcc = 5V, Ta = 25°C, R_L = 5kΩ)

Model No.	Absolute maximum ratings			Electrical characteristics									
				*1 Vo (V)				*1 Vo (V)				Tp (sec.) MAX.	*2 *3
	Vcc (V)	Topr (°C)	Tstg (°C)	MIN.	MAX.	Tc (K)	Ev (lx)	MIN.	MAX.	Tc (K)	Ev (lx)		
GP1W01	+7	−10 ~ +60	−40 ~ +70	1.75	1.85	3,200	1,000	2.17	2.27	6,750	1,000	1.0	*4
GP1W02	+7	−10 ~ +50	−40 ~ +70	1.73	1.87	3,200	1,000	2.15	2.29	6,750	1,000	0.5	*5

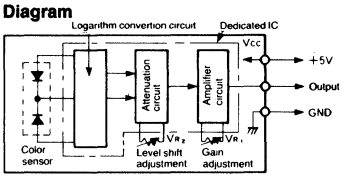
High Performance Automatic White Balance Module

(Vcc = 5V, Ta = 25°C, R_L = 1000kΩ)

Model No.	Absolute maximum ratings			Electrical characteristics			
				Output voltage (1)	Output voltage(2)		Dissipation current
	Vcc (V)	I_O(R,G,B) (mA)	Topr (°C)	V_O(R,G,B) (V) TYP.	ΔV(B−G) (mV) TYP.	ΔV(G−R) (mV) TYP.	Icc (mA) MAX.
GP1W03	0 ~ +7	−0.5 ~ +0.15	−10 ~ +50	1.65	100	150	6

*1 Vo can be set at the rating value by adjusting VR1 and VR2 under the light source with color temperatures of Tc = 3,200K and Tc = 6,750K, respectively.
*2 Characteristics with VR1, and VR2 adjusted to the condition noted in *1
*3 Absolute output voltage fluctuating according to the load resistance against the output voltage when R_L = 5kΩ (pull down).
*4 When the value of Tc is changed from 2,856K (1,000 lx) to 6,750k (1,000 lx)
*5 The time it takes to reach 90% of the output voltage of 6,750K when incident light color temperature changes from Tc = 2,856K to Tc = 6,750K.

Block Diagram



Humidity Sensor Module

If not specified Vcc = 5.0V, V_{IN} = 5.0Vp-p
Ta = 25 C (short wave 1kHz, Duty ratio 0.5)

(Ta = 25°C)

Model No.	Output	Absolute maximum ratings			Electrical characteristics				
					t_{PLH}, t_{PHL}			Hysterisis characteristics	
		Vcc (V)	Topr*6 (°C)	Hopr (%RH)	(sec) TYP.	RH(%)	Wind velocity (m/sec)	(%RH) TYP.	RH (%)
OR05HM1	10	7	−10 ~ +50	10 ~ 95	120	30 ⇄ 90	0.01 or less	±3.0	40 ~ 70

*6 No dewing

Counter Modules

S8029 SERIES

S8045/S8054 SERIES

Model No.	Display device	Character height (mm)	Module size (mm)	Vcc (V)	Functions					
					Counter range	Up/down switching	Counter reset	Zero detection	Tape-end detection	Memory stop
S8029 series	LCD	5.4	16x42x6.5	3.0	0 ~ 9999	○	○	*8○		○
S8045 series*7	LCD	3.0	15x22x3.5	3.0	0 ~ 9999	○	○	*8○		○
S8054 series*7	LCD	3.0	15x22x3.5	3.0	0 ~ 9999	○	○	*9○		

*7 Two indicaton-display systems *8 S80△ △ A, S80△ △ C, S80△ △ E, and S80△ △ G(△ △: 29 or 45) with Zero detection
*9 Zero detection ON-OFF switchable

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CdS/CdSe PHOTOCONDUCTIVE CELLS • OPTICALLY COUPLED ISOLATORS • SILICON PHOTODIODES AND PHOTODIODE ARRAYS • CUSTOMIZED OPTOELECTRONIC ASSEMBLIES

CdS & CdSe PHOTOCELLS

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt.	Max. Power mW.	Description
NSL-3120	75	100	70	50	CdSe Photoconductive Cell in Hermetic Glass and Metal TO-18. CdS versions also available.
NSL-3130	30	100	70	50	
NSL-3140	14	100	70	50	
NSL-3150	550	1000	250	50	
NSL-3160	260	1000	250	50	
NSL-3170	110	1000	250	50	
NSL-3180	50	500	120	50	
NSL-3812	43	10	80	100	CdSe Photoconductive cell in TO-5 plastic coated "open pill" package. Also available in CdS material.
NSL-3822	18.6	10	80	100	
NSL-3832	8	10	80	100	
NSL-3842	3.5	10	80	100	
NSL-3852	330	100	320	100	
NSL-3862	155	100	320	100	
NSL-3872	66	100	320	100	
NSL-4440	120	50	1000	1000	1" CdS Photoconductive Cell in Hermetic Glass and Metal case 1.25" diameter.
NSL-4450	26.0	15	1000	1000	
NSL-4460	11.4	5	1000	1000	
NSL-4470	5.5	0.5	1000	1000	
NSL-4442	120	10	1000	500	1" CdS Photocoductive Cell in plastic coated "open pill" package.
NSL-4452	26	1.5	1000	500	
NSL-4462	11.4	0.5	1000	500	
NSL-4472	5.5	0.2	1000	500	
NSL-4610	65	80	80	100	CdS Photoconductive Cell in Hermetic Glass and Metal ¼" dia. case. Hermetic CdSe versions also available.
NSL-4620	28	20	80	100	
NSL-4630	12	2.7	80	100	
NSL-4640	5.2	0.7	80	100	
NSL-4650	550	160	250	100	
NSL-4660	230	20	250	100	
NSL-4670	100	4	250	100	
NSL-2930	1.7	0.5	80	500	TO-8 Hermetic CdS/Se Photoconductive Cell.
NSL-2940	.75	0.1	80	500	
NSL-2970	7.5	5.0	250	500	
NSL-3921	4.0	2	80	200	TO-8 CdSe Photoconductive Cell in Plastic Case. Glass Lens and Plastic Coated "open pill" and CdS versions also available.
NSL-3931	1.7	2	80	200	
NSL-3941	0.75	2	80	200	
NSL-3951	40.0	5	320	200	
NSL-3961	17.0	5	320	200	
NSL-3971	7.5	5	320	200	
NSL-4920	4.0	2.0	80	500	CdS Photoconductive Cell in Hermetic Glass and Metal TO-8. Hermetic CdSe version also available.
NSL-4930	1.7	0.4	80	500	
NSL-4940	0.75	0.05	80	500	
NSL-4950	40	30	320	500	
NSL-4960	17	4.0	320	500	
NSL-4970	7.5	0.5	320	500	
NORP-11	20	2.5	320	250	CdS Photocell in 0.5" lensed Plastic case.
NORP-12	9	1	320	250	
NORP-13	4	0.5	320	250	
NSL-4510	43.0	65	120	100	CdS Photoconductive cell in Hermetic TO-5 package. Two plastic encapsulated versions also available.
NSL-4520	18.6	15	120	100	
NSL-4530	8	1.8	120	100	
NSL-4540	3.5	0.25	120	100	
NSL-4550	330	200	320	100	
NSL-4560	155	130	320	100	
NSL-4570	65	20	320	100	

UV SENSITIVE LDRs

Cell Type No.	Typical 1.0 Ftc Res. KΩ	Min. Dark Res. MΩ	Max. Peak Volt	Max. Power MW	Description
NSL-2129/3	1.7	0.2	80	200	0.5" Plastic Case with Phosphor-Coated Quartz Window
NSL-2129/6	17.0	1	320	200	

PIN PHOTODIODES

NSL Type No.	Light Current* MA	Dark Current nA	Rise Time nS	Fall Time nS	Description
NSL-530	0.3	10	3	6	TO-18 Package
NSL-580	1.5	30	5	8	TO-5

* At 500 Ftc (25 MW/cm²) 2870°K Source

PHOTODETECTOR LAMP/LED ASSEMBLIES

CdSe Photodetector

Module Type No.	Emitter Volts	Emitter Current MA	Detector Max. ON Res. Ω	Detector Min. OFF Res. MΩ	Detector Max. Volts	Detector Max. Power mW	Description
PL-1033-1	10	15	100	10	80	250	Phenolic .75" x .75" x 625" Pin Leads for P.C. Board Mounting, (Matched, Multi-Detector Configurations available.)
PL-1036-1	10	15	400	50	320	250	
PL-2H33-1	200	2	100	10	80	250	
PL-2H36-1	200	2	400	50	320	250	
PL-5S33-1		25	250	10	80	250	
PL-5S36-1		25	2000	100	320	250	
PLT-10384	10	15	250	10	80	100	Standard tube: Axial leads.
PLT-10387	10	15	3000	50	320	100	
PLT-2H384	200	2	500	10	80	100	
PLT-2H387	200	2	10000	50	320	100	
PLS-5S380		25	250	10	80	100	Small tube; Axial leads.
PLS-5S387		25	4000	100	320	100	
PLM-5S310		25	500	10	80	50	Miniature Tube; Axial leads.
PLM-5S317		25	5000	100	320	50	

SILICON PHOTODIODES

Cell Type No.	Min. Short Ct.* Curr. MA	Min. Open Ct.* Volt.	Dark Curr. μA @ IV @ 25°C	Reverse Voltage Recom. Max.	Description
NSL-701-1	0.30	0.35	3	5	.1 " x .2"Chip. Wire Leads
NSL-801-1	0.325	0.275	1.5	10	
NSL-701-9	0.30	0.35	3	5	9 Element Cell, 0.1" Spacing
NSL-702	0.6	0.35	5	5	.2" x .2* Chip. Wire Leads
NSL-802	0.65	0.275	2.5	10	
NSL-703	1.4	0.35	15	5	.2" v .4" Chip. Wire Leads
NSL-803	1.5	0.275	7.5	10	
NSL-705	4.5	0.35	25	5	.76" x .354" Chip. Wire Leads
NSL-805	4.77	0.275	12.5	10	
NSL-706	2.9	0.35	20	5	.4" x .4" Chip. Wire Leads
NSL-806	3.0	0.275	10	10	
NSL-707	3.3	0.35	25	5	.2" x 1" Chip. Wire Leads
NSL-807	3.5	0.275	12.5	10	
NSL-708	1.3	0.35	15	5	.1" x 1" Chip. Wire Leads
NSL-808	1.4	0.275	7.5	10	
NSL-710	0.125	0.4	1	5	TO-18 Package
NSL-810	0.150	0.275	0.5	10	
NSL-751	1.4	0.35	2.0	5	0.5" dia. Epoxy Package
NSL-851	1.5	0.275	10	10	
NSL-781	0.28	0.35	5	5	Hermetic TO-5 Case
NSL-881	0.3	0.275	2.5	10	
NSL-782	0.42	0.35	5	5	
NSL-791	0.60	0.35	5	5	Hermetic TO-8 Case
NSL-792	1.1	0.35	15	5	
NSL-8932	0.65	0.275	0.5	10	0.5" dia. Ceramic
NSL-6136	100.0	.38	3	5	.05" x .125" Chip.
NSL-6122	110.0	.33	2	10	.05" x .125" Chip.
NSL-6134	150.0	.40	3	5	.130" x .150" Dual Chip.

* At 500 Ftc (25 MW/cm²) 2870°K Source

SILICON PLANAR PHOTODETECTORS

Cell Type No.	Min. Short Ct.* Curr. μA	Min. Open Ct.* Volt.	Dark Curr. NA @ 5V @ 25°C	Break-down Voltage (V)	Description
NSL-811	100	0.4	5	40	TO-18, Flat Window
NSL-812	310	0.4	5	40	TO-18, Low Lens
NSL-813	220	0.4	5	40	TO-18, High Lens
NSL-814	90	0.4	5	40	TO-52, Flat Window
NSL-815	240	0.4	5	40	TO-52, Low Lens
NSL-883	360	0.4	10	20	TO-5, Flat Window
NSL-893	800	0.4	20	10	TO-8, Flat Window

* At 500 Ftc, 2870°K Source

NSL-811 and NSL-883 are available in dual and quad versions in TO-5 and TO-8 packages.

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See EEM Pages B-1333-1341.

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FUSES

Manufacturer	Starting EEM Page No.	Normal Action	Slow Blowing	Fast Action	Failure Indicating	Rectifier	Miniature & Submin.	Clips & Holders	UL	CSA	SEMKO	MIL
Atlee	B•1300							¤				¤
Bel Fuse	B•1302	¤	¤	¤	¤		¤	¤	¤	¤	¤	
FIC Corporation	B•1314				¤			¤	¤	¤		¤
Littelfuse	B•1319											
Micro Devices	B•1343	¤										
Panel Components	B•1344		¤	¤			¤	¤			¤	

CIRCUIT BREAKERS, LIMITERS, SUPPRESSORS

Manufacturer	Starting EEM Page No.	Circuit Breakers	Limiters/ Protectors, Surge	Suppressors, Transient Voltage	Data Line Protectors	UL	CSA	Semko	MIL
Airpax	B•1298	¤				¤	¤	¤	¤
Atlantic Scientific	B•1299			¤	¤	¤			
Carlingswitch	B•1306	¤				¤	¤		
E-T-A Circuit Breakers	B•1311	¤				¤	¤	¤	
Heinemann Electric	B•1315	¤				¤	¤		¤
MCG Electronics	B•1327		¤	¤	¤				¤
Mechanical Products	B•1342	¤				¤	¤		¤
Micro Devices	B•1343		¤						
Perma Power	B•1346			¤		¤			
PolyPhaser	B•1347		¤	¤	¤				
Potter & Brumfield	B•1348	¤				¤	¤	¤	
Raychem Corp.	B•1349	¤	¤	¤					
Siemens Components	B•1350		¤	¤					
USD Products	B•1352	¤							

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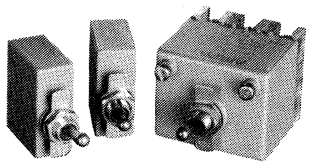
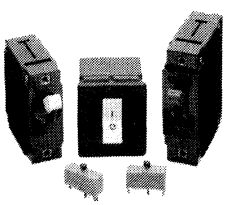


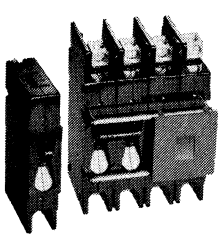
Models AP and UP**

Hermetically sealed. DC, 50/60 Hz or 400 Hz versions. Various delays to meet your needs. UP version has wide glass terminals.
Specifications: 1 to 3 poles. Ratings: 0.05-20A, 240 VAC, 50 VDC. Interrupting capacity: AP MIL 500A @ 120 VAC, 50 VDC; 300A @ 240 VAC. UP 1000A @ 32 VDC, 240 VAC.
Approval: Ⓒ Ⓛ Ⓤ QPL: MIL-C-39019 Lloyds
**(UP, single pole, series only)



Models SNAPAK®, CARDGARD®, IEG and IEL

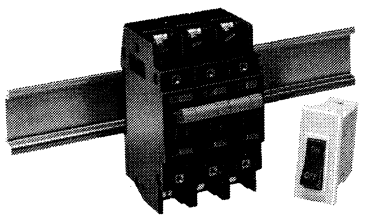
All conform to VDE and IEC spacing requirements. CARDGARD is PC board mountable.
Specifications: SNAPAK: 1 or 2 pole ratings. 7.6 to 15A at 32 VDC/125 VAC, 0.10 to 7.5A at 50 VDC/250 VAC.
2-pole only (2-pole breaking) and ratings: 7.6 to 15A at 125/250 VAC, 32/50 VDC. Interrupting capacity: 1000A at 125 VAC, 250 VAC, 32 VDC and 65 VDC.
Approval: IEC Ⓒ Ⓤ VDE* Ⓛ Ⓢ Lloyds
CARDGARD: 1 pole. Ratings: 1.0-6.0A, 32 VDC, 250 VAC. Interrupting capacity: 10 times rated current, at rated voltage.
Approval: Ⓤ Ⓒ
IEG and IEL Ratings: 0.05-30A, 277 VAC, 65 VDC (Model IEG). 0.05-50A, 277 VAC, 65 VDC (Model IEL). Interrupting capacity: 3500A, 277 VAC max., 2000A, 65 VDC (Model IEG). 5000A, 277 VAC max., 2000A, 65 VDC (Model IEL).
Approval: Ⓒ Ⓛ Ⓤ VDE*



Model 209

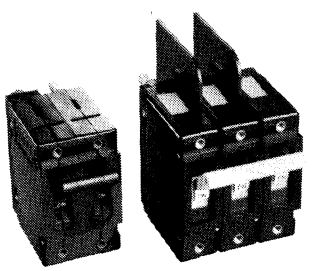
Ideal for branch circuits. Mounts in switch boards, panel enclosures, panel boards, junction boxes. Series includes 219 manual motor controller, 229 appliance controller, 249, 259 and 269 marine power selectors.
Specifications: 1 to 6 poles. Ratings: 0.10-100A, 125 VDC; 0.10-77A, 600 VAC; 0.10-100A, 120, 240, 277 and 480 VAC. Interrupting capacity: 5000A.
Approval: Ⓒ Ⓛ Ⓤ Lloyds

*Limited approvals; consult factory.



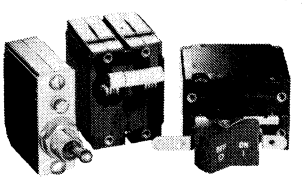
Models 203 and IELHR

203 is a front panel mounting device which combines over-current protection, ON-OFF switching and pilot light. Series, shunt or relay trip.
Specifications: 1 to 3 poles. Ratings: 0.05-10A, 250 VAC, 50 VDC, 10.1-20A, 120 VAC, 32 VDC. Interrupting capacity: 1000A.
Approval: Ⓒ Ⓛ Ⓤ Lloyds
IELHR designed for 35 mm symmetrical DIN rail; quick mounting, easy removal. Handle assembly available in 7 colors.
Specifications: Ratings: 0.05-50A, 65 VDC and 250 VAC. Operating temperature: −40°C to +85°C.



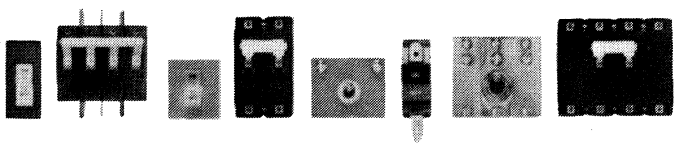
Models APL/UPL and 205

These breakers offer precision operation for critical service. Series, shunt and relay configuration options. Choice of delays, ratings. 205 is dust-sealed for harsh environments.
Specifications: 1 to 9 poles. Model APL/UPL Ratings: 0.05-20A, 277 VAC; 0.05-50A, 250 VAC; 0.05-100A, 65 VDC. Interrupting capacity: 5000A, 120 VAC; 2000A, 65 VDC. Model 205 Ratings: 0.05-20A, 277/480 VAC; 0.05-50A, 250 VAC; 0.05-100A, 32 VDC. Interrupting capacity: 5000A, 277/480 VAC; 5000A, 250 VAC; 2000A, 32 VDC.
Approval: Ⓒ Ⓛ Ⓤ QPL: MIL-C-55629 Lloyds



Models APG/UPG/IPG

Low-cost, precision operation. Multi-pole assemblies, single or multi-handle. For data processing, broadcast equipment, vending machines, controllers, etc.
Specifications: 1 to 4 poles. Ratings: 0.02-30A, 277 VAC, (Model IPG, 250 VAC), 65 VDC, 31-50A, 50 VDC. Interrupting capacity: 1000A, 277 VAC, (Model IPG, 250 VAC), 2000A, 65 VDC, and at 5000A, max. ratings of 30A at 120 VAC, 20A at 250 VAC, 10A at 277 VAC, (Model IPG, 250 VAC).
Approval: Ⓒ Ⓛ Ⓤ QPL: Mil-C-55629 Lloyds Model IPG-VDE*



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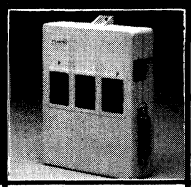
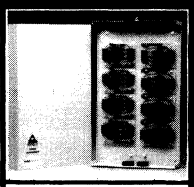
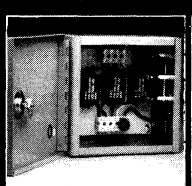
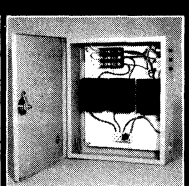
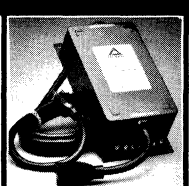
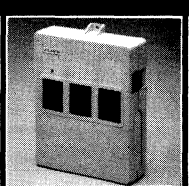
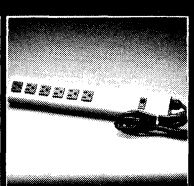
DATA LINE PROTECTORS





FEATURES	IMC SERIES*	DL SERIES	DLM SERIES
MAX SURGE CURRENT:	Up to 1,000 A per line (6,500 A optional)	Up to 1,000 A per line (6,500 A optional)	Up to 1,000 A per line (6,500 A optional)
RESPONSE TIME:	< 5 nanoseconds	< 5 nanoseconds	< 1 nanosecond
HOLD OVER CURRENT:	None	None	None
NUMBER OF WIRES PROTECTED:	4 (shield optional)	Up to 8	Up to four lines and shield per card. 8 or 24 card enclosures available.
APPLICATION:	Transient voltage protection for three AC power devices and one data communication interface. Several connector types available. *For AC features see IM Series below.	Transient protection for Standard RS-232 and RS-422 data lines. The DL Service connects directly in line for Data Com interface protection.	Transient voltage protection for a variety of data line types. Dense mounting enclosure for individual or trunk data lines.

POWER LINE PROTECTORS

FEATURES	MB SERIES	MB-HPB SERIES	RB SERIES	IM SERIES	ST SERIES
MAX SURGE CURRENT:	65,000 A	1,000 A	Up to 25,000 A	5,000 A	5,000 A
RESPONSE TIME:	50 nanoseconds	< 1 nanosecond	< 1 nanosecond	< 1 nanosecond	< 1 nanosecond
FAIL SAFE MODE:	Short	Short	Short	Short	Short
FAILURE INDICATOR:	Yes	Yes	Yes	Yes	Yes
HOLD OVER CURRENT:	None	None	None	None	None
APPLICATION:	Placed at the service entrance, the MB Series protects against incoming transient voltages. Conforms to new UL1449 Standard, effective 7/2/87.	Used in conjunction with the MB Series, the MB-HPB Series provides transient voltage protection for secondary panels. Conforms to new UL1449 Standard, effective 7/2/87. When used in conjunction with MB Series.	Plug in transient voltage suppressor for computer systems, large or small, and any solid-state equipment. Conforms to new UL1449 Standard effective 7/2/87.	Transient voltage protection for up to three separate units, including terminals, PC's, printers and Data Com equipment. Conforms to new UL1449 Standard, effective 7/2/87.	Transient voltage protection for up to six separate units, including terminals, PC's, printers and Data Com equipment. Conforms to new UL1449 Standard, effective 7/2/87.

All products covered by Seven Year Limited Warranty.

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ATLEE COMPONENT HOLDERS

Atlee component clips are made of spring steel and beryllium copper because they afford the most generally desirable combination of properties. Specific selection of material will depend on conditions of the application. In addition clips can be manufactured to your specification for a variety of uses. Please contact the factory with your questions and special requirements.

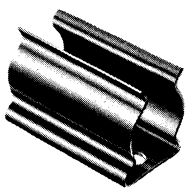
Atlee offers a complete line of MS and NAS component clips.

M24066 **M17160**

MS28136 **MS28137** **NAS1464**

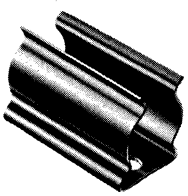
FEATURES

- The design of our component holders, from raw material through the finished product, ensures maximum performance and reliability under extreme usage, insertion, withdrawal force, and shock and vibration.
- Holding power increases as shock and vibration increase, measured by force required to remove component.
- Special contour design acquires closer set to component during shock and vibration, increasing security without localized pressure.
- Slotted design assures firm retention for fragile components without risk of injury.
- As an indication of the spring characteristics of Atlee's component holders, all of which are heat treated after forming, the following data is supplied; beryllium copper will withstand over 500 and spring steel 100 insertion-withdrawals of a slug 1/32" larger than nominal diameter, without metal fatigue.



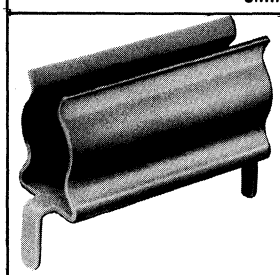
Beryllium Copper, QQ-C-533a

PLATING: cadmium CQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-T-425; nickel, QQ-U-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors and small cylindrical devices. Fastened by means of rivets, eyelets, screws or similar fasteners.



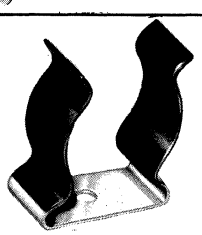
Spring Steel, QQ-S-777a

PLATING: cadmium CQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-T-425; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors and small cylindrical devices. Fastened by means of rivets, eyelets, screws or similar fasteners.



Tab Mounted Clips

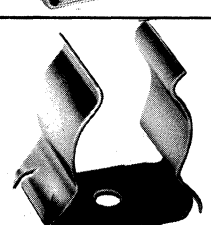
MATERIAL: beryllium copper, QQ-C-533a.
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold resistors, capacitors, relays and similar cylindrical components. Fastened to a circuit board by tabs.



Industrial Component Holders

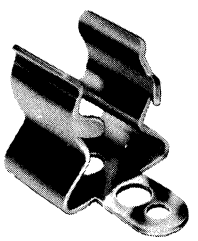
MATERIAL: spring steel S.A.E. 1065, .020 thick.

PLATING: commercial nickel, commercial nickel and vinyl coating
Designed for use in industrial and commercial applications.



No-Twist Clips

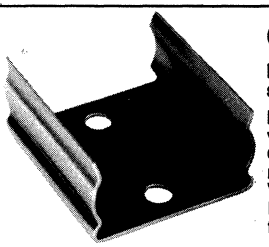
MATERIAL: spring steel, QQ-S-777a.
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc, QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed for holding capacitors and similar cylindrical components, without twisting.



Fuse and Resistor Holders

MATERIAL: phosphor bronze, QQ-B-750; beryllium copper, QQ-C-533a.

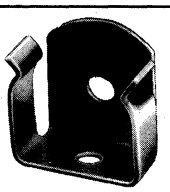
PLATING: silver, QQ-S-365a.
Finishes available silver plate.
Designed to hold fuses and ferrule-type resistors plus reduce heating by providing high contact pressure.



Crystal Clips

MATERIAL: spring steel, QQ-S-777a, spring steel S.A.E. 1065.

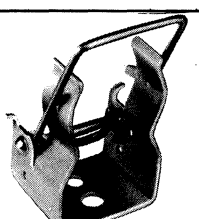
PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; zinc QQ-Z-325; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to provide secure mounting for flattened elliptical components.



Transistor Clips

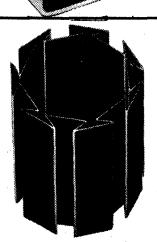
MATERIAL: beryllium copper, QQ-C-533a.

PLATING: cadmium, QQ-P-416a; silver, QQ-S-365a; tin, QQ-M-151; nickel, QQ-N-290; black matte, MIL-F-495A.
Various finishes available.
Designed to hold transistors without depending on soldered leads and at the same time act as a heat sink.



Locking Clips

MATERIAL: spring temper phosphor bronze, QQ-B-750.
PLATING: silver, QQ-S-365a; cadmium, QQ-P-416a; nickel, QQ-N-290; Class II, Type VI.
Various finishes available.
Designed to hold a fuse, ferrule-type resistor or similar component against the most severe shock and vibration.



Heat Dissipating Liners

MATERIAL: beryllium copper, .002 thick per QQ-C-533a, heat treated.

FINISH: black matte
Designed to cool many types of components combined with different types of cooling methods.

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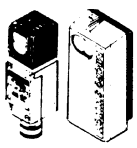
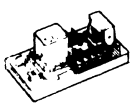
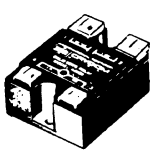
TOGGLE SWITCHES

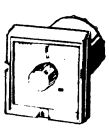

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS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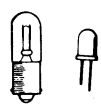
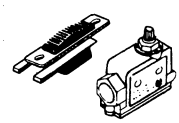
CIRCUIT BREAKERS FUSES & FUSEHOLDERS

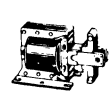
KNOBS


LAMPS & LEDS

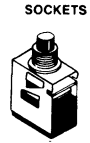

SWITCHES

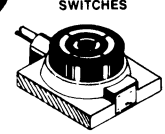
RELAYS

INDICATOR LIGHTS


SOLENOIDS

SOCKETS


PUSHBUTTON SWITCHES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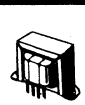
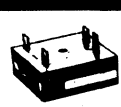
PADDLE SWITCHES


TRANSFORMERS


TIMERS

COUNTERS

FANS

ORDERS PLACED BY 3 P.M. ARE SHIPPED THE SAME DAY

FUSES/UL, CSA 1-1/4" x 1/4" & 1" x 1/4"

TYPE 3AG NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Inches (mm)
Diameter	.250 (6.35)
Length	1.250 (31.75)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3AG010	1/100	250	3AG1	1	250
3AG031	1/32	250	3AG1.25	1-1/4	250
3AG062	1/16	250	3AG1.5	1-1/2	250
3AG100	1/10	250	3AG1.6	1-6/10	250
3AG125	1/8	250	3AG1.75	1-3/4	250
3AG150	15/100	250	3AG2	2	250
3AG175	.175	250	3AG2.3	2-3/10	250
3AG187	3/16	250	3AG2.5	2-1/2	250
3AG200	2/10	250	3AG3	3	250
3AG250	1/4	250	3AG3.5	3-1/2	250
3AG300	3/10	250	3AG4	4	250
3AG375	3/8	250	3AG4.5	4-1/2	250
3AG400	4/10	250	3AG5	5	250
3AG500	1/2	250	3AG6	6	125
3AG600	6/10	250	3AG7	7	125
3AG750	3/4	250	3AG8	8	125
3AG800	8/10	250	3AG10	10	125

Listed by Underwriters' Laboratories through 10 amperes. Certified by Canadian Standards Association through 10 amperes.

Type 3AG fuses, described as normal blow, are medium to quick acting protectors for use in general circuit applications. Suitable for most circuits where high surges or transients are not anticipated.

TYPE 3AP NORMAL BLOW PIGTAIL GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Inches (mm)
Diameter	.270 (6.86)
Length	1.280 (32.5)
Pigtail Leads	**Inches (mm)**
Diameter	.032 (.813)
Length	1.5 (38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3AP010	1/100	250	3AP1	1	250
3AP031	1/32	250	3AP1.25	1-1/4	250
3AP062	1/16	250	3AP1.5	1-1/2	250
3AP100	1/10	250	3AP1.6	1-6/10	250
3AP125	1/8	250	3AP1.75	1-3/4	250
3AP150	15/100	250	3AP2	2	250
3AP175	.175	250	3AP2.3	2-3/10	250
3AP187	3/16	250	3AP2.5	2-1/2	250
3AP200	2/10	250	3AP3	3	250
3AP250	1/4	250	3AP3.5	3-1/2	250
3AP300	3/10	250	3AP4	4	250
3AP375	3/8	250	3AP4.5	4-1/2	250
3AP400	4/10	250	3AP5	5	250
3AP500	1/2	250	3AP6	6	125
3AP600	6/10	250	3AP7	7	125
3AP750	3/4	250	3AP8	8	125
3AP800	8/10	250	3AP10	10	125

Listed by Underwriters' Laboratories through 10 amperes. Certified by Canadian Standards Association through 10 amperes.

Type 3AP fuses are medium to quick blowing fuses with the same electrical characteristics as Type 3AG. They are supplied with pigtail leads so that the fuse can be wired directly to the circuit.

TYPE 3SB SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Inches (mm)
Diameter	.250 (6.35)
Length	1.250 (31.75)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
3SB010	1/100	250	3SB1	1	250
3SB031	1/32	250	3SB1.2	1-2/10	250
3SB040	4/100	250	3SB1.25	1-1/4	250
3SB062	1/16	250	3SB1.5	1-1/2	250
3SB100	1/10	250	3SB1.6	1-6/10	250
3SB125	1/8	250	3SB1.8	1-8/10	250
3SB150	15/100	250	3SB2	2	250
3SB175	.175	250	3SB2.25	2-1/4	250
3SB187	3/16	250	3SB2.5	2-1/2	250
3SB200	2/10	250	3SB2.8	2-8/10	250
3SB250	1/4	250	3SB3	3	250
3SB300	3/10	250	3SB3.2	3-2/10	250
3SB375	3/8	250	3SB3.5	3-1/2	250
3SB400	4/10	250	3SB4	4	250
3SB500	1/2	250	3SB4.5	4-1/2	250
3SB600	6/10	250	3SB5	5	250
3SB700	7/10	250	3SB6	6	250
3SB750	3/4	250			
3SB800	8/10	250			

Listed by Underwriters' Laboratories through 6 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 3SB fuses, described as slow blow, are designed to prevent unnecessary blowing in circuits where transient surges are anticipated. Protection against short circuit or continued overload is still maintained.

TYPE 3SBP SLOW BLOW PIGTAIL GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Inches (mm)
Diameter	.270 (6.86)
Length	1.280 (32.5)
Pigtail Leads	**Inches (mm)**
Diameter	.032 (.813)
Length	1.5 (38.1)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Rating Voltage
3SBP010	1/100	250	3SBP1	1	250
3SBP031	1/32	250	3SBP1.2	1-2/10	250
3SBP040	4/100	250	3SBP1.25	1-1/4	250
3SBP062	1/16	250	3SBP1.5	1-1/2	250
3SBP100	1/10	250	3SBP1.6	1-6/10	250
3SBP125	1/8	250	3SBP1.8	1-8/10	250
3SBP150	15/100	250	3SBP2	2	250
3SBP175	.175	250	3SBP2.25	2-1/4	250
3SBP187	3/16	250	3SBP2.5	2-1/2	250
3SBP200	2/10	250	3SBP2.8	2-8/10	250
3SBP250	1/4	250	3SBP3	3	250
3SBP300	3/10	250	3SBP3.2	3-2/10	250
3SBP375	3/8	250	3SBP3.5	3-1/2	250
3SBP400	4/10	250	3SBP4	4	250
3SBP500	1/2	250	3SBP4.5	4-1/2	250
3SBP600	6/10	250	3SBP5	5	250
3SBP700	7/10	250	3SBP6	6	250
3SBP750	3/4	250			
3SBP800	8/10	250			

Listed by Underwriters' Laboratories through 6 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 3SBP fuses, designated as slow blow, prevent unnecessary blowing from sudden current surges. Normal protection is still maintained against continued overload and short circuits. Similar electrically to the 3SB series, but supplied with pigtail leads.

TYPE 8AG/8AP NORMAL BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	8AG Inches (mm)	8AP Inches (mm)	Pigtail Leads Inches (mm)
Diameter	.250 (6.35)	.270 (6.9)	.032 (.813)
Length	1.00 (25.4)	1.03 (26.2)	1.5 (38.1)

Catalog Number		Ampere Rating	Voltage Rating
8AG100	8AP100*	1/10	250
8AG125	8AP125	1/8	250
8AG250	8AP250	1/4	250
8AG375	8AP375	3/8	250
8AG500	8AP500	1/2	250
8AG750	8AP750	3/4	250
8AG1	8AP1	1	250
8AG1.5	8AP1.5	1-1/2	250
8AG2	8AP2	2	250
8AG2.5	8AP2.5	2-1/2	125
8AG3	8AP3	3	125
8AG4	8AP4	4	125
8AG5	8AP5	5	125
8AG6	A8P6	6	125
8AG7	8AP7	7	125

*Pigtail (AP)

Listed by Underwriters' Laboratories through 7 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 8AG is designated as a normal blow fuse for use in general circuit protection. Their smaller size permits use where space limitations prevent use of Type 3AG. Pigtail leads (Type 8AP) are available when direct soldering into circuits is desired.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

FUSES/UL, CSA & SEMKO 5mm x 20mm

TYPE 5MF FAST ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, maximum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MF100	1/10	250	5MF1	1	250
5MF125	1/8	250	5MF1.25	1-1/4	250
5MF200	2/10	250	5MF1.6	1-6/10	250
5MF250	1/4	250	5MF2	2	250
5MF300	3/10	250	5MF2.5	2-1/2	250
5MF400	4/10	250	5MF3	3	250
5MF500	1/2	250	5MF4	4	125
5MF600	6/10	250	5MF5	5	125
5MF700	7/10	250	5MF6	6	125
5MF800	8/10	250	5MF7	7	125
			5MF8	8	125

Listed by Underwriters' Laboratory from 50 mA to 8 amperes. Certified by Canadian Standards Association through 8 amperes.

Type 5MF fuses, described as fast acting are manufactured to meet the requirements of UL 198G and CSA 22.2. They permit European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. **Pigtail leads (5MFP) are available when direct soldering into circuits is desired.**

TYPE 5MT TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	2 minutes, maximum
1000%	10 milliseconds, minimum

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5 (0.197)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5MT100	1/10	250	5MT1	1	125
5MT125	1/8	250	5MT1.25	1-1/4	125
5MT200	2/10	250	5MT1.6	1-6/10	125
5MT250	1/4	250	5MT2	2	125
5MT300	3/10	250	5MT2.5	2-1/2	125
5MT400	4/10	250	5MT3	3	125
5MT500	1/2	250	5MT4	4	125
5MT600	6/10	250	5MT5	5	125
5MT700	7/10	250	5MT6	6	125
5MT800	8/10	250	5MT7	7	125

Listed by Underwriters' Laboratories from 50 mA to 5 amperes. Certified by Canadian Standards Association through 5 amperes.

Type 5MT fuses, described as time lag offer additional surge protection for circuits where momentary transients are anticipated. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration. **Pigtail leads (5MTP) are available when direct soldering into circuits is desired.**

TYPE 5SF QUICK ACTING GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Max.
32 to 100 mA inclusive	30 min	10 ms	500 ms	3 ms	100 ms	20 ms
Above 100 mA to 6.3A	30 min	50 ms	2 s	10 ms	300 ms	20 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5SF032	.032	250	5SF500	1/2	250
5SF040	.040	250	5SF630	.630	250
5SF050	1/20	250	5SF800	8/10	250
5SF063	1/16	250	5SF1	1	250
5SF080	.080	250	5SF1.25	1-1/4	250
5SF100	1/10	250	5SF1.6	1-6/10	250
5SF125	1/8	250	5SF2	2	250
5SF160	.160	250	5SF2.5	2-1/2	250
5SF200	2/10	250	5SF3.15	3.15	250
5SF250	1/4	250	5SF4	4	250
5SF315	.315	250	5SF5	5	250
5SF400	4/10	250	5SF6.3	6-3/10	250

Approved by SEMKO for 80 mA, 125 mA, and from 250 mA through 6.3A.

Type 5SF fuses, described as quick acting, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet II (Type F). Used throughout Europe, they carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are not anticipated. **Pigtail leads (5SFP) are available when direct soldering into circuits is desired.**

TYPE 5ST TIME LAG GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rated Current	2.1 I_n Max.	2.75 I_n Min.	2.75 I_n Max.	4 I_n Min.	4 I_n Max.	10 I_n Min.	10 I_n Max.
32 to 100 mA inclusive	2 min	200 ms	10 s	40 ms	3 s	10 ms	300 ms
Above 100 mA to 6.3A	2 min	600 ms	10 s	150 ms	3 s	20 ms	300 ms

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5ST032	.032	250	5ST500	1/2	250
5ST040	.040	250	5ST630	.630	250
5ST050	1/20	250	5ST800	8/10	250
5ST063	1/16	250	5ST1	1	250
5ST080	.080	250	5ST1.25	1-1/4	250
5ST100	1/10	250	5ST1.6	1-6/10	250
5ST125	1/8	250	5ST2	2	250
5ST160	.160	250	5ST2.5	2-1/2	250
5ST200	2/10	250	5ST3.15	3.15	250
5ST250	1/4	250	5ST4	4	250
5ST315	.315	250	5ST5	5	250
5ST400	4/10	250	5ST6.3	6-3/10	250

Approved by SEMKO from 63 mA through 6.3A.

Type 5ST fuses, described as time lag, low breaking capacity, are manufactured to the specifications of IEC 127, CEE 4, Standard Sheet III (Type T). They carry the SEMKO mark in the ratings indicated. They are used for general circuit protection in electrical and electronic equipment where momentary transients are anticipated. **Pigtail leads (5STP) are available when direct soldering into circuits is desired.**

TYPE 5TT SLOW BLOW GLASS TUBE FUSE SERIES

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
110%	4 hours, minimum
135%	1 hour, maximum
200%	5 seconds, minimum (3 seconds minimum for fuses with rating over 3 amp)

MECHANICAL DIMENSIONS

Dimensions	Millimeters (Inches)
Diameter	5.1 (0.200)
Length	20 (0.787)

Catalog Number	Ampere Rating	Voltage Rating	Catalog Number	Ampere Rating	Voltage Rating
5TT100	1/10	250	5TT1	1	250
5TT125	1/8	250	5TT1.25	1-1/4	250
5TT200	2/10	250	5TT1.6	1-5/10	250
5TT250	1/4	250	5TT2	2	250
5TT300	3/10	250	5TT2.5	2-1/2	250
5TT400	4/10	250	5TT3	3	250
5TT500	1/2	250	5TT4	4	125
5TT600	6/10	250	5TT5	5	125
5TT700	7/10	250	5TT6	6	125
5TT800	8/10	250	5TT7	7	125

Listed by Underwriters' Laboratories from 50mA to 5 amperes and certified by CSA through 5 amperes.

Type 5TT fuses, described as slow blow, are designed to withstand higher surge currents occurring at switching during the normal life of equipment than the 5MT series. They are built to meet the specifications of UL 198G and CSA 22.2. They permit the European manufacturers of original equipment to substitute a fuse listed or certified by UL/CSA when exporting their equipment to the United States or Canada without making costly changes in mountings and printed circuit board layouts. Since fusing characteristics are different than those specified by IEC 127 for specific ratings, a careful analysis of the blowing curves should be made before determining the proper substitution. The small size of these fuses also offer the American/Canadian designer a protective device where space limitations are an important consideration.

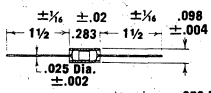
Pigtail leads (5TTP) are available when direct soldering into circuits is required.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

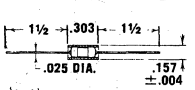
Fuse Clips
Reel And Rail Packaging

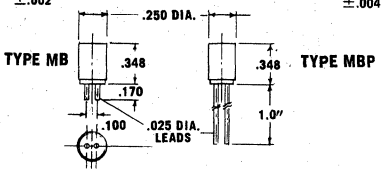
TYPE MF/MFS/MB/MBP/MFA MICROBEL MICRO FUSE SERIES

TYPE MF/MFS



TYPE MFA





ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
*150%	10 minutes, maximum
200%	5 sec. max.

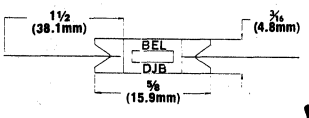
*Not applicable to MFS

Catalog Number				Ampere Rating	Voltage Rating
MFS125	MB125	MBP125	MFA125	1/8	125
MFS250	MB250	MBP250	MFA250	1/4	125
MFS375	MB375	MBP375	MFA375	3/8	125
MFS500	MB500	MBP500	MFA500	1/2	125
MF750	MB750	MBP750	MFA750	3/4	125
MF1	MB1	MBP1	MFA1	1	125
MF1.5	MB1.5	MBP1.5	MFA1.5	1-1/2	125
MF2	MB2	MBP2	MFA2	2	125
MF2.5	MB2.5	MBP2.5	MFA2.5	2-1/2	125
MF3	MB3	MBP3	MFA3	3	125
MF3.5	MB3.5	MBP3.5	MFA3.5	3-1/2	125
MF4	MB4	MBP4	MFA4	4	125
MF5	MB5	MBP5	MFA5	5	125
MF7	MB7	MBP7	MFA7	7	125

MF is UL listed and CSA certified through 7A and MFS is UL recognized and CSA certified through 500 mA.

MF/MFS are subminiature fuses for use in circuits where space requirements are an important factor. They are supplied with kynar sleeve insulation. Their axial construction permits them to be packaged in bulk or taped and reeled. On special orders the MF/MFS fuses can be cut and formed by the factory and supplied as radial lead devices.

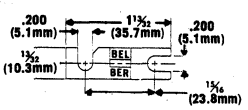
TYPE DJB FLAT PACK FUSE



ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
160%	25 seconds, maximum

TYPE BER FLAT PACK FUSE

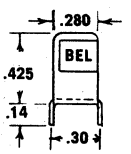


ELECTRICAL CHARACTERISTICS

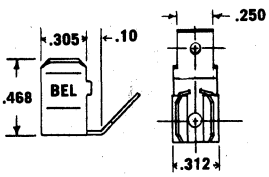
Rating	Blow Time
100%	4 hours, minimum
135%	1 hour, maximum
200%	1 minute, maximum

Catalog Number		Ampere Rating	Catalog Number		Ampere Rating
DJB250	BER250	1/4	DJB2	BER2	2
DJB300	BER300	3/10	DJB2.25	BER2.25	2-1/4
DJB400	BER400	4/10	DJB2.5	BER2.5	2-1/2
DJB500	BER500	1/2	DJB2.75	BER2.75	2-3/4
DJB600	BER600	6/10	DJB3	BER3	3
DJB750	BER750	3/4	DJB3.5	BER3.5	3-1/2
DJB875	BER875	7/8	DJB4	BER4	4
DJB1	BER1	1	DJB5	BER5	5
DJB1.25	BER1.25	1-1/4	DJB8	BER8	8
DJB1.5	BER1.5	1-1/2	DJB10	BER10	10

CLIPS

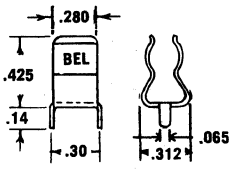


TYPE FC-101
3AG Clip
PC Board Mount
(Ear Stops)

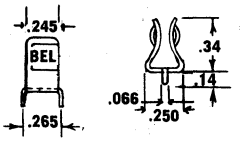


TYPE FC-107
3AG Clip
Hole Mount
(.250 Quick
Connect)

TYPE FC-102
3AG Clip
PC Board Mount
(Earless)

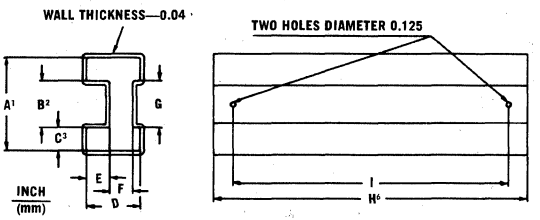


TYPE FC-201
5mm Clip
PC Board Mount
(Ear Stops)



All Bel Fuse clips are manufactured from .020 phosphor bronze stock and specially hardened to assure long life and minimum contact resistance. They are bright tin plated to facilitate soldering and prevent oxidation. In addition to the stock designs illustrated, clips can be quickly tooled to meet customer specifications.

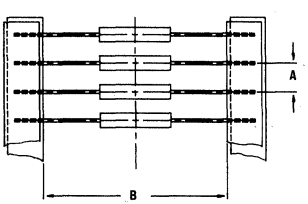
RAIL PACKAGING



Fuse Type	A	B	C	D	E	F	G	H	I
5mm x 20mm	1.00 +.02 −.00	.34 ±.01	.330	.55 +.02 −.00	.280	.20 +.02 −.00	.300 ±.010	13.2	12.60
	(25.4 +0.5 −.0)	(8.6 ±0.3)	(8.4)	(14.0 +0.5 −.0)	(7.1)	(5.1 +0.5 −.0)	(7.6 ±0.3)	(335.2)	(320.0)
¼ inch x 1¼ inch	1.45 +.03 −.00	.64 ±.01	.405	.73 +.025 −.000	.365	.26 +.025 −.000	.600 ±.010	15.75	15.08
	(36.8 +0.8 −.0)	(16.3 ±0.3)	(10.3)	(18.5 +0.6 −.0)	(9.3)	(6.6 +0.6 −.0)	(15.2 ±0.3)	(400.1)	(383)

To minimize assembly costs cartridge fuses can be supplied with clips attached. They are shipped in rails. Rail sizes are given above.

REEL PACKAGING



Leaded fuses can be supplied taped and reeled to assist in automatic assembly. Reeled fuses are supplied in quantity increments of 2500 pieces for microfuses and 1000 pieces for 1¼x ¼ inch, 1500 pieces for 5 x 20mm fuses.

Fuse Type	A	B
Micro fuses (MF, MFS, MFA)	5.0 mm	52.4 mm
¼x1¼ inch and 5x20 mm fuses	10.0 mm	73.0 mm

Specifications Subject To Change Without Notice.

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

MICRO FUSES

MQ QUICK ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	5 seconds, maximum

MQ is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MQ125	1/8	125
MQ250	1/4	125
MQ375	3/8	125
MQ500	1/2	125
MQ750	3/4	125
MQ1	1	125
MQ1.5	1.5	125
MQ2	2	125
MQ2.5	2.5	125
MQ3	3	125
MQ3.5	3.5	125
MQ4	4	125
MQ5	5	125
MQ7	7	125
MQ10	10	125
MQ12	12	125
MQ15	15	125

Marking

Current rating, voltage rating, MQ designation and Bel Fuse logo are printed on each fuse in white ink.

Lead diameter 0.025″ except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032″.

MM MEDIUM ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	1 minute, maximum
400%	20 millisecond, minimum

MM is recognized under the components program of the UL and certified by the CSA through 15 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MM2	2	125
MM2.5	2.5	125
MM3	3	125
MM3.5	3.5	125
MM4	4	125
MM5	5	125
MM7	7	125
MM10	10	125
MM12	12	125
MM15	15	125

Marking

Current rating, voltage rating, MM designation and Bel Fuse logo are printed on each fuse in orange ink.

Lead diameter 0.025″ except for 10, 12 and 15 Ampere fuses which have a lead diameter of 0.032″.

MS SLOW ACTING

ELECTRICAL CHARACTERISTICS

Rating	Blow Time
100%	4 hours, minimum
200%	1 minute, maximum
800%	20 millisecond, minimum

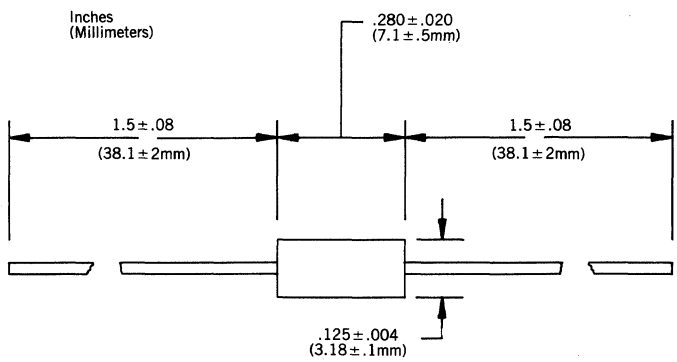
MS is recognized under the components program of the UL and certified by the CSA through 7 Amperes.

Catalog Number	Ampere Rating	Voltage Rating
MS125	1/8	125
MS250	1/4	125
MS375	3/8	125
MS500	1/2	125
MS750	3/4	125
MS1	1	125
MS1.5	1.5	125
MS2	2	125
MS2.5	2.5	125
MS3	3	125
MS3.5	3.5	125
MS4	4	125
MS5	5	125
MS7	7	125

Marking

Current rating, voltage rating, MS designation and Bel Fuse logo are printed on each fuse in green ink.

Lead diameter 0.032″.



Specifications Subject To Change Without Notice

bel BEL FUSE INC. 198 Van Vorst Street/Jersey City, NJ 07302/(201) 432-0463/TWX 710-730-5301/FAX (201) 432-9542

CARLINGSWITCH CIRCUIT BREAKERS

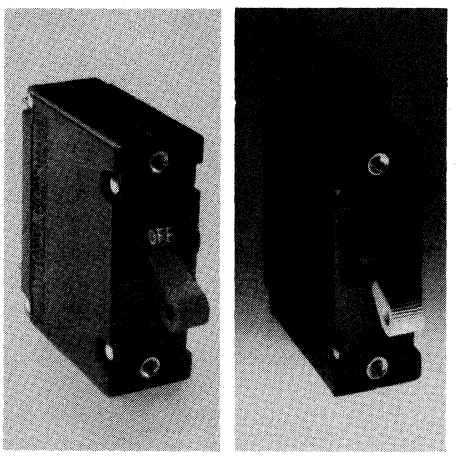
Magnetic Circuit Breakers

Applications: EDP, power supply, power conditioner, instrumentation, office and vending machines, marine and other OEM applications.

"A & B" Series — Toggle

Compact, temperature stable magnetic design for precision operation in both domestic and world market applications. 1–6 poles, .1–50 amps, AC or DC, choice of time delays, terminals and actuator colors.

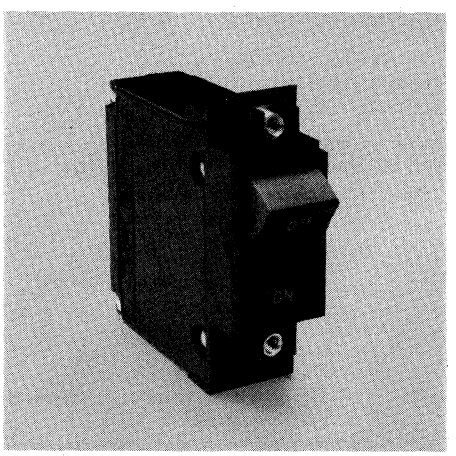
Approvals: UL recognized, CSA certified, VDE certified ("B" Series only).



"A" Series — Rocker

Same specifications as "A" and "B" Series toggle. Where front panel operation and aesthetics demand a clean contemporary design, the unique Visi-Rocker® two-color actuator, an industry first, can be specified to indicate either the "tripped" (off) mode or the "on" mode. One to three pole variations are available.

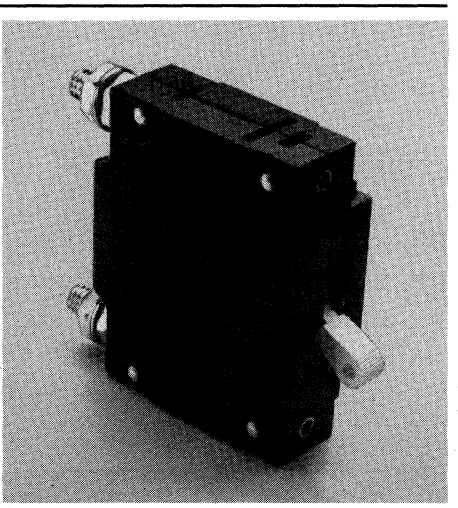
Approvals: UL recognized, CSA and VDE certified.



"C" Series — Toggle

The "C" Series breaker is designed for those applications requiring higher amperage and higher voltage handling capabilities. World market design available with English or Metric "Stud" terminals. "Saddle Clamp" type screw terminals are also offered. 1–6 poles, .1–70 amps, 65VDC, up to 480 VAC, with a choice of time delays and actuator colors.

Approvals: UL recognized, CSA certified, with other world market approvals pending.



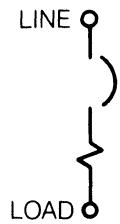
CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231

CARLINGSWITCH CIRCUIT BREAKERS

Circuit Options

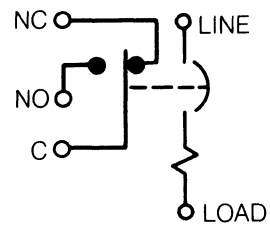
Series Trip

A basic two (2) terminal device usually used as a combination power switch and overload protector. The contacts and current sensing coil are connected in series with the line and load terminals.



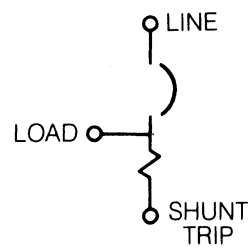
Series Trip with Auxiliary Switch

Same as "Series Trip" except with the addition of a SPDT snap-action switch which is *electrically isolated,* but *mechanically* linked to the movement of the main breaker contacts. Commonly used to remotely signal the status of the breaker (on or off/tripped).



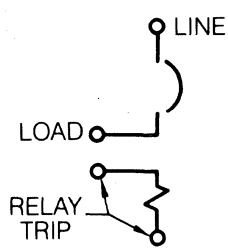
Shunt Trip

A three (3) terminal device similar to a "Series Trip" with the addition of a third terminal between the contacts and coil. This circuit is usually used to control two separate loads from the same power source, while sensing overload current in only one load.



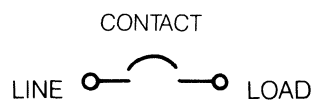
Relay Trip

A four (4) terminal device in which the contact and coil circuits are *electrically isolated* but are still *mechanically* linked to each other. An overload in the coil circuit will cause the contact circuit to open. Both circuits may be of opposite polarity to each other. Commonly used in "dump" circuit or "remote shut down" applications. (Note: World Approval Agencies may require an extra "Series Trip" pole for this function.)



Switch Only

Same as a "Series Trip" device without a sensing coil. Provides low cost, heavy duty switch capability when overload protection is not needed.



Note: The preceding circuits may be mixed on multi-pole units for special application requirements—(consult factory).

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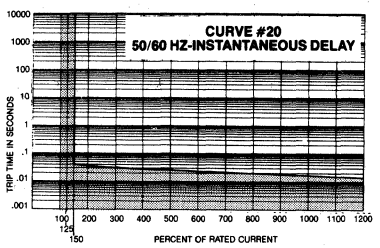
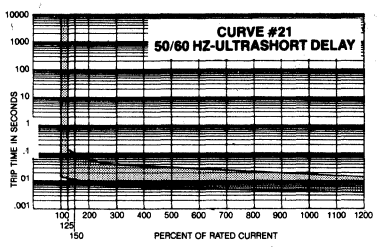
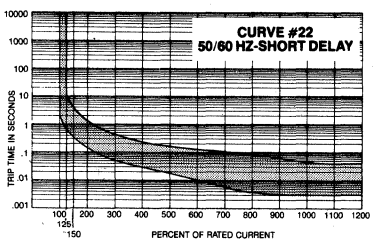
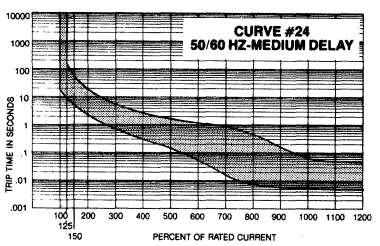
Time Delay Options

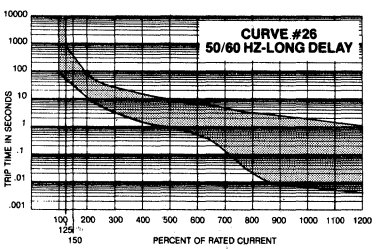
AC



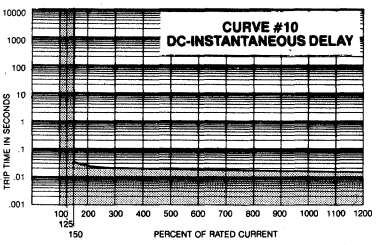


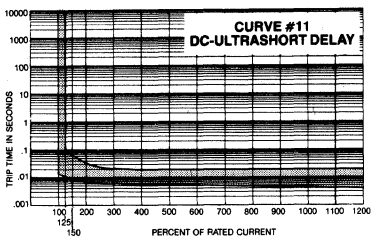


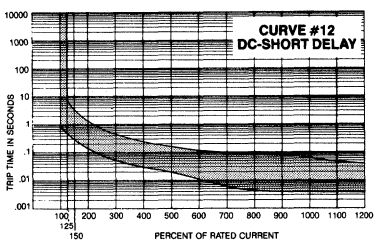


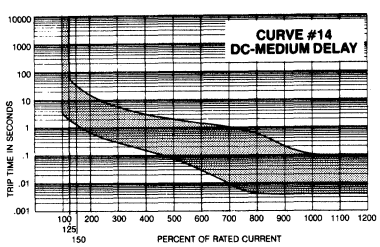


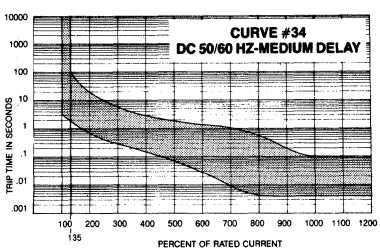
DC











Curve #34 is a combination AC/DC Time Delay Curve.

Notes:

High Inrush Time Delay Curves #42, 44, 46 are also available

Time Delay Curves (#11, 12, 14, 21, 22, 24 & 26):

Breakers must hold 100%, may trip between 101% to 125%, must trip at 125% of rated current and above within time limits shown in curves.

Time Delay Curve (#34):

Breaker must hold 100%, may trip between 101% to 135%, must trip at 135% of rated current and above within time limits shown in curve.

Instantaneous Curves (#10 & 20):

Breakers must hold 100%, may trip between 101% to 150%, must trip at 150% of rated current and above within maximum times shown in curves.

All Curves:

Curve data shown represents breaker response at ambient temperature of 77°F (25°C) with no preloading. Breakers are mounted in standard wall-mount position.

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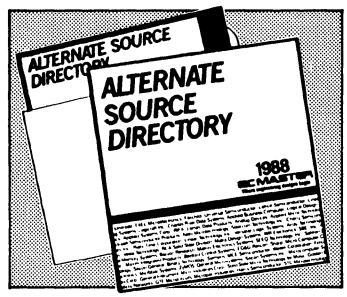

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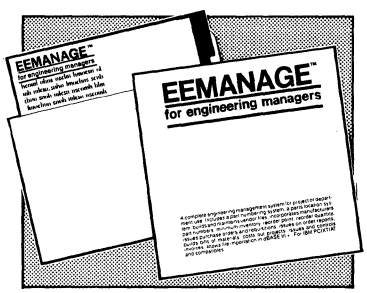

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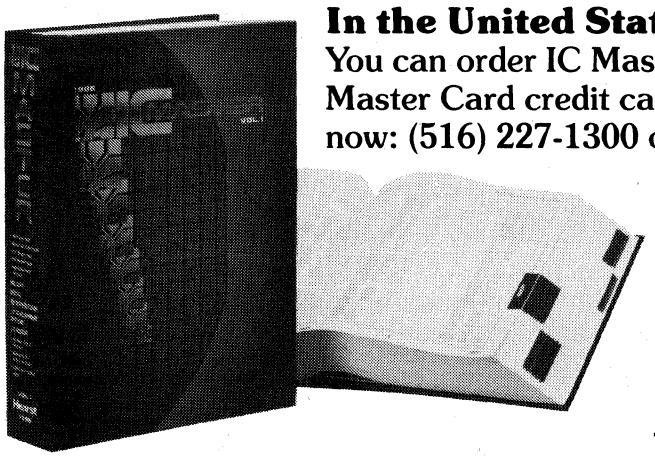

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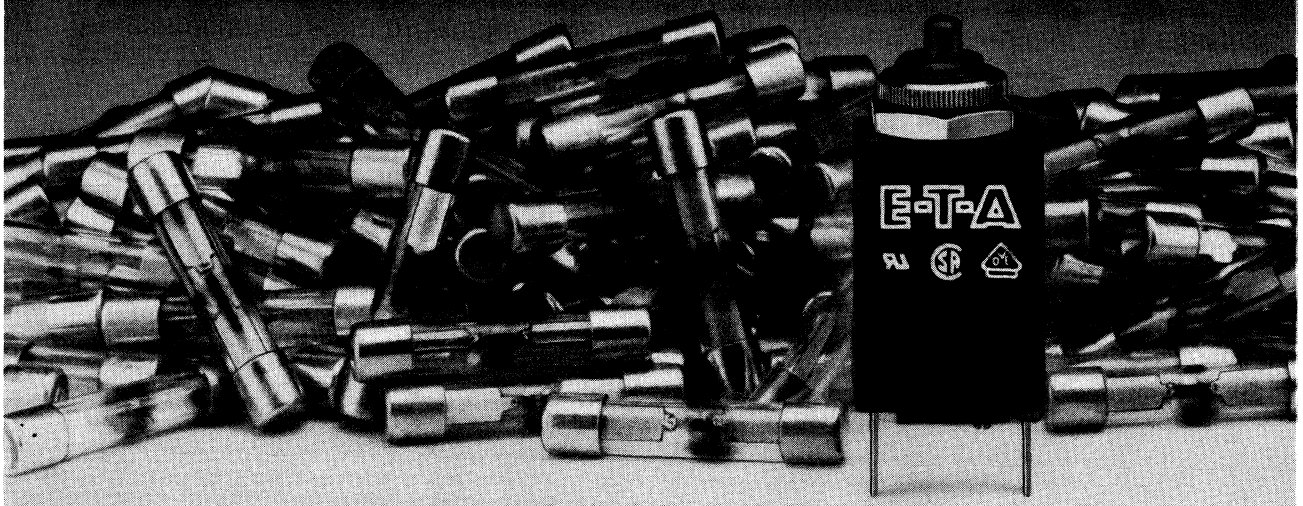

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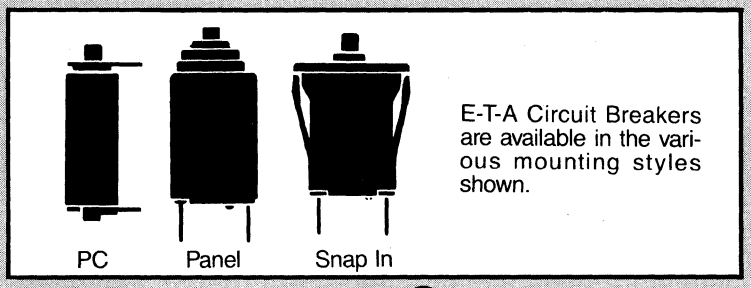

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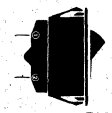

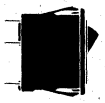

3120-F621 fits panel cutout Heinemann TX2 and AIRPAX 203-11 2 pole.

Series	41-10-P10/41-11-P10	3120-F321	45-700-IG1-P10-DD	41-04-PR 41-05-P30 41-06-P30	45-700-IG1-P10	46-500-P10
Description	Single pole, series trip Rocker, Toggle or Baton handles in many colors. (Illumination Optional)	Double pole, identical Snap-in mounting of single pole 41-10/41-11 series (Illumination Optional)	Single pole, series trip B/W button trip indicator Push ON/Push OFF Switching	Series trip, miniature. 41-04-PR: PC Board Mount 41-05-P30: Snap-in Mount 41-06-P30: Panel Mount	Series trip	Series trip automatic reset
Current ratings	0.1 thru 16A	0.1 thru 16A	0.05 thru 25A	0.05 thru 10A	0.05 thru 25A	0.1 thru 15A
Maximum voltage ratings	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc	250V ac or 28V dc
Maximum interrupting capacity depending on current rating. UL 1077 approved breakers have been tested to 2000A.	10 times rated current normal use. UL up to 2000A.	10 times rated current 0.1-2A. 300A for ratings 2.5-16A. UL tested to 2000A.	10 times rated current normal use. UL up to 2000A.	6 times rated current. UL up to 1000A. 5 times for ratings 3.5 thru 5A, 4 times for ratings 6 thru 10A.	10 times rated current of circuit breaker, normal use. UL up to 2000A.	6 times rated current of circuit breaker, 60A maximum
Current capacity of auxiliary contacts, NO, NC.	NA	5A resistive 3, .110″ quick connect NO-NC-COM	NA	NA	NA	NA
Life	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 25,000 mechanical	6000 cycles (UL 1077) 10,000 mechanical	2000 cycles at rated current	6000 cycles at rated current	10,000 cycles at 200% rated current
Terminals	.250 quick connect	.250 quick connect	.250 quick connect	.110 quick connect	.250 quick connect	.250 quick connect
Shunt circuit—A3, optional	Optional; specify—A3	Optional	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3	Optional; specify—A3
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request	UL 1077; E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 up to 16A CSA: 16186 up to 15A VDE	UL: E29255 CSA: 16186 VDE
Design notes See technical data sheets for data	41-10 is unlighted 41-11 is illuminated	Options: • handle colors • handle marking • Illumination • Amp ratings • Dust/water seal	Aircraft styling B/W reset button. Ideal for marine control panels. Screw terminals, (—S10) optional.	Smallest full feature circuit breaker. .250 quick-connect avail. non-standard (—P10)	Screw terminals available, non-standard. Version for Class 2 transformers available: Specify 45-700-P10-CL2 3.2 or 5A.	Screw terminals 1, 2 available (—S20), non-standard
Technical Data Sheet	Catalog Sheet 40129 Catalog Sheet 40130	Catalog Sheet 40136	Catalog Sheet 40132	Catalog Sheet 40127	Catalog Sheet 40119	Catalog Sheet 40701
Physical Dimensions in Inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	.85 1.97 recommended panel cutout Safety shield extension to avoid accidental switching is optional. 2.126 1.3		.57 1.14 OFF ON 1.81	.43 .75 OFF ON 1.10 Shown: 41-06-P30	.57 1.14 OFF ON 1.81	2.05 .81 .25 .86 2.40

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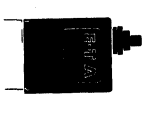
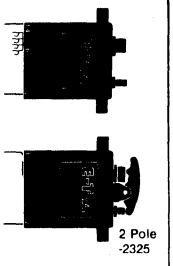
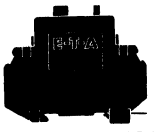
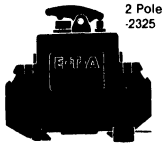
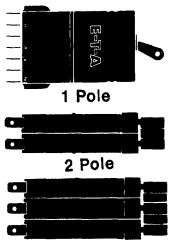
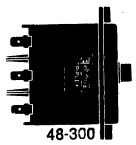
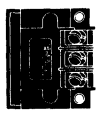
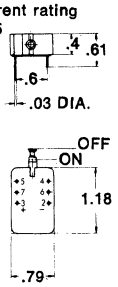
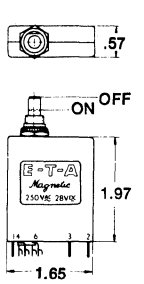
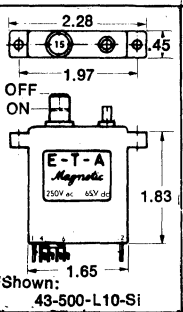
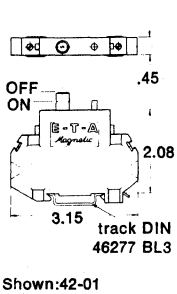
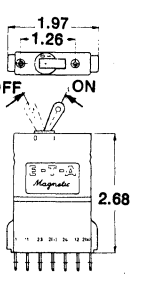
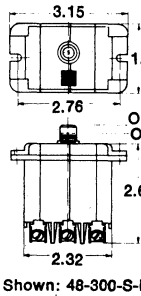
			 2 Pole -2325	 2 Pole -2325 	 1 Pole 2 Pole 3 Pole	 48-300  48-800
Series	**48-08**	**43-400-L10**	**43-500-L10 43-500-L10-2325**	**42-01 42-01-2325**	**2210**	**48-300-S 48-800-S**
Description	Magnetic, undelayed trip, PC board mount, NO and NC contacts. ON-OFF switching.	Series trip, two auxiliary contacts NO, NC optional (-Si). Fast Acting: specify series 43-300	Series trip, UL approved for primary ON-OFF switching. Two pole version: order -2325, has rocker handle.	Series trip, ON-OFF switching. DIN track 3 mounting. Adapter for DIN track 1 available.	Series trip, ON-OFF switching. Aux. contacts std. 1, 2 or 3 pole configuration.	Series trip, ON-OFF switch (-H) optional, auxiliary contacts NO, NC (suffix-Si) optional. Auto-reset version 0.1-5A: 48-800.
Current ratings	0.01 thru 3.25A	0.05 thru 15A	0.05 thru 15A	0.1 thru 15A	0.1 thru 16A	0.5 thru 15A
Maximum voltage ratings	115V ac or 60V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	250V ac or 65V dc	0.5—5A: 500V ac 5.5—15A: 380V ac
Maximum interrupting capacity depending on current rating, UL 1077 approved breakers have been tested to 2000A.	40A at 115Vac/ 60V dc 60A at 48V ac/dc 100A at 24V ac/dc	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 43-4-P10 not-Si)	200A normal use. UL up to 1000A. 1500A/250V ac version, current ratings 8-15A. E-T-A series 42-1-P10 (not-Si)	200A normal use. UL tested to 1000A.	500A normal use, not to exceed 100 times rated current	6 times rated current of circuit breaker
Current capacity of auxiliary contacts, NO, NC.	NO contacts: 5A continuous at 24V	1A resistive 4 solder terminals optional	1A resistive 4 solder terminals optional (single pole only)	NA	1A resistive, 4 quick connects, standard	3A resistive at 250V ac, 4 solder terminals, optional
Life	10,000 cycles at rated current	4000 cycles at 200% rated current	6000 cycles (UL 1077) at rated current	6000 cycles (UL 1077) at rated current	10,000 cycles at rated current	5000 cycles at rated current
Terminals	PC board pins	Solder terminals	Solder terminals	Screw clamp terminals	.250 quick connect(7x)	Screw terminals
Shunt circuit— A3, optional	Can be arranged	Optional; specify—A3	Optional; specify—A3	NA	Standard	NA
Approvals E-T-A also has European approvals, such as VDE etc. Additional info upon request		UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL 1077: E67320 CSA: 16186 VDE	UL, CSA: upon request VDE	CSA: 16186 up to 3.5A VDE: up to 10A
Design notes See technical data sheets for data	Series 48-08 has extra low impedance.	Quick-connect or screw terminals avail., non-standard DUAL CONTROL available.	Quick-connect or screw terminals avail., non-standard. DUAL CONTROL available. UL approved for primary ON-OFF switching.	Half inch spacing makes this device especially attractive for modern control systems design.	Shunt and auxiliary contacts are standard. DIN track mountable via terminal block #17-P10-Si	ON/OFF version available (suffix—H). Quick-connect terminals (—P10) avail. non-std. For tech. data 48-800-S see Cat. sheet 40806
Technical Data Sheet	Catalog Sheet 42433	Catalog Sheet 40223	Catalog Sheet 40228	Catalog Sheet 40237	——	Catalog Sheet 40308 (48-800: Cat. Sheet 40806)
Physical Dimensions in inches All dimensions without tolerances are for reference only. In the interest of improved design and performance, E-T-A reserves the right to make changes in these specifications.	Current rating 3.25 		 Shown: 43-500-L10-Si	 Shown:42-01		 Shown: 48-300-S-H

E-T-A® CIRCUIT BREAKERS

7400 North Croname Road, Chicago, IL 60648 • 312/647-8303 • TELEX: 253780 • FAX: 312/647-7494

fic ·Fuseholders·Fuse Clips ·Blown Fuse Indicators

Commercial & Military Approved Panel Mount Fuseholders

- Superior Clip Design for Solid Fuse Contact
- UL Recognized & C.S.A. Certified
- Most Commercial Models are recognized under the Marine Electrical and Fuel System (PEQZ2) as "Ignition Protected Devices"
- Blown Fuse Indicating & Non-Indicating
- High Impact Plastic for Superior Strength
- Dead-Front, Watertight
- Military Versions Meet MIL-F-19207

Commercial Fuseholders

All Recognized by Underwriters Laboratories

Model	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Voltage AC/DC	UL Recognized Amps	UL Recognized Voltage
5000+	¼x1¼"	1	N	250	0-30	250 max
5100+	¼x1¼"	3	N	250	0-30	250 max
5200+	¼x1¼"	1	N or I	250	0-30	250 max
*5300+	¼x1¼"	2	N or I	250	0-30	250 max
*5400+	13/32x1½"	1	N	600	0-30	600 max
*5500+	13/32x1½"	3	N	600	0-30	600 max
*5600+	13/32x1½"	1	N or I	600	0-30	600 max
*5700+	13/32x1½"	2	N or I	600	0-30	600 max
*5800	9/16x2"	1	N or I	600	0-30	250 max
*5900	13/16x3"	1	N or I	600	31-60	250 max

*CSA Certified
+Ignition Protected Devices

Indicating models can be modified for use in low voltage applications.

Military Fuseholders

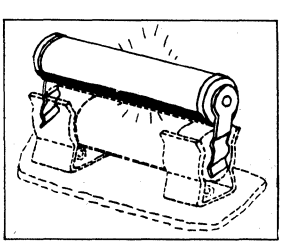
MIL-SPEC	Type	Fuse Size	Qty	Indicating (I) or Non-Indicating (N)	Amps	Volts	Moisture Protection
19207/1	FHL10U	¼x1¼"	2	I	0-30	90-250	Unsealed
19207/2	FHL11U	¼x1¼"	1	I	0-30	90-250	Unsealed
19207/3	FHL12U	13/32x1½"	1	I	0-30	90-500	Unsealed
19207/4	FHL13G	9/16x2"	1	I	0-30	90-500	Dripproof
19207/5	FHL14G	13/16x3"	1	I	31-60	90-500	Dripproof
19207/6	FHL15G	1 1/16x5⅝"	1	I	61-100	90-500	Dripproof
19207/7	FHL16G	1⅜x7⅛"	1	I	101-200	90-500	Dripproof
19207/17	FHN28WB	¼x1¼"	1	N	0-30	250 Max	Watertight Body Sealed
19207/18	FHL29G	¼x1¼"	2	I	0-30	12-90	Dripproof
19207/19	FHL30G	¼x1¼"	1	I	0-30	12-90	Dripproof
19207/21	FHL32W	¼x1¼"	1	I	0-30	90-250	Watertight
19207/22	FHL33W	¼x1¼"	2	I	0-30	90-250	Watertight
19207/23	FHL34W	13/32x1½"	2	I	0-30	90-500	Watertight
19207/24	FHL35W	13/32x1½"	1	I	0-30	90-500	Watertight
19207/25	FHN41WB	13/32x1½"	1	N	0-30	500 Max	Watertight Body Sealed
19207/30	FHN46WB	¼x1¼"	3	N	0-30	250 Max	Watertight Body Sealed
19207/31	FHN47WB	13/32x1½"	3	N	0-30	500 Max	Watertight Body Sealed

Blown Fuse Indicators

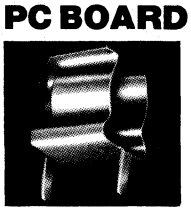
When A Fuse Blows, A Light Glows!®

Several Models To Choose From

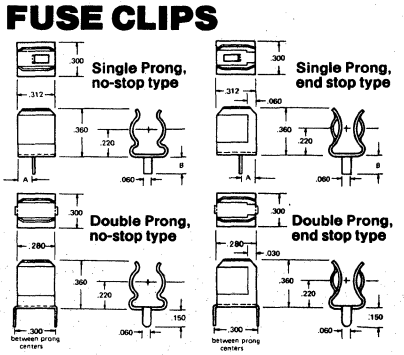
- Bolt Down for Rectifier Fuses
- Snap On for Ferrule Fuses
- Top Mounting for Knife Blade Fuses



PC BOARD FUSE CLIPS



Low profile clips (.360" high) are soldered to printed circuit boards eliminating eyeletting or riveting. Available in Spring brass, beryllium copper or spring bronze with various platings.



FIC CORPORATION
P.O. Box 2046
12216 Parklawn Drive
Rockville, MD 20852
TOLL FREE: 800/638-6594
IN MD: 301/881-8124
TWX: 710-828-9809

HEINEMANN® Circuit Breakers First in Features, First in Quality

Heinemann offers the widest choice of styles and current ratings in high-quality, reliable circuit protectors. Ratings range from 0.01A to as high as 700A. Their applications are as diverse as medical equipment, computers, industrial air conditioners, electric locomotives and telecommunications equipment.

Heinemann can also supply circuit breakers that provide auxiliary functions. For example, a heavy-duty relay, an on/off switch and a hydraulic-magnetic circuit breaker, all in one economical and compact unit.

Use this condensed guide to locate the type of circuit breaker that best meets your requirements. Then write or call us for a copy of the appropriate product bulletin containing detailed specifications and ordering information. Or call one of our technical assistance engineers to dicuss your particular application.

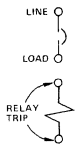
Technical assistance, important features and quality products...three reasons why it pays to look to Heinemann "When your reputation's on the line."

SPECIAL-FUNCTION CIRCUITS

Heinemann circuit breakers (except for PS1, KD, TX and Hector) can be furnished with a number of special-function internal circuits. They permit a single protector to perform the protection and control functions of several components.

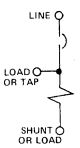
RELAY-TRIP

Permits remote actuation using a separate control circuit. Electrical isolation allows use of a different current or voltage from contact circuit. Both time delay and non-time delay constructions are available.



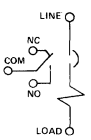
SHUNT/TAP

Use of third terminal permits remote tripping by utilizing line voltage with or without a time delay response. On breakers rated up to 1A, the trip point may be raised by shunting with an external resistor on the shunt/tap terminal.



AUXILIARY SWITCH

Used for logic functions, alarms, lights and other circuits. Miniature snap-action SPDT or DPDT switch is mounted on the back of the breaker, mechanically connected to the switching mechanism. Contact capacity: 10A at 125/250 V, 50/60 Hz; 4A resistive at 30 Vdc; 2.5A inductive at 30 Vdc. Minimum operating voltage 6 Vdc or ac, at 3 VA dc or ac.

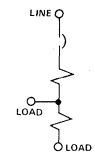


SERIES TRIP (Standard internal circuit)

Ideal for use as both power switch and overload protector. Usually installed in series with line and load terminals to provide circuit interruption in the protected circuit.

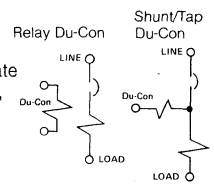
DUAL RATING

Two concentrically-wound sensing coils provide two discrete current ratings in the same breaker. Protects equipment designed to operate at two different current levels or supply voltages within certain limitations.



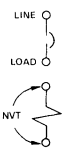
DU-CON™ (DUAL-CONTROL)

Provides sensing of both overcurrent and separate voltage signals in the same pole through a small, non-continuous-duty voltage sensing coil. DU-CON overload and voltage coils must be specified separately.



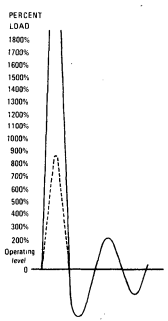
NO-VOLTAGE TRIP

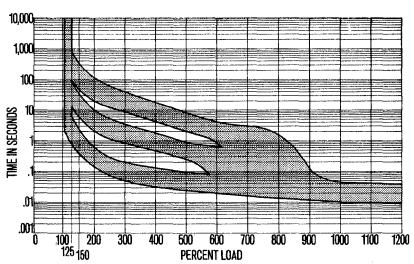
Prevents uncontrolled re-start of equipment after power outage. Used in ground-fault interrupters and other safety applications. Not intended for overload protection without one pole connected in series-trip configuration.



HIGH-INRUSH

Economical protection of high-reactance loads, which draw starting surges often as high as 30 times normal load current in a 50/60 Hz 1/2-cycle pulse, such as ferro-resonant power supplies and distribution transformers. Eliminates nuisance tripping without derating or special circuitry.





Typical Time Delay Curves

Circuit breakers are available in a variety of time-delay curves for applications such as high-inrush, 50/60 Hz and dc as well as with no intentional delay.

When your reputation's on the line

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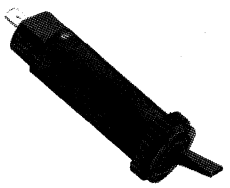
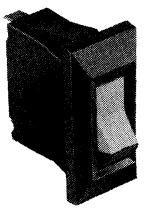
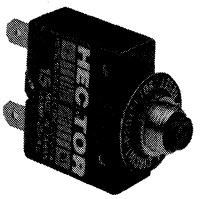
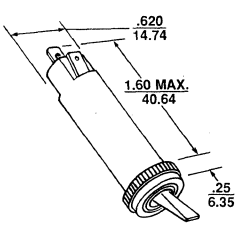
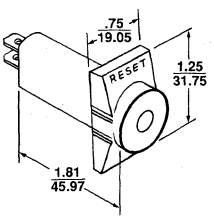
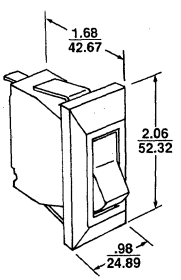
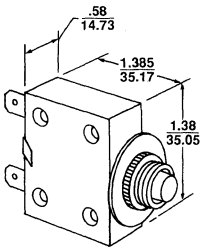
P.O. Box 6800, Lawrenceville, NJ 08648-0800 USA • (609) 882-4800 • EasyLink 62886238 • FAX (609) 882-2183

HEINEMANN® Circuit Breakers First in Features, First in Quality

	PS1 FUSE-SWITCH	RE-CIRK-IT® SERIES KD1	TYPE TX	HECTOR
				
	Fuse-Switch provides ON/OFF control and fuse protection in a single low-cost component. Its use eliminates a hole and interconnecting wiring and makes it easy to re-fuse from the front panel. It accepts standard 1/4-inch diameter by 1¼-inch fuses. An adapter is available for 5 mm x 20 mm fuses. Can be supplied for normally open or normally closed operation.	A low-cost, pushbutton supplementary protector for electrical equipment, designed to fit in a standard 5/8-inch round or "D" fuseholder panel cutout. Resettable at up to 1000% of its rated current from 2.5A through 15A, 500% from 0.25A through 2A. Slide-on retaining ring included.	The attractively designed Type TX circuit protector doubles as an economical ON/OFF switch and with an optional lamp as a power indicator. Rocker arms available in a variety of colors; in one and two pole models. Its trip free design cannot be held closed against a fault. Features quick-connect terminals and snap-in mounting.	A low-cost fuse eliminator for the protection of electronic equipment and high-inrush circuitry from 4A to 20A. Its trip-free design prevents the contacts from being held closed manually during an overload condition. Supplied with mounting nut and faceplate reading "PRESS TO RESET." It has 1/4-inch quick-connect terminals that are also solderable.
APPLICATIONS	Consumer and industrial products that would otherwise use a separate ON/OFF switch and fuse holder.	Consumer and industrial products, office machines, appliances, power supplies, convenience outlets, electronic games.	Commercial and consumer products, power supplies, medical electronic equipment, office and reproduction equipment, data processing equipment.	Consumer and commerical electronic equipment, appliances and high-inrush circuitry.
NO. OF POLES	1	1	1 and 2	1
CURRENT RATINGS	Determined by choice of fuse. To 20A	0.25-15A	2,3,5,7,10,15 and 20A	4,5,6,7,7.5,9,10,12,15, 18 and 20A
MAX. VOLTAGE	120 Vac @ 20A 250 Vac @ 15A 32 Vdc @ 20A	250 V, 50/60 Hz 50 Vac up to 10A 32 Vdc @ 15A 50 Vdc @ 10A	250 Vac (10A max.) 125 Vac (20A max.) 32 Vdc (20A max.)	125 Vac (20A max.) 12/24 Vdc (20A max.)
INTERRUPTING CAPACITY		1000A @ 250 V, 50/60 Hz 200A @ 32 Vdc and 50 Vdc per UL Std 1077 testing procedures	3500A (ac) with backup fusing 1000A (dc) with backup fusing	1000A (ac) with backup fuse 200A (dc) with backup fuse
AGENCY RECOGNITION OR APPROVAL	UL recognized CSA certified SEV approved	UL recognized (Std 1077) CSA certified VDE approved SEV approved	UL recognized, Component Recognition Program CSA certified Suitable for VDE 0730 Equipment	UL recognized (Std 1077) CSA certified
DIMENSIONS				

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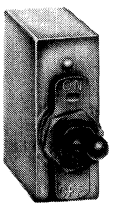
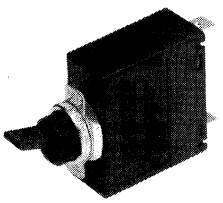
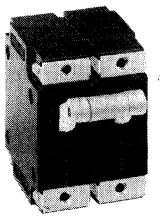
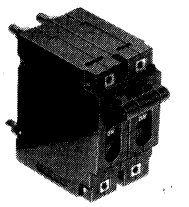
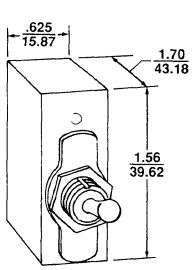
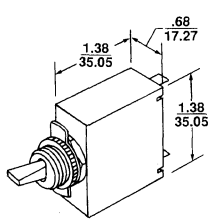
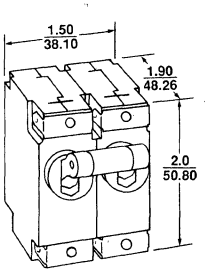
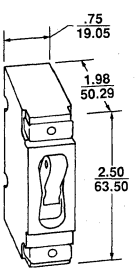
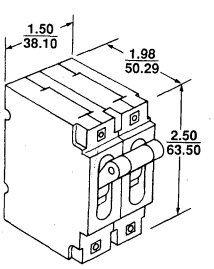
HEINEMANN® Circuit Breakers First in Features, First in Quality

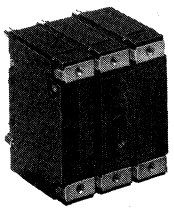
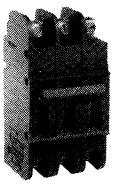
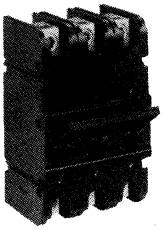
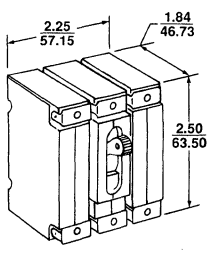
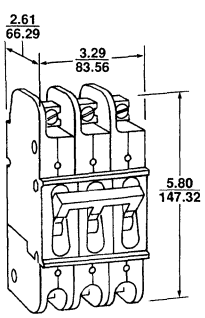
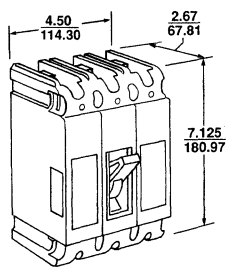
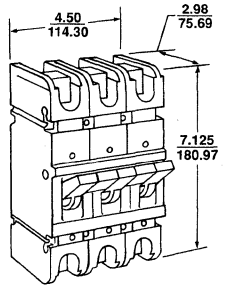
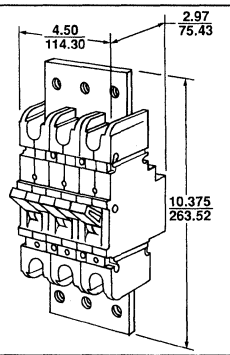
SERIES HM	SERIES L	SERIES J/S	SERIES AM	SERIES AM-MIL
				
Lightweight, subminiature, multi-frequency circuit breaker designed to withstand severe environmental extremes such as shock, vibration and high humidity. Housed in a corrosion-resistant brass case, nickel plated. Meets MIL-C-39019, is explosion- and fungus-resistant, operates in any position. Silver contacts provide good conductivity with low power loss.	This compact hydraulic-magnetic circuit protector provides the same quality, precision and choice of time delays found in larger Heinemann magnetic circuit breaker. Over-the-center, non-teasable mechanism provides snap-action operation that prolongs contact life by reducing arcing. Handles available in seven different colors for decorative or circuit-identification purposes.	Compact, lightweight, moderately-priced circuit breaker for single or multi-pole OEM applications. Also available with snap-in mounting or rocker handles. Sealed mount models are also available, single pole only. Series J/S breakers are suitable for domestic or world-market applications. Models also available for marine applications.	A low-cost, lightweight breaker available in single or multi-pole configurations, the Series AM features rear-connection studs, a high level of moisture resistance, and a current range up to 100A dc or 60A ac. Qualified under MIL-C-55629 to 50A dc and ac.	Heinemann Series AM-MIL breakers are specifically built and tested in accordance with the requirements of MIL-C-55629. Fungus- and moisture-resistance is provided by treating all ferrous parts with a special finish, and by using special springs and inherently fungus-resistant phenolic cases, covers and handles.
Military programs and commercial products, power supplies, mining and medical applications where hermetically-sealed circuit protection is required.	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment).	OEM (power supplies, medical-electronic equipment, control systems, office and EDP equipment), control panels, marine equipment, field instrumentation.	OEM (data-processing equipment, mobile applications, humid environments).	OEM (data processing equipment, mobile applications, military equipment subject to humid, tropical environments).
1 and 2	1 and 2	1 to 4	1 to 4	1 to 3
0.050-20A	0.1 to 20A	0.02-50A	0.020-60A (ac) 0.020-100A (dc)	0.020-50A (ac and dc)
240 Vac, 60 or 400 Hz; 50 Vdc	250 Vac (7.5A max.) 125 Vac (15A max.) 32 Vdc (20A max.)	250 Vac (30A max.) 65 Vdc (50A max.) 80 Vdc (15A max.)	250 V, 50/60 or 400 Hz 277 V, 50/60 Hz, 1-phase 480 V, 50/60 Hz, 3-phase "Y" 65 Vdc AC/DC	240 V 50/60 Hz 240 V 400 Hz 50 Vdc
1000A @ 240 V, 60 Hz or 400 Hz and 50 Vdc per UL Std 1077 testing procedures	1000A 5000A with backup fusing	1000A 5000A with backup fusing	1000A 5000A with backup fusing	2000A @ 50 Vdc and 120 Vac 60 Hz 1500A @ 120 Vac, 400 Hz 1000A @ 240 Vac, 60 and 400 Hz
Not UL/CSA recognized or listed. Available as MIL-C-39019 QPL item.	UL recognized (Std 1077) CSA certified SEV approved IEC approved Designed to meet VDE	UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	UL recognized CSA certified	Not required for QPL items
				

When your reputation's on the line

HEINEMANN® ELECTRIC COMPANY

P.O. Box 6800, Lawrenceville, NJ 08648-0800 USA • (609) 882-4800 • EasyLink 62886238 • FAX (609) 882-2183

HEINEMANN® Circuit Breakers First in Features, First in Quality

SERIES AM/S	SERIES CF E-FRAME	SERIES GH EH-FRAME	SERIES GJ	SERIES GJ1P
				
Series AM/S "world class" circuit breakers meet International Standard IEC 380 and German Standard VDE 0730. The 8-mm spacing requirement and dielectric-withstand specification are incorporated into the standard AM breaker housing without changes in size, thereby eliminating mounting procedure modifications or the need for adapter plates.	Priced considerably lower than competitive E-frame breakers, the Series CF is the most compact and versatile circuit breaker available for equipment and branch-circuit protection. Single- and multi-pole models are stocked in a wide range of standard ratings for fast, off-the-shelf delivery.	This rugged new EH-frame breaker offers all the advantages of a completely magnetic, three-pole breaker with 14,000A interrupting capacity for less than most thermal units. Compact, environmentally stable and to 100A at 480 Vac and 250 Vdc.	Where space is at a premium and current capacity up to 250A is called for, the Series GJ is the answer. Available in one-, two-, or three-pole models, it is especially suitable for panelboards, service entrances, and electric vehicles.	GJ1P parrallel-pole breakers incorporate Precision Current Equalization (PCE) to automatically distribute current equally through the current-sensing elements. PCE thereby minimizes nuisance tripping which can occur with conventional parallel-pole breakers. An optional shunt permits metering of current. Since shunt output is only 25 mv, light-gauge wiring can be used between shunt and meter.
OEM (data processing equipment, mobile applications, humid environments).	Panelboards, switchboards, branch circuits, EDP equipment, machine tools, environmental systems, single- and three-phase applications.	Motor controls, air conditioning, electric heating, computer main frames, transportation, indoor or outdoor installations.	Commercial, industrial, and residential service — entrance or panelboard applications; lighting, appliance, transformer, electric vehicles, EDP power supplies, heating, air conditioning, and electronic circuit protection.	Telecommunications, transportation, air conditioning, other outdoor "heat-loaded" equipment.
1 to 4	1 to 6	1 to 3	1 to 3	1
0.020-60A (ac) 0.020-100A (dc)	0.01-100A (ac) 1.0-100A (dc)	.5-100A (ac) .5-100A (dc)	100-250A	100-700A (dc)
250 V 50/60 Hz or 400 Hz 277 V 50/60 Hz 1-phase 65 Vdc 480 V 50/60 Hz 3-phase "Y"	240 V, 50/60 or 400 Hz 480 V, 1- and 3-phase 125 Vdc 600 V, 3-phase 125 Vdc	480 V, 50/60 Hz 250 Vdc	240 V, 50/60 Hz 125/250 Vdc	160 Vdc
1000A 5000A with backup fusing	10,000 @ 120 Vac 7500A @ 120/240 Vac 50/60 Hz; 240 Vac 50/60 Hz 5000A @ 120/240 Vac 400 Hz; 240 Vac 400 Hz 125 Vdc	14,000A (ac) 10,000A (dc)	18,000A @ 240 V, 50/60 Hz 10,000A @ 125/250 Vdc 14,000A @ 160 Vdc 25,000A @ 65 Vdc	10,000A @ 160 Vdc 25,000A @ 65 Vdc
UL recognized (Std 1077) CSA certified SEV approved IEC approved VDE approved	240 V, 50/60 Hz and 125 Vdc: UL listed Others: Recognized CSA certified	UL listed (ac) (3-pole) 480 Vac 15-100A	240 V, 50/60 Hz and 125/250 Vdc: UL listed	160 Vdc: UL listed
				

When your reputation's on the line

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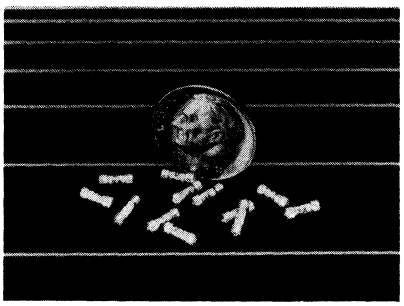
P.O. Box 6800, Lawrenceville, NJ 08648-0800 USA • (609) 882-4800 • EasyLink 62886238 • FAX (609) 882-2183

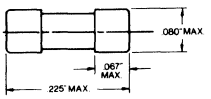
Littelfuse® CIRCUIT PROTECTION DEVICES

SUBMINIATURE SURFACE MOUNT NANOFUSE™



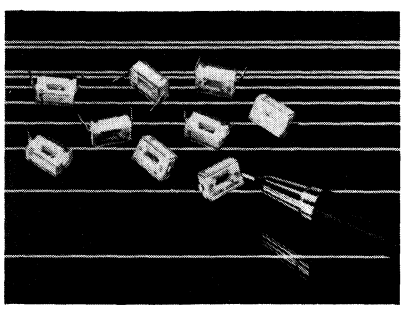
- Design compatibility for surface mount applications.
- Reduced subminiature size for compact board layouts.
- Supplied on 12mm tape and reel for use with automatic placement equipment per EIA Standard 481.
- Designed to meet a wide variety of electrical and environmental MIL specifications for more demanding applications.

Opening Time: 100%, 4 hrs. min. 200%, 1 sec. max. (1/16-5A), 5 sec. max. (7-10A), 20 sec. max. (12-15).
Interrupting Rating: 300A D.C. and 50A A.C. at rated voltage.
Approvals: U.L. Recognized and Certified by C.S.A.



Catalog Number	Ampere Rating	Voltage Rating
R271.062	1/16	125V
R271.125	1/8	125V
R271.250	1/4	125V
R271.375	3/8	125V
R271.500	1/2	125V
R271.750	3/4	60V
R271001	1	60V
R27101.5	1-1/2	60V
R271002	2	60V
R27102.5	2-1/2	60V
R271003	3	60V
R27103.5	3-1/2	60V
R271004	4	60V
R271005	5	32V
R271007	7	32V
R271010	10	32V
R271012	12	32V
R271015	15	32V

FLAT-PAK® DIP FUSES

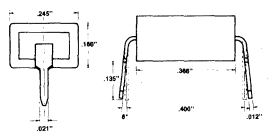


- Low profile design.
- New subminiature rectangular shape for easy fuse identification.

- Visible element for blown fuse indication.
- Stamped with "T" symbol and color-coded blue to indicate Slo-Blo® performance feature.
- Stamped with "F" symbol and color coded red to indicate fast-acting performance feature.
- Unique DIP design and magazine cartridge packaging make Flat-Pak® ideal for high speed automatic insertion.
- Patent Number 4,563,666.

Fast-Acting Type—
Opening Time: 100%, 4 hrs. min. 200%, 2 sec. max.
Slo-Blo Type—
Opening Time: 100%, 4 hrs. min. 200% 1 sec. min./30 sec. max.
Interrupting Rating: 50A A.C. at rated voltage.
Approvals: U.L. Recognized and Certified by C.S.A.

Littlefuse Number			
Fast-Acting	Slo-Blo	Ampere Rating	Voltage Rating
202.062	—	1/16	250V
202.125	—	1/8	250V
202.250	203.250	1/4	250V
202.500	203.500	1/2	250V
202.750	203.750	3/4	250V
202001	203001	1	250V
20201.5	20301.5	1-1/2	250V
202002	203002	2	250V
20202.5	20302.5	2-1/2	250V
202003	203003	3	250V
202004	203004	4	250V
202005	203005	5	250V



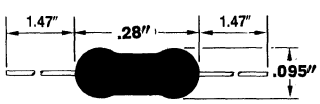
PICO II™ SUBMINIATURE FUSES

- World's smallest axial lead fuse for use in micro electronic circuits including computer and aerospace applications.
- Available on tape and reel.
- Low resistance values.
- Hi-speed action.
- Epoxy coated body for protection against environmental conditions.
- Withstand axial pull of 7 lbs.
- Available with or without color-coding per I.E.C. standards.
- Interrupting rating of 300A D.C. and 50A A.C. at rated voltage.

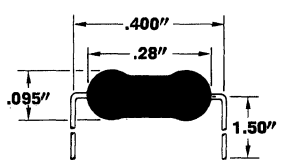
ENVIRONMENTAL CHARACTERISTICS
- Operating ambient temperature range: −55°C to 125°C
- Current carrying capacity:
  −55°C = 110% of rating
  25°C = 100% of rating
  125°C = 80% of rating
- Withstand vibrations of 10-55 Hz per method 201 of MIL-STD-202 and vibrations of 55-2000 Hz at 10 G's per method 204 test condition C of MIL-STD-202.
- Withstand shock of 100 G's for 6 milliseconds per method 213 test condition I of MIL-STD-202.

Opening Time: 100%, 4 hrs. min.; 200%, 5 sec. max. (1/16-7A) 3 sec. max. (10A) 10 sec. max. (12-15A).
U.L. Recognized and Certified by C.S.A. through 15 amperes.

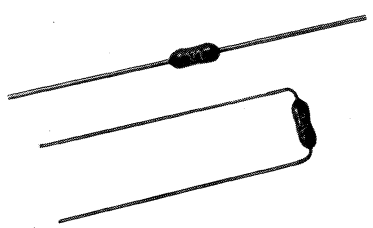
251 Series - Axial Leads



252 Series - Radial Leads



Note: Leads are solder-coated copper, .025" diameter for 1/16-10A, .032" diameter for 12-15A.



L.F. Number		Amp Rating	Voltage Rating
Axial Leads	Radial Leads		
251.062	252.062	1/16	125
251.125	252.125	1/8	125
251.250	252.250	1/4	125
251.375	252.375	3/8	125
251.500	252.500	1/2	125
251.750	252.750	3/4	125
251001	252001	1	125
25101.5	25201.5	1-1/2	125
251002	252002	2	125
25102.5	25202.5	2-1/2	125
251003	252003	3	125
25103.5	25203.5	3-1/2	125
251004	252004	4	125
251005	252005	5	125
251007	252007	7	125
251010	252010	10	125
251012	252012	12	32
251015	252015	15	32

Note: To order color-coded PICO II™ fuses, use **255 Series** (for Axial leads) or **256 Series** (for Radial leads) in part number table above.

Littelfuse®

CIRCUIT PROTECTION DEVICES

3AG FUSES (32V) ¼" x 1¼"

Medium-acting fuses for use in cars, radios, amplifiers, etc.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 10 sec. max. (4-30A), 20 sec. max. (35A)

U.L. Listed under U.L. STD 275 through 30 amps.
CSA Certified through 30 amps.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
311004	4	31107.5	7-1/2	311015	15
311005	5	311008	8	311025	25
311006	6	311010	10	311030	30
311007	7	311012	12	311035	35

3AG FUSES (250V) ¼" x 1¼"

Quick-acting, normal-blo fuses for general circuit protection.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
312.010	1/100	312.300	3/10	312002	2
312.031	1/32	312.375	3/8	3122.25	2-1/4
312.062	1/16	312.500	1/2	31202.5	2-1/2
312.100	1/10	312.600	6/10	312003	3
312.125	1/8	312.750	3/4	312004	4
312.150	15/100	312001	1	312005	5
312.175	.175	3121.25	1-1/4	312006	6
312.187	3/16	31201.5	1-1/2	312007	7
312.200	2/10	31201.6	1-6/10	312008	8
312.250	1/4	3121.75	1-3/4	312010	10

3AG AXIAL LEAD FUSES

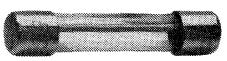
Same as above but with Axial leads for direct wiring into chassis. Leads are 1-1/2" long, copper wire.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 5 sec. max.

U.L. Listed and Certified by CSA

Note: To order fuses with axial leads, change **312** series number to **318.**

3AG SLO BLO® FUSES (250V or less) ¼" x 1¼"



Designed to withstand momentary high-current surges but still blow quickly on shorts. Provide protection for equipment with high reactive current surges or heavy starting currents such as solenoids, motors and lamp circuits.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
313.010	1/100	313.700	7/10	313005	5
313.031	1/32	313.750	3/4	3136.25	6-1/4
313.040	4/100	313.800	8/10	313007	7
313.062	1/16	313001	1	313008	8*
313.100	1/10	31301.2	1-2/10	313010	10*
313.125	1/8	3131.25	1-1/4	313012	12*
313.150	15/100	31301.5	1-1/2	313015	15*
313.175	.175	31301.6	1-6/10	313020	20*
313.187	3/16	31301.8	1-8/10	313025	25*
313.200	2/10	313002	2	313030	30*
313.250	1/4	3132.25	2-1/4		
313.300	3/10	31302.5	2-1/2		
313.375	3/8	31302.8	2-8/10		
313.400	4/10	313003	3		
313.500	1/2	31303.2	3-2/10		
313.600	6/10	313004	4		

*32 volt. Note: For axial leads, change **313** to **315.**

3AG SLO BLO®AXIAL LEAD FUSES

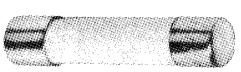
Same as above but with Axial leads for direct wiring into chassis. Leads are 1-1/2" long, copper wire.

Opening Time: 100%, 4 hour min.; 135%, 1 hour max., 200%, 5 sec. min.

U.L. Listed and certified by CSA through 7 amps.
U.L. Recognized from 8-30 amps.

Patents: U.S. patents 4,409,729 and 4,445,106.

3AB CERAMIC SLO BLO® FUSES (250V or less) ¼" x 1¼"



Similar to 313(000) series above, but have higher interrupting rating.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 5 sec. min.

U.L. Listed 1/100 - 10 amps.
U.L. Recognized 12-30 amps.
CSA Certified 1/4-10 amps.
Patents: U.S. Patents 4,409,729 and 4,445,106.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
326.010	1/100	326.600	6/10	326004	4
326.031	1/32	326.700	7/10	326005	5
326.062	1/16	326.750	3/4	3266.25	6-1/4
326.100	1/10	326.800	8/10	326007	7
326.125	1/8	326001	1	326008	8
326.150	15/100	32601.2	1-2/10	326010	10
326.175	.175	3261.25	1-1/4	326012	12
326.187	3/16	32601.5	1-1/2	326015	15
326.200	2/10	32601.6	1-6/10	326020	20
326.250	1/4	326002	2	326025	25*
326.300	3/10	32602.5	2-1/2	326030	30*
326.375	3/8	32602.8	2-8/10		
326.400	4/10	326003	3		
326.500	1/2	32603.2	3-2/10		

* 125 volt.

3AB CERAMIC BODY FUSES (250V or less) ¼" x 1¼"

Ceramic body and arc-quenching filler in higher amperages provide high interrupting rating.

Opening Time: 1/8-30 amps: 110%, 4 hrs. min.; 135%, 1 hr. max.; **1/8-12 amps:** 200%, 15 sec. max.; **15-30 amps:** 200%, 60 sec. max.

U.L. Listed through 15 amps.

Certified by CSA through 15 amps. U.L. Recognized 20-30 A.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
314.125	1/8	314003	3	314012	12
314.250	1/4	314004	4	314015	15
314.375	3/8	314005	5	314020	20
314.500	1/2	314006	6	314025	25*
314.750	3/4	314007	7	314030	30*
314001	1	314008	8		
314002	2	314010	10		

* 125 volt.

3AB CERAMIC BODY RECTIFIER FUSES (250V or less) ¼" x 1¼"

Extremely fast-acting fuses for protection of silicon controlled rectifiers and similar solid state devices.

Opening Time: 1-30 amps: 100%, 4 hour min.; **1-10 amps:** 250%, .2 sec. max. (pre-arcing); **12-30 amps:** 250%, 1 sec. max. (pre-arcing).

U.L. Recognized.

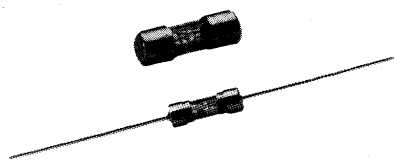
L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
322001	1	322006	6	322012	12*
3221.25	1-1/4	322007	7	322015	15*
322002	2	322008	8	322020	20*
322003	3	322009	9	322025	25*
322004	4	322010	10	322030	30*
322005	5				

* 65V. All others 250V.

Littelfuse®

CIRCUIT PROTECTION DEVICES

2AG SUBMINIATURE FUSES



Smallest glass fuse available today. Size .177" dia. × .58".

FAST ACTING TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 1 sec. max.

Interrupting Rating: 1/8-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amp** — 10,000A (125V); 100A (250V). **4-7 amps** — 10,000A (125V).
Approvals: U.L. Listed and Certified by C.S.A.
PATENTS: U.S. Patent 4,636,765

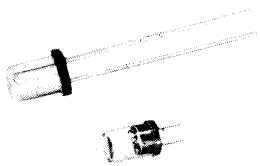
SLO-BLO® TYPE

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.; 200%, 3 sec. min./1 min. max.
Interrupting Rating: 1/4-1 amp — 10,000A (125V); 35A (250V). **1.5-3.5 amps** — 10,000A (125V); 100A (250V). **4-7 amps** — 400A (125V).
Approvals: U.L. Listed and Certified by C.S.A. thru 3.5 amps. U.L. Recognized 4-7 amps.
PATENTS: U.S. Patent 4,409,729 and 4,445,106.

Littlefuse Number			
Fast-Acting	Slo-Blo	Ampere Rating	Voltage Rating
225.125	—	1/8	250V
225.250	229.250	1/4	250V
225.375	229.375	3/8	250V
225.500	229.500	1/2	250V
—	229.600	6/10	250V
225.750	229.750	3/4	250V
225001	229001	1	250V
22501.5	22901.5	1-1/2	250V
225002	229002	2	250V
—	2292.25	2-1/4	250V
22502.5	22902.5	2-1/2	250V
225003	229003	3	250V
22503.5	22903.5	3-1/2	250V
225004	229004	4	125V
225005	229005	5	125V
225007	229007	7	125V

Note: To order fast-acting fuses with axial leads, change **225** to **224**; to order Slo-Blo® fuses with axial leads, change **229** to **230.**

MICROFUSE SUBMINIATURE FUSES (125V)

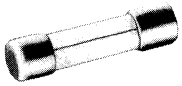


Designed for applications where space is a critical factor. Ideal for installation on printed circuit boards. Interrupting rating — 125 volts at 10,000 amperes A.C.

Opening Time: 100%, 4 hour min.; 200%, 5 sec. max. (1/500-3/10A). 2 sec. max. (4/10-5A).
Size: 1/4" dia. × 11/32" (fuse body).
U.L. Recognized and Certified by C.S.A.
Plug-in, transparent cap type listed. Use prefix **272** for plug-in, metal cap; prefix **279** for radial, transparent cap; prefix **278** for radial, metal cap.
PATENTS: U.S. Patent 3,110,787.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
273.002	1/500	273.125	1/8	273.750	3/4
273.005	1/200	273.200	2/10	273.800	8/10
273.010	1/100	273.250	1/4	273001	1
273.015	1/64	273.300	3/10	27301.5	1-1/2
273.031	1/32	273.400	4/10	273002	2
273.050	1/20	273.500	1/2	273003	3
273.062	1/16	273.600	6/10	273004	4
273.100	1/10	273.700	7/10	273005	5

SUBMINIATURE FUSES (250V) 5 x 20mm



For original installations and replacements in foreign-made equipment, such as home and car radios, amplifiers, tape recorders, etc. and in other applications where space is a factor. Available in fast-acting, high interrupting; fast-acting; and slo-blo types.

FAST-ACTING HIGH-INTERRUPTING (250V) TYPE F

Opening Time: .050-3.15 amp — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-2 seconds; 400%, .003-0.3 seconds; 1000%, .02 seconds max. **4-10 amp** — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-3 seconds; 400%, .003-0.3 seconds; 1000%, .02 seconds max.

Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.
216.050	.050	216.315	.315	216002	2
216.063	.063	216.400	.400	21602.5	2.5
216.080	.080	216.500	.500	2163.15	3.15
216.100	.100	216.630	.630	216004	4
216.125	.125	216.800	.800	216005	5
216.160	.160	216001	1	21606.3	6.3
216.200	.200	2161.25	1.25	216008	8*
216.250	.250	21601.6	1.6	216010	10*

SEMKO approved through 6.3 amps.
U.L. Recognized.

FAST-ACTING (250V) TYPE F

Opening Time: .032-.100 amp — 150%, 60 minutes min.; 210%, 30 minutes max.; 275%, .01-5 seconds; 400%, .003-.1 second; 1000%, .02 seconds max. **125-10 amp** — 150%, 60 minutes min.; 210% 30 minutes max.; 275%, .05-2 seconds; 400%, .01-.3 seconds; 1000%, .02 seconds max.

Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.	Cat. No.	Amp. Rtg.
217.032	.032	217.250	.250	217002	2
217.040	.040	217.315	.315	217702.5	2.5
217.050	.050	217.400	.400	2173.15	3.15
217.063	.063	217.500	.500	217004	4
217.080	.080	217.630	.630	217005	5
217.100	.100	217.800	.800	21706.3	6.3
217.125	.125	217001	1	217008	8*
217.160	.160	21701.25	1.25	217010	10*
217.200	.200	21701.6	1.6		

SEMKO approved through 6.3 amperes. BSI approved from .050-6.3 amperes.

SLO-BLO® (250V) TYPE T

Opening Time: .032-.100 amp — 150%, 60 minutes min.; 210%, 2 minutes max.; 275%, 0.2-10 seconds; 400%, .04-3 seconds; 1000%, .01-3 seconds. **.125-10 amp** — 150%, 60 minutes min.; 210%, 2 minutes max.; 275%, 0.6-10 seconds; 400%, .15-3 seconds; 1000%, .02-3 seconds.

Catalog Number	Ampere Rating	Catalog Number	Ampere Rating
218.032	.032	218.630	.630
218.040	.040	218.800	.800
218.050	.050	218001	1
218.063	.063	2181.25	1.25
218.080	.080	21801.6	1.6
218.100	.100	218002	2
218.125	.125	21802.5	2.5
218.160	.160	2183.15	3.15
218.200	.200	218004	4
218.250	.250	218005	5
218.315	.315	21806.3	6.3
218.400	.400	218008	8*
218.500	.500	218010	10*

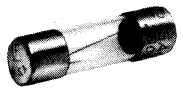
SEMKO and BSI approved through 6.3 amperes.
U.L. Recognized.

*** Standards for 5 x 20mm fuses do not include ratings above 6.3 amperes.**

Littelfuse®

CIRCUIT PROTECTION DEVICES

8AG INSTRUMENT FUSES (250V or less) ¼" x 1"



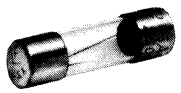
Very fast-acting fuses for protection of delicate equipment such as microammeters, galvanometers, voltmeters and other instruments.

Opening Time: 100%, 4 hour min.; 200%, 5 sec. max.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
361.002	1/500	361.125	1/8	361.750	3/4
361.005	1/200	361.187	3/16	361001	1
361.010	1/100	361.200	2/10	36101.5	1-1/2
361.015	1/64	361.250	1/4	361002	2
361.031	1/32	361.375	3/8	361003	3*
361.062	1/16	361.400	4/10	361004	4*
361.100	1/10	361.500	1/2	361005	5*

* 125 volt.

8AG NORMAL BLO FUSES ¼" x 1"



Normal blo fuses designed to standard N.E.C. specs. Used when space limitations prevent use of 3AG fuses.

Opening Time: 110%, 4 hour min.; 135%, 1 hour max.; 200%, 10 sec. max.

U.L. Listed through 6 amps. Certified by CSA 1/4-5 amps.

L.F No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
362.125	1/8	362002	2	362010	10†
362.250	1/4	36202.5	2-1/2*	362012	12†
362.375	3/8	362003	3*	362015	15†
362.500	1/2	362004	4*	362020	20†
362.750	3/4	362005	5*	362025	25†
362001	1	362006	6*	362030	30†
36201.5	1-1/2	362007	7*		
		362008	8†		

*125V. † 32V.

BLF FUSES (250V/125V or less) 13/32" x 1½"

For low-cost, non-time delay use in control circuits.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 15 sec. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed.
Certified by CSA.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLF 1/2	BLF 3	BLF 7	BLF 15
BLF 1	BLF 4	BLF 8	BLF 20*
BLF 1-1/2	BLF 5	BLF 9	BLF 25*
BLF 2	BLF 6	BLF 10	BLF 30*
BLF 2-1/2	BLF 6-1/4	BLF 12	

Note: Numerals indicate amperage ratings.

* 125V. All others 250V.

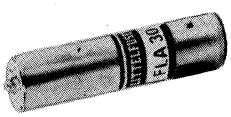
BLN FUSES (250V or less) 13/32" x 1½"

For low-cost, non-time delay use in control circuits and military applications.
Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 15 sec. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed. Certified by CSA.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLN 1	BLN 5	BLN 10	BLN 20
BLN 2	BLN 6	BLN 12	BLN 25
BLN 3	BLN 8	BLN 15	BLN 30
BLN 4			

Note: Numerals indicate amperage ratings.

FLA FUSES (125V) 13/32" x 1½"



Time delay fuses for use in circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed 1/10 - 15 amperes.
C.S.A. Certified 1/10 - 10 amperes.

Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLA 1/10	FLA 1	FLA 2-8/10	FLA 6-1/4
FLA 15/100	FLA 1-1/8	FLA 3	FLA 7
FLA 2/10	FLA 1-1/4	FLA 3-2/10	FLA 8
FLA 1/4	FLA 1-1/2	FLA 3-1/2	FLA 10
FLA 3/10	FLA 1-6/10	FLA 4	FLA 12
FLA 4/10	FLA 1-8/10	FLA 4-1/2	FLA 15
FLA 1/2	FLA 2	FLA 5	FLA 20
FLA 6/10	FLA 2-1/4	FLA 5-6/10	FLA 25
FLA 8/10	FLA 2-1/2	FLA 6	FLA 30

FLM FUSES (250V or less) 13/32" x 1½"

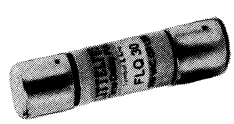
Dual element, time delay fuses for use in circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 12 sec. min.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed.
C.S.A. Certified.
PATENTS: U.S. Patents 4,409,729 and 4,445,106.

Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLM 1/10	FLM 1-1/8	FLM 3	FLM 8
FLM 15/100	FLM 1-1/4	FLM 3-2/10	FLM 9
FLM 2/10	FLM 1-4/10	FLM 3-1/2	FLM 10
FLM 1/4	FLM 1-1/2	FLM 4	FLM 12
FLM 3/10	FLM 1-6/10	FLM 4-1/2	FLM 15
FLM 4/10	FLM 1-8/10	FLM 5	FLM 20
FLM 1/2	FLM 2	FLM 5-6/10	FLM 25
FLM 6/10	FLM 2-1/4	FLM 6	FLM 30
FLM 8/10	FLM 2-1/2	FLM 6-1/4	
FLM 1	FLM 2-8/10	FLM 7	

FLQ FUSES (500V) 13/32" x 1½"



Time delay fuses for circuits with high in-rush currents.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max., 200%, 12 sec. min.
Interrupting Rating: 10,000 Amperes AC.
U.L. Listed. C.S.A. Certified.
PATENTS: U.S. Patents 4,409,729 and 4,445,106.

Note: Numerals indicate amperage ratings.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
FLQ 1/10	FLQ 8/10	FLQ 3-2/10	FLQ 9
FLQ 1/8	FLQ 1	FLQ 3-1/2	FLQ 10
FLQ 15/100	FLQ 1-1/8	FLQ 4	FLQ 12
FLQ 3/16	FLQ 1-1/4	FLQ 4-1/2	FLQ 14
FLQ 2/10	FLQ 1-1/2	FLQ 5	FLQ 15
FLQ 1/4	FLQ 1-6/10	FLQ 5-6/10	FLQ 20
FLQ 3/10	FLQ 2	FLQ 6	FLQ 25
FLQ 4/10	FLQ 2-1/4	FLQ 6-1/4	FLQ 30
FLQ 1/2	FLQ 2-1/2	FLQ 7	
FLQ 6/10	FLQ 3	FLQ 8	

BLS FUSES (600V or less) 13/32" x 1⅜"

Fast clearing, space-saving fuses for street lighting, control and electronic circuits.
Opening Time: 110%, 4 hrs. min., 135%, 1 hr. max. 200%, 5 sec. max. (2/10-5A), 10 sec. max. (6-10A).
Interrupting Rating: 10,000 amperes AC.
U.L. Listed 1/2 - 5 amperes.
C.S.A. Certified 1/2 - 5 amperes.
PATENTS: U.S. Patents 4,563,809 and 4,656,453.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
BLS 2/10	BLS 1	BLS 2	BLS 6
BLS 4/10	BLS 1-1/2	BLS 3	BLS 7
BLS 1/2	BLS 1-6/10	BLS 4	BLS 8
BLS 3/4	BLS 1-8/10	BLS 5	BLS 10
BLS 8/10			

Note: Numerals indicate amperage ratings.

Littelfuse®

CIRCUIT PROTECTION DEVICES

KLK FUSES (600 VAC) 13/32" × 1 1/2"

Fast-acting, current limiting fuses for use in control electronic and other circuits with high fault current capacity.

Opening Time: 110%, 4 hrs. min.; 135%, 1 hr. max. 200%, 2 sec. max. (1/10-4A) 15 sec. max. (5-12A) 2 min. max. (15-30A).
Interrupting Rating: 100,000 amperes AC. Capable of 200,000 amperes A.C.
U.L. Listed 3/10 - 30 amperes.
C.S.A. Certified 3/10 - 30 amperes.
PATENTS: U.S. Patents 4,563,809 and 4,656,453.

L.F. No.	L.F. No.	L.F. No.	L.F. No.
KLK 1/10	KLK 3/4	KLK 4	KLK 10
KLK 1/8	KLK 1	KLK 5	KLK 12
KLK 2/10	KLK 1-1/2	KLK 6	KLK 15
KLK 1/4	KLK 2	KLK 7	KLK 20
KLK 3/10	KLK 3	KLK 8	KLK 25
KLK 1/2	KLK 3-1/2	KLK 9	KLK 30

Note: Numerals indicate amperage ratings.

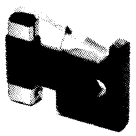
BLADE TYPE TERMINAL FUSES (32V) (ATO®)

Low voltage plug-in fuses. Color coded for amperage identification.

Opening Time: 110%, 100 hours min.; 135%, 1800 sec. max.; 200%, 5 sec. max. 350%, .02 sec. min. (1-2A), .08 sec. min. (3-30A) min. **Size:** .75" wide × .75" high × .207" deep.
U.L. Listed 3 - 30 amps.
PATENTS: Sixteen worldwide. U.S. Patent 3,909,767.

L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.	L.F. No.	Amp Rtg.
257001	1	257005	5	257020	20
257002	2	25707.5	7.5	257025	25
257003	3	257010	10	257030	30
257004	4	257015	15		

ALARM INDICATING FUSES (125 VAC, 60 VDC)



Plug-in fuses for telecommunications and similar applications. Blown fuse indicating flag can also activate alarm circuit. Flag is color-coded by ampere rating.

Opening Time: 100%, 10 minutes min.; 150%, 5 minutes max.
U.L. Recognized at 60 VDC.

L.F. No.	Amp Rtg.	Color Code	L.F. No.	Amp Rtg.	Color Code
401.180	18/100	Yellow	401002	2	Orange
401.250	1/4	Violet	401003	3	Blue
401.500	1/2	Red	401005	5	Green
401.650	65/100	Black	40107.5	7-1/2	Black/ White
401.750	3/4	Brown			
401001	1	Gray	401010	10	Red/ White
4011.33	1-1/3	White			

TYPE T FUSE BLOCKS WITH SCREW TERMINAL CLIPS

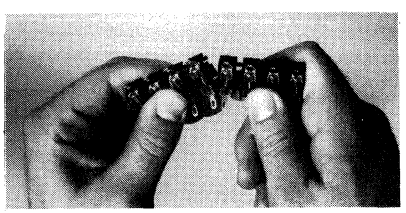
Open type blocks available for 3AG and (13/32" × 1-1/2") fuse sizes from one to twelve poles. Bases are of grade X black laminate with 1/32" insulator sheet cemented to underside. Screw terminal clips.

Mounting Hole: 3AG — .142"/.147" dia. with .295"/.302" by 82°CS. **5AG** — .171"/.176" dia. with .342"/.349" x 82°CS.
Clip Material: 356 Series—Nickel Plated Spring Brass. **359** and **556** Series—Silver Plated Beryllium Copper.
Size: Width: 2-3/8" (3AG), 2-3/4" (5AG). See chart for length dimensions. **356 Series and 556 Series are Recognized under the Components Program of Underwriters Laboratories.**

No. of Poles	For 3AG Fuses		For 5AG Fuses	
	Length (In.)	Part No.	Length (In.)	Part No.
1	25/32	356001	27/32	556001
2	1-11/16	356002	1-13/16	556002
3	2-19/32	356003	2-25/32	556003
4	3-1/2	356004	3-3/4	556004
5	4-13/32	356005	4-23/32	556005
6	5-5/16	356006	5-11/16	556006
7	6-7/32	356007	6-21/32	556007
8	7-1/8	356008	7-5/8	556008
9	8-1/32	356009	8-19/32	556009
10	8-15/16	356010	9-9/16	556010
11	9-27/32	356011	10-17/32	556011
12	10-3/4	356012	11-1/2	556012

For 3AG block with silver plated beryllium copper, change series number to **359.**

2AG OMNI FUSE BLOCK

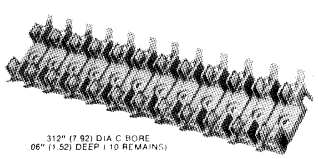


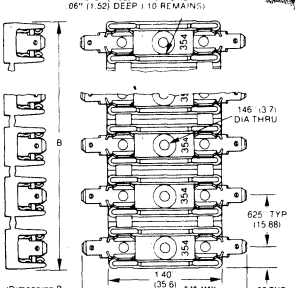
ELECTRICAL SPECIFICATIONS:
- 7 amps at 300 volts.
- Minimum dielectric - 1,500 volts RMS

MATERIALS:
Clip Terminals: Solder or Quick-connect, tin-plated, spring brass.
Base: Thermoplastic, glass reinforced. (Black standard) UL94V0 flammability rated.
Approvals: UL Recognized and Certified by CSA.

Catalog Number		Number of Poles	Overall Width (B)
Solder Type Terminals	0.110" Q.C. Terminals		
254001	254201	1	0.35"
254002	254202	2	0.80"
254003	254203	3	1.25"
254004	254204	4	1.70"
254005	254205	5	2.15"
254006	254206	6	2.60"
254007	254207	7	3.05"
254008	254208	8	3.50"

3AG OMNI-BLOK® FUSE BLOCKS





For 3AG fuses. New, low profile fuse blocks with "break-away" pole feature.

354000 SERIES SOLDER TERMINALS

354800, 354900 SERIES 1/4" Q.C. TERMINALS

354600 SERIES 3/16" Q.C. TEMINALS

354101-GY P.C. BOARD TERMINALS

Approvals: U.L. Recognized and Certified by CSA up to 300V and at current ratings shown below.

Series	Current Rating	
	U.L.	CSA
354000	30A	30A
354600	20A	20A
354800	20A	20A
354900	30A	25A
354101-GY	15A	15A

Specifications: 354 (000) Series (Solder type terminals); 30 amps, 300V. 354 (600) Series (3/16" Q.C. terminals); 20 amps, 300V. 354 (800) Series (1/4" Q.C. terminals); 20 amps, 300V. 354 (900) Series (1/4" Q.C. terminals): 30 amps, 300V. 354101-GY (PC Board): 15A, 300V.

Materials: Clip/terminal; High tensile spring brass, electro-tin plated. Base; Grey Polyester, glass reinforced. UL-94V0 flammability rating.

Special Options: Standard color is gray. Contact factory for special colors. Single pole units can be supplied with anti-rotation boss. Contact factory.

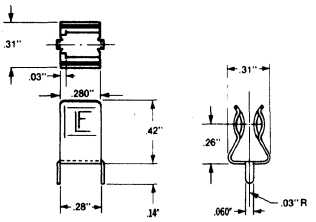
PATENTS: Pending.

Catalog Number				No. of Poles	Dimension "B"
Solder Type Terminals	NEMA STYLE 3/16" Q.C. Terminals	1/4" Q.C. Terminals	NEMA STYLE 1/4" Q.C. Terminals		
354001-GY	354601-GY	354801-GY	354901-GY	1	.50"
354002-GY	354602-GY	354802-GY	354902-GY	2	1.12"
354003-GY	354603-GY	354803-GY	354903-GY	3	1.75"
354004-GY	354604-GY	354804-GY	354904-GY	4	2.38"
354005-GY	354605-GY	354805-GY	354905-GY	5	3.00"
354006-GY	354606-GY	354806-GY	354906-GY	6	3.63"
354007-GY	354607-GY	354807-GY	354907-GY	7	4.25"
354008-GY	354608-GY	354808-GY	354908-GY	8	4.88"
354009-GY	354609-GY	354809-GY	354909-GY	9	5.50"
354010-GY	354610-GY	354810-GY	354910-GY	10	6.13"
354011-GY	354611-GY	354811-GY	354911-GY	11	6.75"
354012-GY	354612-GY	354812-GY	354912-GY	12	7.38"

FOR INFORMATION ON OTHER STYLES OF FUSE BLOCKS, CONTACT FACTORY.

Littelfuse® CIRCUIT PROTECTION DEVICES

P.C. BOARD FUSE CLIPS
FOR 1/4" DIAMETER FUSES

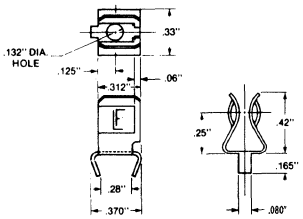


Cat. No.	Clip Material	Finish	Style
102071	Spring Brass	Tin Plated	Ear
102074	Spring Brass	Tin Plated	Earless
122083	Beryllium Copper	Silver Plated	Ear
122088	Beryllium Copper	Tin Plated	Ear
122087	Beryllium Copper	Silver Plated	Earless
122093	Beryllium Copper	Tin Plated	Earless

122093 Beryllium Copper Tin Plated Earless

Note: Spring brass clips are suitable for current levels up to 15 amperes; beryllium copper clips up to 30 amps.

P.C. BOARD FUSE CLIPS
BOWED TAB TYPE FOR 1/4" DIAMETER FUSES

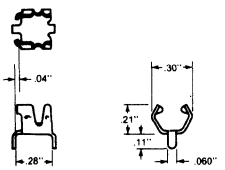


Cat. No.	Clip Material	Finish	Style
102078	Spring Brass	Tin Plated	Earless
102079	Spring Brass	Tin Plated	Ear
102082	Spring Brass	Hot Tin	Ear

102082 Spring Brass Hot Tin Ear

Note: Spring brass clips are suitable for current levels up to 15 amperes.

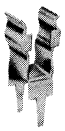
P.C. BOARD FUSE CLIPS
LOW PROFILE TYPE FOR 1/4" DIAMETER FUSES

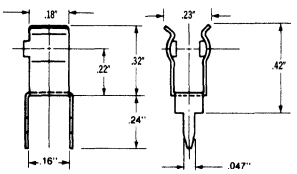


Cat. No.	Clip Material	Finish	Style
122090	Beryllium Copper	Silver Plated	Low Profile
102080	Spring Brass	Tin Plated	Low Profile

Note: Spring brass clips are suitable for current levels up to 15 amperes; beryllium copper clips up to 30 amperes.

P.C. BOARD FUSE CLIPS
FOR 5mm DIAMETER FUSES

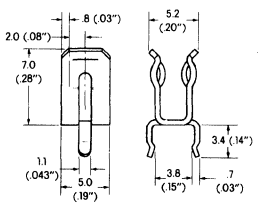




Cat. No.	Clip Material	Finish	Style
100054	Spring Brass	Silver Plated	Ear
100056	Spring Brass	Tin Plated	Ear

Note: Spring brass clips are suitable for current levels up to 10 amperes.

P.C. BOARD FUSE CLIPS
FOR 2AG OR 5mm DIAMETER FUSES



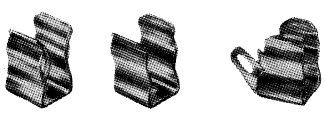
Cat. No.	Clip Material	Finish	Style
111501	Spring Brass	Tin Plated	Ear
111506	Beryllium Copper	Tin Plated	Ear

111506 Beryllium Copper Tin Ear

Note: Suitable for current levels up to 10 amperes.

Note: Metric dimensions are shown. Inch dimensions are in parentheses.

RIVET MOUNT FUSE CLIPS



EAR TYPE EARLESS TYPE LUG TYPE

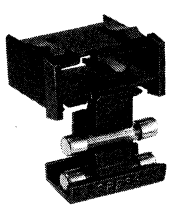
Be Cu*	Spring Brass†	Style	Fuse Dia.
121001	101001	Ear	1/4"
125001	105001		13/32"
127001	107001		9/16"
129001	109001		13/16"
121002	101002	Earless	1/4"

* Silver Plated. † Nickel Plated. ‡ Tin Plated.

Be Cu*	Spring Brass†	Style	Fuse Dia.
125002	105002	Earless	13/32"
127002	107002		9/16"
129002	109002		13/16"
121004	101003‡	Lug-45°	1/4"
122081	102064‡	Lug-Straight	1/4"

FLIP TOP SHOCK-SAFE PANEL MOUNT FUSEHOLDER #346877 FOR 3AG. (#286377 FOR 2AG, ∓286677 FOR 5x20mm)

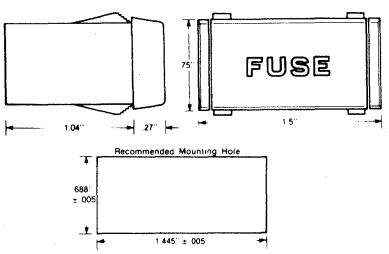
FUSE CARRIER HOLDS SPARE FUSE



Shock-Safe design eliminates any possibility of electrical shock, per IEC Standards 257 and 65. Fuse carrier holds spare fuse for fast, easy fuse replacement and convenient servicing. Low profile design complements modern panels.
APPROVALS: Recognized under the Components Program of Underwriters Laboratories and Certified by CSA.

SPECIFICATIONS:
Electrical Rating: See Approvals.
Insulation Resistance: 10,000 megohm minimum at 500 VDC.
Contact Resistance: Less than .01 ohm.
Dielectric Strength: 250 volts minimum.
Mounting: Snap-in mounting. No hardware required. Panel thickness = .032"/.125".
Molded Parts: Thermoplastic, 94V0 black standard (other colors available as special).
Fuse Carrier: Springloaded. Unlocks with a press of the finger. Locks into place to prevent accidental circuit interruption. Permanently attached to fuseholder body to prevent loss. Extracts fuse from live terminals.
Terminals: Copper alloy, tin plate. Accept .250" × .032" quick-connect or solder. .072" dia. hole.
Ambient Temperature: −40°C to +85°C.

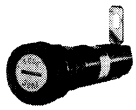
Vibration: 10-55-10 Hz at .06 double amplitude (Method 201, MIL-STD-202).
PATENTS: U.S. Patent 4,543,557.



Note: Dimensions differ for 2AG and 5×20 styles.

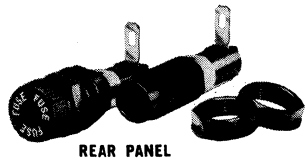
Littelfuse® CIRCUIT PROTECTION DEVICES

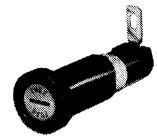
SHOCK-SAFE FUSEHOLDERS FOR 3AG OR 5 x 20mm FUSES


FRONT PANEL, LOW PROFILE

FRONT PANEL, HIGH PROFILE

FRONT PANEL


REAR PANEL


LOW PROFILE, QUICK MOUNT

- Designed to meet IEC (International Electrotechnical Commission) specifications 65 and 257.
- Eliminate possibility of electrical shock.
- Bodies accept ¼" x 1¼" or 5 x 20mm fuses with use of appropriate knob.
- **U.L. Recognized. Certified by CSA (20A, 300V). SEMKO approved (6.3A, 250 V). VDE approved (10A, 250V).**

SPECIFICATIONS

MOLDED PARTS
Body material: black glass-filled thermoplastic
Knob material: grey or black glass-filled thermoplastic
Hex nut material: glass filled thermoplastic

LOW PROFILE BODY
(with screwdriver slot knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345601	345621	X	
345611	345631		X

Body and Nut only: #345601-010 (Rt. Angle) #345611-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

HIGH PROFILE BODY
(with screwdriver slot knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345602	345622	X	
345612	345632		X

Body and Nut only: #345602-010 (Rt. Angle) #345612-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

KNOB
Finger grip or screwdriver slot types
Spring loaded, bayonet style
Fuse extractor
Nickel plated copper alloy insert

TERMINALS
Electro tin plated brass
Accept solder or 3/16" female connector. See below.

MOUNTING
Withstands 15 pound/inch mounting torque
Maximum panel thickness: 5/16"

ELECTRICAL CHARACTERISTICS
300 volt rating 20 amperes max.
Insulation resistance: 10,000 megohm minimum at 500 VDC

FINGER GRIP BODY
(with finger grip knob)

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345603	345623	X	
345613	345633		X

Body and Nut only: #345603-010 (Rt. Angle) #345613-010 (Straight)
Knob only: #345603-020 (¼" x 1¼") #345623-020 (5 x 20mm)

REAR PANEL-FINGER GRIP

L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345903	345923	X	
345913	345933		X

Body and Nuts (2) only: #345903-010 (Rt. Angle) #345913-010 (Straight)
Knob only: #345603-020 (¼" x 1¼") #345623-020 (5 x 20mm)

Contact Resistance: Less than .005 ohms average at currents up to 1 ampere.
Dielectric strength: 4000 volts minimum

ENVIRONMENTAL
Ambient temperature: −40°C to +85°C
Vibration: 10-500 Hz, .03" constant amplitude or 10 G's constant acceleration

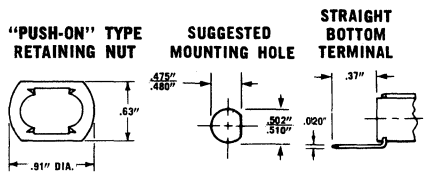
Patents: Pending

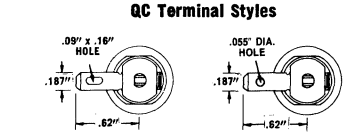
LOW PROFILE-FAST MOUNT

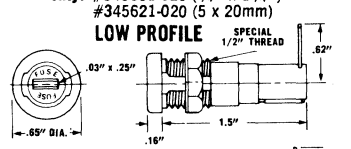
L.F. No.		Bottom Terminal	
1/4" x 1-1/4" Fuses	5mm x 20mm Fuses	Right Angle	Straight
345701	345721	X	
345711	345731		X

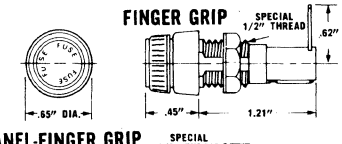
Body and Retaining Nut only: #345701-010 (Rt. Angle) #345711-010 (Straight)
Knob only: #345601-020 (¼" x 1¼") #345621-020 (5 x 20mm)

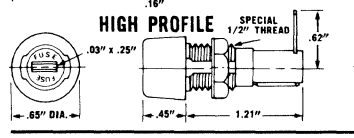
NOTE: Knobs are color-coded. On screwdriver slot type, knobs are grey for 1/4" × 1-1/4" fuses, black for 5 × 20mm fuses. On finger grip type, the lettering on knobs for 1/4" × 1-1/4" fuses are filled with white paint.

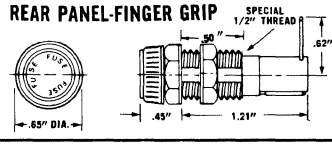


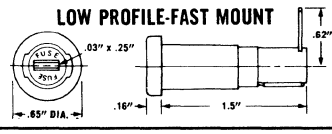


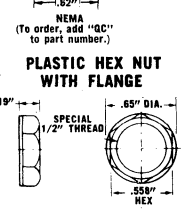




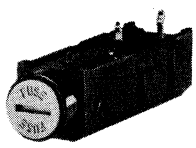








P.C. BOARD SHOCK-SAFE FUSEHOLDERS FOR 3AG OR 5x20MM FUSES



Similar to shock-safe fuseholders shown above but designed for p.c. board mounting. Shock-safe design per IEC Standards 257 and 65. Two different knob styles available for use with ¼" x 1¼" or 5 x 20mm fuses.

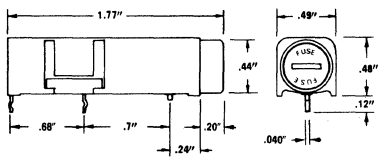
SPECIFICATIONS:
Electrical: Rating See APPROVALS.
Insulation Resistance: 10,000 megohm minimum at 500 VDC.
Contact Resistance: Less than .005 ohms average at a current of one ampere.
Dielectric Strength: 4000 volts minimum.

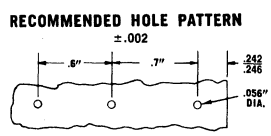
Mounting: Intended for soldering to printed circuit boards.
Molded Parts: Body Material: Black glass-filled thermoplastic. Knob Material: Grey or black glass-filled thermoplastic.
Knob: Screwdriver slot, fuse extractor type with nickel-plated copper alloy insert. Spring-loaded, bayonet style.
Terminals: Brass. Tin-plated.
Ambient Temperature: −40°C to +85°C.

APPROVALS: Recognized under the Components Program of Underwriters Laboratories (16A, 250V)
Certified by CSA (15A, 250V).
SEMKO approved (6.3A, 250V). VDE approval pending.

L.F. No.	
1/4" x 1-1/4 FUSES 345101	5mm x 20mm FUSES 345121

Body only: #345101-010
Knob only: #345101-020 (¼" x 1¼") #345121-020 (5 x 20mm)





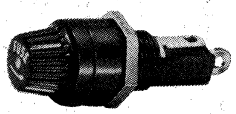
NOTE: Knobs are color-coded; grey for 1/4" x 1-1/4" fuses, black for 5 x 20mm fuses.

Littelfuse® CIRCUIT PROTECTION DEVICES

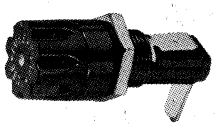
3AG FUSEHOLDERS WITH SOLDER TYPE, 3/16" OR 1/4" QUICK-CONNECT TERMINALS

Extend only 1" behind panel. **UL Recognized and Certified by CSA.**

KNURLED KNOB



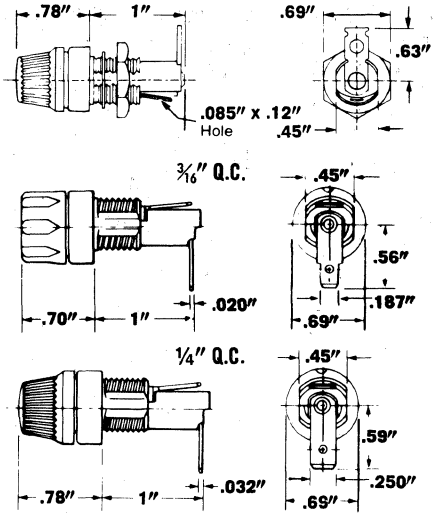
FLUTED KNOB



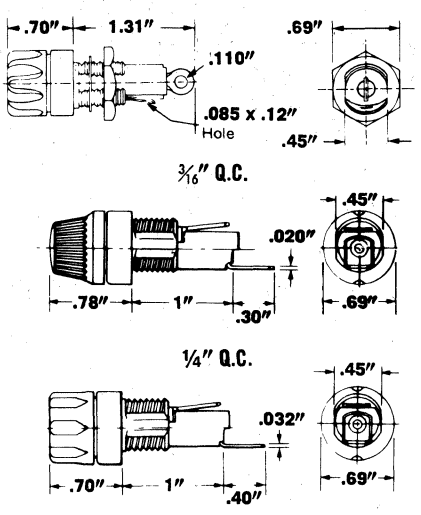
SPECIFICATIONS

Electrical: Rated at 20 amperes for any voltage up to 250V. Dielectric withstanding voltage exceeds 2400 volts.
Mounting: Withstands 15 pound/inch (1.69Nm) mounting torque. Maximum panel thickness 18" (4.8).
Molded Parts: Black thermoplastic.
Knob: Bayonet style with white lettering.
Copper and Copper Alloy Terminals: Tin plated except 1/4" quick connect terminals are nickel plated.
Hardware: Standard fuseholders supplied with a neoprene washer and a hex nut unassembled. Lockwasher (L) and drip-proof seal (P) variations available by adding appropriate suffix letters (L, P or PL) to catalog number.

Right Angle Terminal
SOLDER



Straight Bottom Terminal
SOLDER



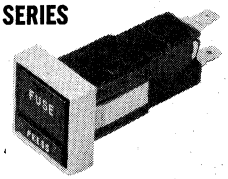
RIGHT ANGLE TERMINAL

Fluted Knob	Knurled Knob	Type of Terminal
342004	342022	Solder
342028	342048	3/16" Q.C.
342828	342848	1/4" Q.C.

STRAIGHT BOTTOM TERMINAL

Fluted Knob	Knurled Knob	Type of Terminal
342014	342012	Solder
342038	342058	3/16" Q.C.
342838	342858	1/4" Q.C.

LOW PROFILE FUSEHOLDERS 348 (000) SERIES

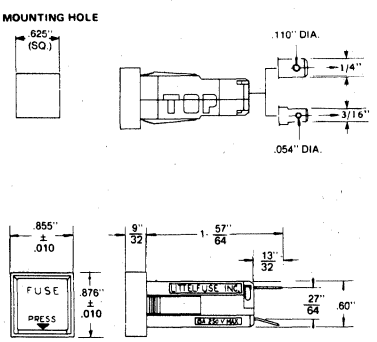


Snap into panel. Eliminate need for mounting hardware. Square cap design and choice of cap and bezel colors. 3/16" or 1/4" Q.C. terminals. **U.L. Recognized and Certified by CSA.**

SPECIFICATIONS

Molded Parts: Body-Black Thermoplastic. Cap-High temperature thermoplastic.
Terminals: One piece-brass-Electro-tin plated.
Electrical Characteristics: Rated at 15 amps for any voltage to 250. Dielectric withstanding voltage between terminals and terminals to ground at room temperature and 90% R.H. exceeds 1,500 volts.
Patents: U.S. Patent 3,659,252.

Mounting: .625" sq. hole in 1/32" through 1/8" thick chassis panel.



HOW TO ORDER LOW PROFILE FUSEHOLDERS

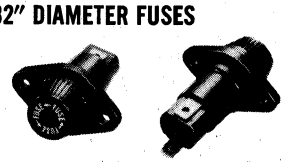
The six digit catalog number is a coded description of the finished unit. To specify type required, select appropriate code numbers from chart below. To order a cap assembly only for 3AG fuses, use **348** series numbers and insert a "0" in the terminal style and bezel color locations. To order a body assembly only, use **348** series number and insert a "0" in the cap color location.

SIX DIGIT CATALOG NUMBERS CONSIST OF

Series No.	Terminal Style	Bezel Color	Cap Color
348 For 3AG Fuses		1 Red	1
		2 Green	2
		3 Yellow	3
		4 Blue	4
	6 3/16" Wide Terminals	5 White	5
	8 1/4" Wide Terminals	7 Black	7
		9 Grey	9

For example: 348615 is a holder with 3/16" terminals, red bezel and white cap.

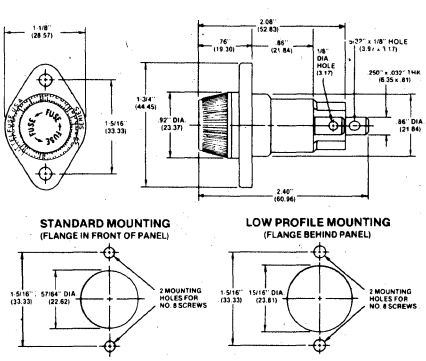
PANEL FUSEHOLDER FOR 13/32" DIAMETER FUSES



Recessed side terminal for additional shock-safe characteristics. **U.L. Recognized and Certified by CSA.**

Catalog Number		Fuse Length Range*
Standard	Watertight	
571027	571027P	15/16" — 1 3/8"
571007	571007P	1 13/32" — 1 1/2"

* Fuse diameter is 13/32".



SPECIFICATIONS

Molded Parts: Black Thermoset.
Knob: Screw type, with engraved markings: Unfilled characters (571007, 571007P), light blue characters (571027, 571027P).
Terminals: Brass, tin plated. Combination solder/1/4" quick-connect. Side terminal has .125" diameter hole. Bottom terminal has .156" x .124" elongated hole.
Mounting: Flange mounting either in front of or behind panel. Watertight version must be front panel mounted. Maximum panel thickness is .75".
Electrical Characteristics: Rated at 30 amps for any voltage up to 600. Dielectric withstanding voltage greater than 2400V.

SURGE PROTECTION by MCG

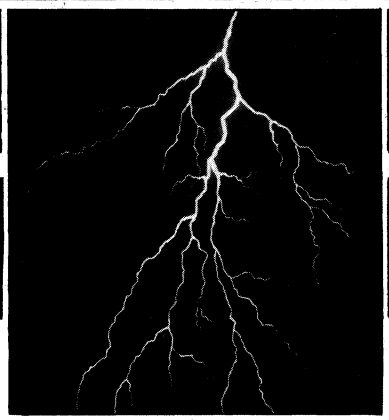
AC Power Line Protection
See Pages B•1328–B•1332

Data Line Protection
See Pages B•1333–B•1341

MCG
ELECTRONICS INC.

AC POWER LINE PROTECTOR

SPA/SPB/SPC SERIES



PROTECTS SENSITIVE EQUIPMENT FROM DAMAGING TRANSIENT OVERVOLTAGES!

Lightning and power line transients surge along AC power lines producing costly damage to computers, medical equipment and other sensitive electrical devices. Prevent these malfunctions and downtime with a reliable, maintenance-free SP Series AC power line protector.

Operating in nanoseconds, the SP series will vigorously clamp lightning and transient overvoltages on the AC line to safe levels whenever the clamping threshold is exceeded. After each transient, the protector recovers automatically—without power interruption. The use of redundant protection elements virtually guarantees no "downtime."

How to Choose the Proper Protector Size

A surge of voltage running into a facility will dissipate by subdividing throughout the building's power distribution system.

The capability of a surge suppressor is determined by its intended location. At the point of entry, the energy contained in a surge is at maximum. Fanning out on its journey through the system, it will offer less magnitude to each branch panel encountered. Finally, the least amount of damaging potential will be experienced by the local panels and outlets deep in the system.

The SP Series is designed to make the selection of a model not only easy, but also provide the best choice of protection versus cost.

Main Service Panel Protector—SPC Series

To keep damaging overvoltages from entering the building, choose the heavy-duty SPC series. These shunt connected protectors vigorously clamp high energy transients with a sophisticated combination of high speed and brute force MOV's. An SPC installed at the main service panel is your most cost-effective solution to protecting the facility's AC lines.

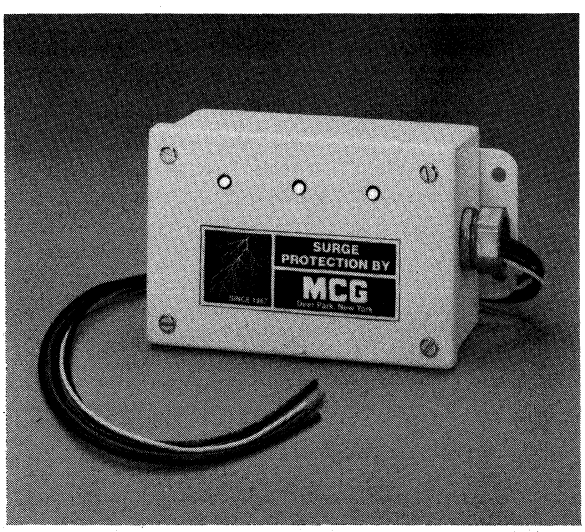
Branch Panel Protector—SPB Series

Installed in shunt at the branch distribution panel, the SPB series provides ideal protection for several rooms or an entire floor of a building. The SPB protectors, when located at the branch panel, also provide transverse protection (i.e., it prevents transients generated from one room being coupled through a common panel into another room).

Local Service Panel Protector—SPA Series

The SPA protectors install in shunt at the local panel or directly at the equipment. These compact units provide very substantial protection for one or more pieces of sophisticated equipment or a small computer room.

SPB/SPC protects branch distribution and main service panels.



SPA protects at the local service panel.

MCG ELECTRONICS INC

Specialists in Circuit Protectors, Transients, Lightning & Surges.

12 Burt Drive, Deer Park. NY 11729
516-586-5125 • FAX: 516-586-5120

2 year warranty

Technical Assistance:

800-851-1508

AC POWER LINE PROTECTOR

SPA/SPB/SPC SERIES (con't)

SPA Features:

—Close clamping
—Automatic reset
—"Protection present" indicators
—Easy installation

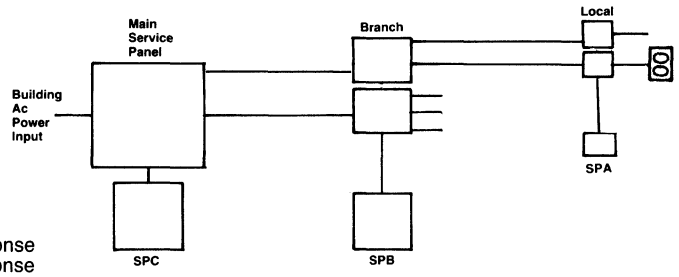
SPB/C Adds:

—Redundant protection
—Troubleshooting LED's
—Modular construction for on-site repair

General Specifications:

Response time	
SPA	5ns component response
SPB/C	1ns component response
Frequency	50/60/400 Hz
Operating temperature	– 40 to + 85 degrees C
Meets or exceeds	IEEE 587 Cat. B

Protector Placement Guide



SPA—Local Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	1140	1140	200V	$350
120T	120/240	1ph	1140	570	200V	355
120Y	120/208	3ph wye	1140	380	200V	365
220S	220	1ph	1680	1680	400V	360
220Y	220/380	3ph wye	1680	560	400V	385
240Y	240/415	3ph wye	1680	560	400V	405
277Y	277/480	3ph wye	1800	600	400V	435
240D	240	3ph delta	1680	560	400V	415
480D	480	3ph delta	3360	1120	800V	455

SPB—Branch Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	2400	2400	200V	$645
120T	120/240	1ph	2400	1200	200V	655
120Y	120/208	3ph wye	2400	800	200V	775
220S	220	1ph	6000	6000	400V	750
220Y	220/380	3ph wye	6000	2000	400V	800
240Y	240/415	3ph wye	6000	2000	400V	825
277Y	277/480	3ph wye	9000	3000	460V	845
240D	240	3ph delta	6000	2000	400V	805
480D	480	3ph delta	13800	4600	800V	985

SPC—Main Service Panel Protector

MODEL	RATED VOLTAGE (VAC)	SERVICE	ENERGY ABSORPTION* Joules Total	Per Leg	CLAMP VOLTAGE 1ma	Price
120S	120	1ph	4800	4800	200V	$1405
120T	120/240	1ph	4800	2400	200V	1425
120Y	120/208	3ph wye	4800	1600	200V	1475
220S	220	1ph	12000	12000	400V	1450
220Y	220/380	3ph wye	12000	4000	400V	1510
240Y	240/415	3ph wye	12000	4000	400V	1545
277Y	277/480	3ph wye	18000	6000	460V	1625
240D	240	3ph delta	12000	4000	400V	1590
480D	480	3ph delta	27600	9200	800V	1865

*Measured employing 8 × 20 μs waveform.

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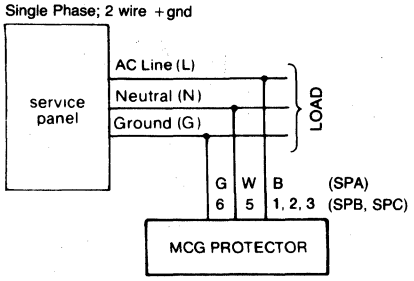
Technical Assistance:
800-851-1508

AC POWER LINE PROTECTOR

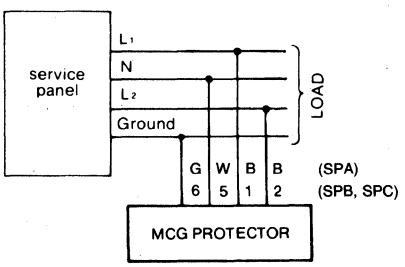
SPA/SPB/SPC SERIES (con't)

Connection Information

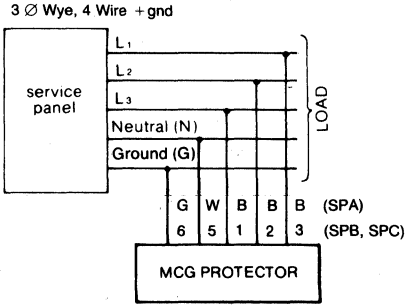
1) Single Phase; 2 wire +gnd



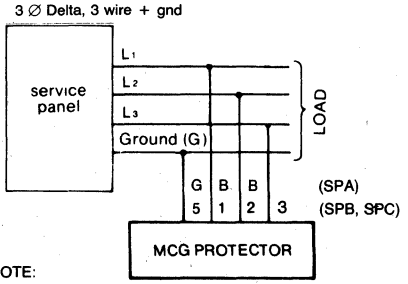
2) Single Phase; 3 wire + gnd.



3) 3 Ø Wye, 4 Wire +gnd



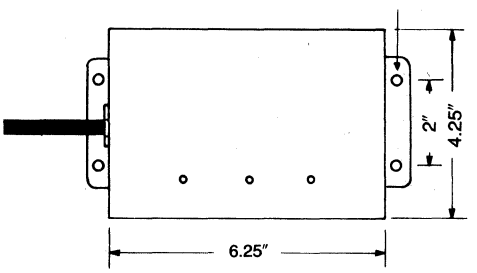
4) 3 Ø Delta, 3 wire + gnd



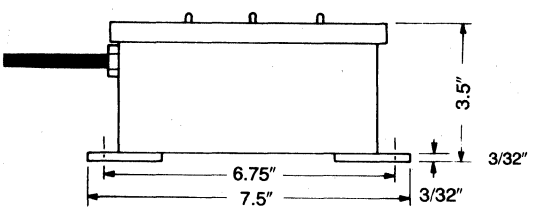
NOTE:
The protectors should be operated on "Load" side of service panel.

Mounting Information

SPA

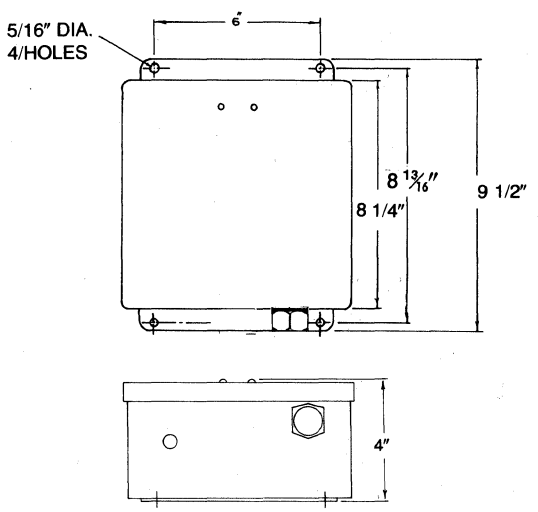


*3-5 LEADS 36"



Size: 6.25" × 4.25" × 3.5"
Weight: 4 lbs.

SPB/SPC



Size: 8" × 8" × 4"
Weight: 10 lbs

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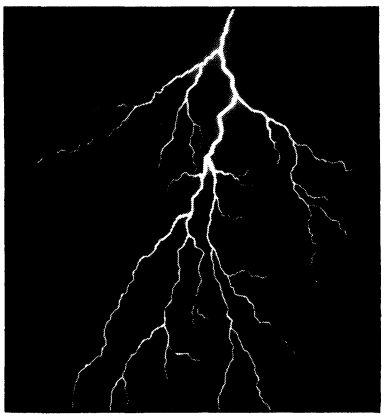
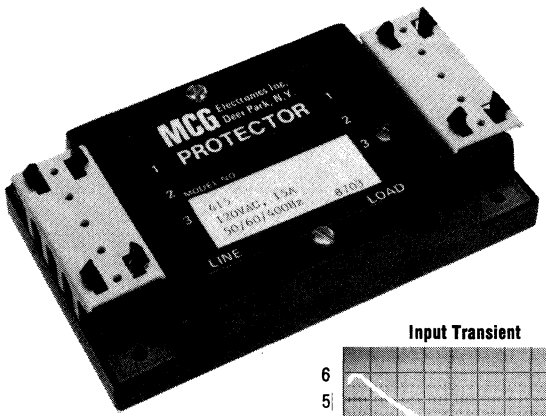
AC POWER LINE SURGE PROTECTOR



415 SERIES to 15A

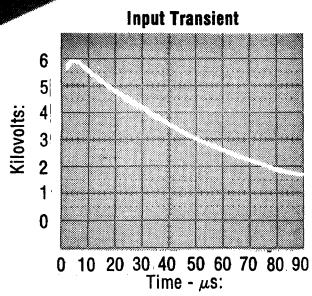
A SOPHISTICATED BLEND OF HIGH SPEED AND BRUTE FORCE PROTECTION

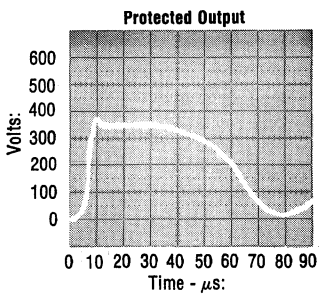
- **480 joule transient absorption**
- **Reliable protection against transients and spikes**
- **Vigorously clamps IEEE 587 ring and impulse waves**
- **1 nanosecond response**
- **Low profile**
- **Brute force EMI/RFI filtering**
- **Field repairable**



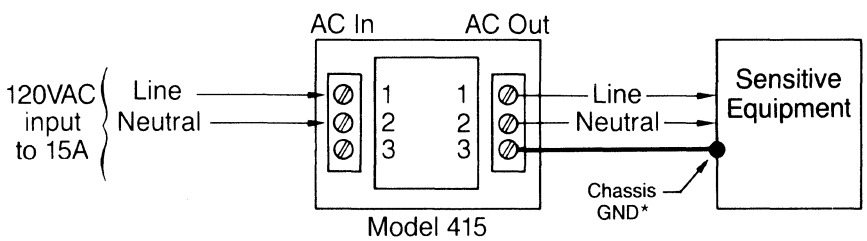
$55
(1–4 pieces)

Equipment level protection installed "within" a piece of equipment. Employs a sophisticated combination of brute force surge protection and impulse filtering to prevent equipment damage or malfunction. Reaction time less than 1 ns with automatic reset after transient has passed. Absorption capability exceeds 480 joules. Provides superior attenuation at the critical lower frequencies. For 120VAC single phase, 50/60/400 Hz power lines handling currents to 15A. Incorporates a green LED that indicates unit is operational and protection is present. Military versions are available.

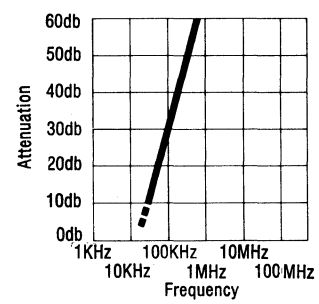




Connection Information



***Installation Note:** Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12 AWG) as short as possible, less than 6" is highly preferred.



Also available for 250 VAC single phase, 50/60/400 Hz, power lines handling currents to 30A. Consult factory for details.

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516-586-5125 • FAX: 516-586-5120

2 year warranty

Technical Assistance:
800-851-1508

Superior Power Protection Against Voltage Surges and Power Line "Noise"

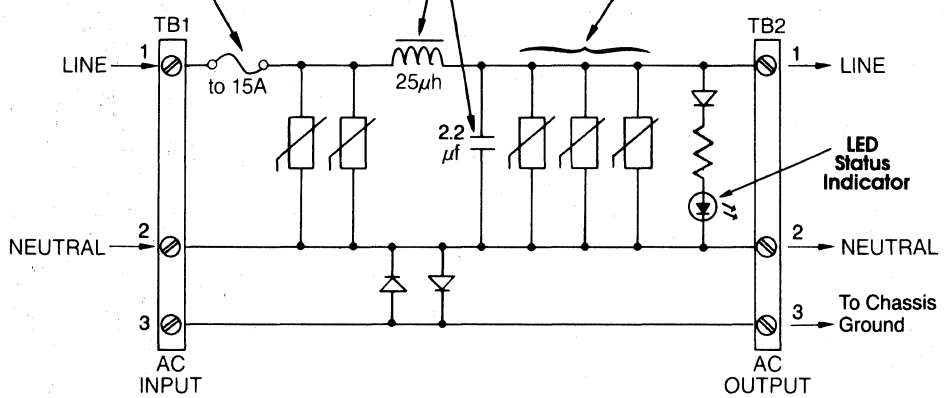
415 SERIES (con't)

The Inside Story . . . Heavy Duty Components . . . Superior Protection

Replaceable fuse
Automatically disconnects unit from power line in the event of serious line current overload.

Heavy duty EMI/RFI filtering
Provides superior attenuation at the lower frequencies (20db/65KHz, 40db/170KHz, 60db/650KHz). Wire wound inductors ensure continued performance under severe transient conditions.

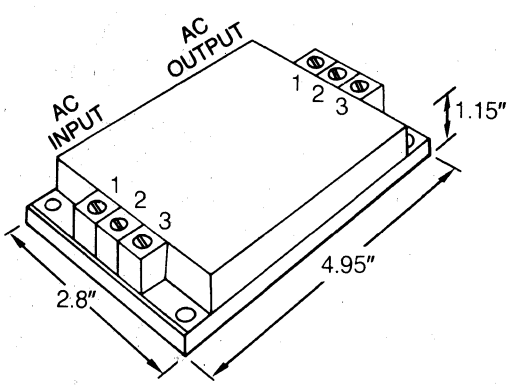
Extraordinary 480 joule protection
- "Brute Force" MOV transient suppressors
- The only protector engineered to provide protection against all possible transient entry conditions.
- 3 line L-G, L-N, N-G protection

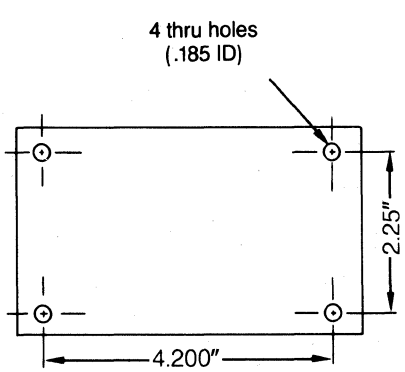


General Specifications

Rated voltage	120VAC
Rated current	15A RMS
Frequency/Service	50/60/400Hz, single phase
Energy absorption	480 joules (watt/sec)
Clamp voltage	235V (1ma) Threshold 375V peak 6KV (IEEE 587 Cat. B)
Response time	<1ns
Filter attenuation	65KHz—20db 170KHz—40db 650KHz—60db
Operating temperature	−40 to +85 degrees C
Efficiency	99+%
Size (L x W x H)	4.95″ x 2.8″ x 1.15″
Weight	<1.0 lb.

Mechanical Data—Model 415





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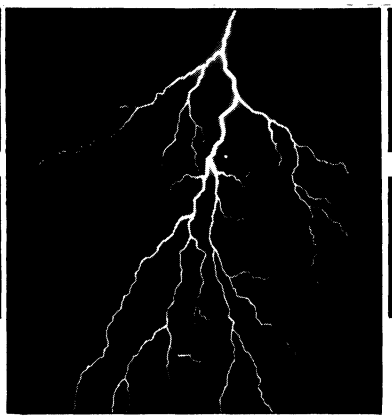
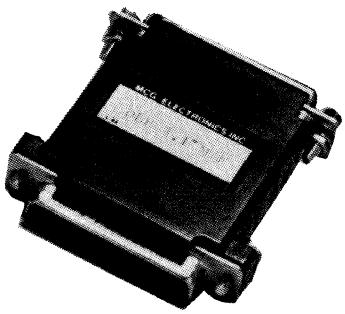
DATA LINE PROTECTORS



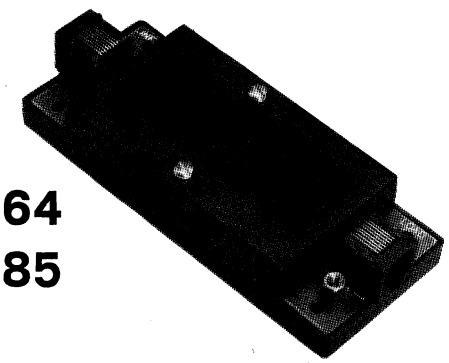
DLP-3.1
DLP-4.2, 4.4

DLP-3.1

$48



DLP-4.2 $64
DLP-4.4 $85



RS232 In-line computer and terminal protection from damaging transients caused by lightning and switching surges. Installs in minutes in series with data line providing a quick retrofit for existing equipment or new installations. Employs 25 pin D-Sub connectors and the standard unit (RS232) protects pins 2, 3, 4, 5, 6, 7, 8 and 20.

Dial-up/leased line modem protection. Prevents costly downtime and equipment failure due to lightning and transient overvoltages. Use DLP-4.2 for 2 wire (tip and ring) dial-up telephone lines. Use DLP-4.4 for 4 wire leased lines. Protects RS232, 422, 423 and 20ma loops. Installs between modem and wall outlet, telephone or leased lines. RJ11 jacks.

General Specifications

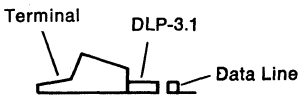
Clamp Voltage (±)	25V
Pins protected	2, 3, 4, 5, 6, 7, 8, 20 (Referenced to pin 1 and shell)
Meets or exceeds	IEEE 587 Cat. A Ringwave 1500V (100KHz, 125A)
Dimensions (L x W x H)	2.18″ x 1.86″ x .65″

General Specifications

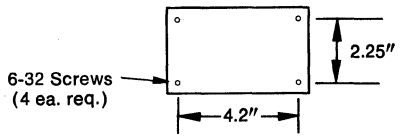
Clamp voltages available (±)	6V, 10V, 15V, 25V, 200V
Series resistance	25 ohms
Meets or exceeds	FCC Docket 68 IEEE Std. 472 (SWC) 1KV, (10 x 1000) μs waveform

Installation Information

Installs in series with existing data line



Mounting Diagram



Ordering Information

If protected port has female connector
—order DLP-3.1 F/M

If protected port has male connector
—order DLP-3.1 M/F

Ordering Information

Dial-up lines	DLP-4.2
Leased lines (4 wires)	DLP-4.4

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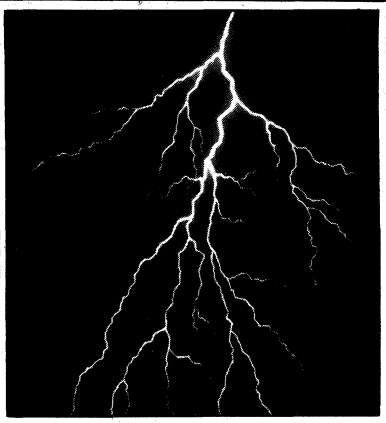
2 year warranty

Technical Assistance:
800-851-1508

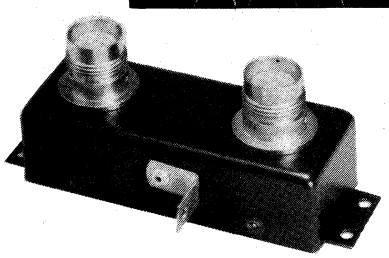
DATA LINE PROTECTOR



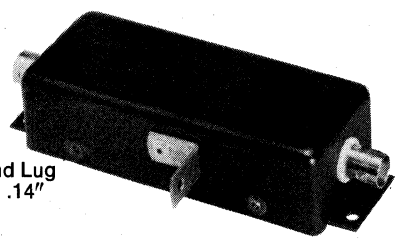
DLP-5.1, 5.2
Protects High Speed Video and Data Lines

WIDELY USED ON IBM SYSTEMS!

Protects high-speed video and data lines from damaging transients caused by lightning and switching surges. Provides 20 MHz or greater bandwidth, with attenuation of less than 1db. Installs in-line with coaxial or twin axial cable and is located adjacent to equipment to be protected. Ground lug accepts #10 AWG. Ideal for IBM and similar equipment having cable runs extending to 1500 feet.



$104
DLP-5.2-10V5
Height 1.9″



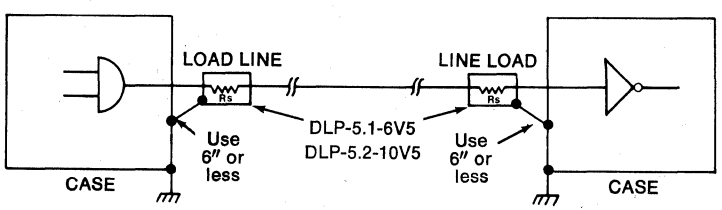
Ground Lug
I.D. = .14″

$76
DLP-5.1-6V5
Height 1.1″

General Specifications

Clamp Voltages	±6V (DLP-5.1) ±10V (DLP-5.2)
Series Resistance	5 ohms
Attenuation	<.8db to 20 MHz
Meets or Exceeds	IEEE 587 CAT. B IEEE Std. 472 (SWC) 1 KV (10 x 1000) μs waveform FCC Docket 68

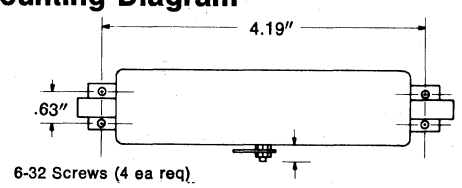
Typical Application



Ordering Information

BNC/Coaxial Systems	DLP-5.1-6V5
Twin Axial Systems	DLP-5.2-10V5 IBM Compatible

Mounting Diagram



MCG ELECTRONICS INC.
Specialists in Circuit Protectors, Transients, Lightning & Surges.
12 Burt Drive, Deer Park, NY 11729
516-586-5125 • FAX: 516-586-5120

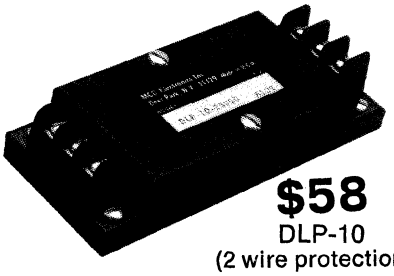
2 year warranty
Technical Assistance:
800-851-1508

DATA LINE PROTECTOR

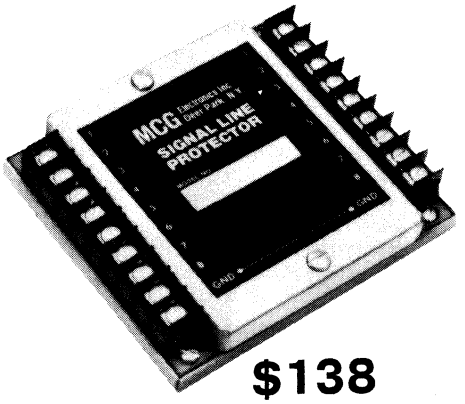
DLP-10, 20, 30

Multiple Line Protection for Computers, Terminals, Printers, etc.

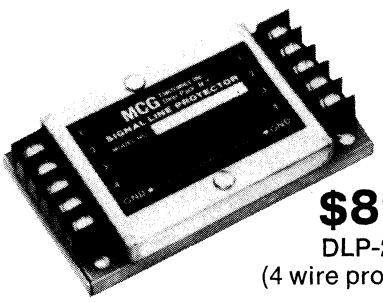
Multiple line protection against damaging transients and overvoltages, in a single compact package. Protects computer main frames, terminals, printers and other peripherals. Ideal for data logging and monitoring, and complex instrumentation installations. Available for 2 wire (DLP-10), 4 wire (DLP-20) and 8 wire (DLP-30) protection for RS232, 422, 423 and 20 ma loops.



$58
DLP-10
(2 wire protection)



$138
DLP-30
(8 wire protection)



$89
DLP-20
(4 wire protection)

General Specifications

Clamp Voltages Available	±6V (RS422, 423) ±10V ±15V (RS232 typ.) ±25V (RS232 max.) ±50V ±200V (dial-up lines)
Series Resistance	25 ohms (standard)
Meets or Exceeds	IEEE 587 CAT. B IEEE Std. 472 (SWC) 1 KV (10 x 1000) μs waveform FCC Docket 68

Ordering Information

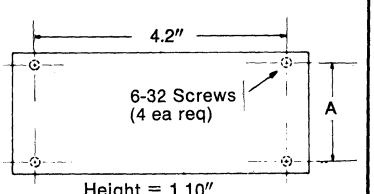
Example—to protect a 4 wire RS422 circuit, order **DLP-20-6V-25**

- Model
- Clamp Volt
- Series Resistance

Installation Information

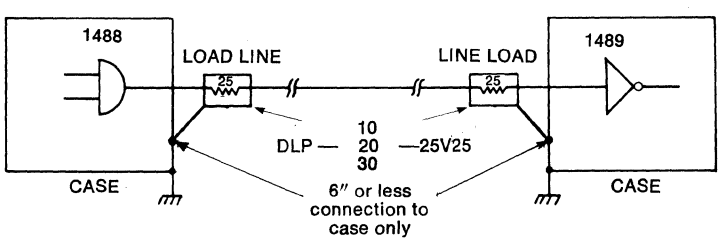
Installs in series with existing data lines. Ground terminal must be connected to cabinet frame by short lead, less than 6″ (#12 AWG) highly preferred.

Mounting Diagram



Dimension A
1.50″ (DLP-10)
2.25″ (DLP-20)
3.75″ (DLP-30)

Typical Application



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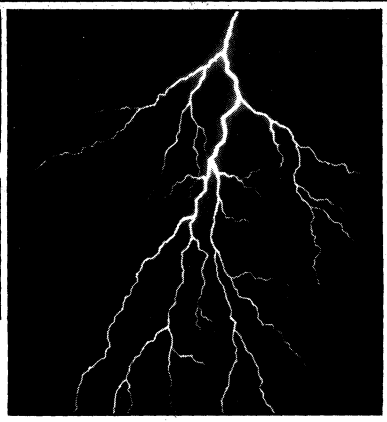
DATA LINE PROTECTORS



DLP-36A SERIES

MIX AND MATCH MODULAR PROTECTION FOR TELEPHONE AND DATA LINES

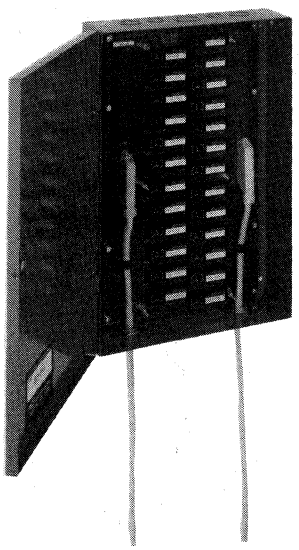
Protects PABX systems, CPU's, key systems, multiplexers, port selectors, etc. from damaging transients.

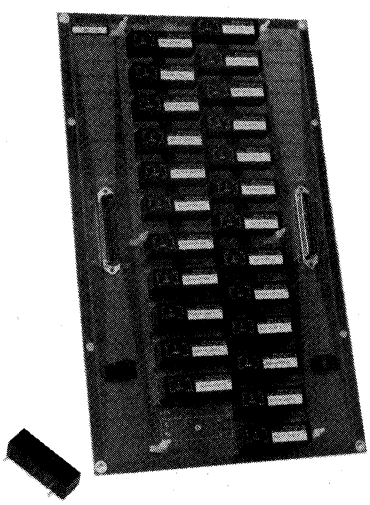
The DLP-36A is a new 25 pair, point-of-entry transient suppressor. The unit offers high speed protection for PABX systems, CPU's and instrumentation systems that use telephone lines, RS232, 423 and 20 ma loops.

Modular protection elements (25 provided) allow you to mix and match telephone and data lines at different clamping levels. This flexibility offers a convenient "one protector" solution to the varied protection needs in a building. And, if your application changes, simply switch the module to accommodate the new requirement. The plug-in module feature also permits on-site repair or replacement by non-technical personnel.

The unit uses fast-acting Avalanche diodes (1 nanosecond) and brute force gas tubes to ensure continued protection even under severe transient situations.

Utilizing 50 pin telephone industry connectors, the DLP-36A is ideal for termination to 66 blocks. To suit most applications, the unit is available with or without the enclosure.





General Specifications

Clamp voltages available	+/–6, 10, 15, 25, 50, 200V peak
Energy handling capability	50 joules/line
Gas Discharge Tube	
Life	100 coulombs (amp/sec)
Energy handling	5000 joules (one time)
Current	5000 amps
Series resistance	25 ohms (standard)
Response time	less than 1 nanosecond
Effectively clamps	IEEE 587 Cat. B. 2KV (10/50μs, 8/20μs) IEEE Std. 472 (SWC) 1KV (10 × 1000 μs) waveform
Dimensions	H-18″ W-15″, D-4″
Operating temperature	–55 to +125 degrees C
Circuit attenuation (db)	–3db/3MHz (Rs = 25, RL = 1K, Cs = 2000pf)

$880 w/enclosure
$795 w/o enclosure

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2 year warranty
Technical Assistance:
800-851-1508

DATA LINE PROTECTORS

DLP-36A SERIES (con't)

To Specify the DLP-36A

Determine the signal voltage:
a) look in the service manual
b) call your service company
c) use an oscilloscope
The most effective protection will be attained by clamping overvoltages as close to the normal signal voltage as possible (i.e. for a data line with a signal level of 12V, choose a clamping voltage of 15V).

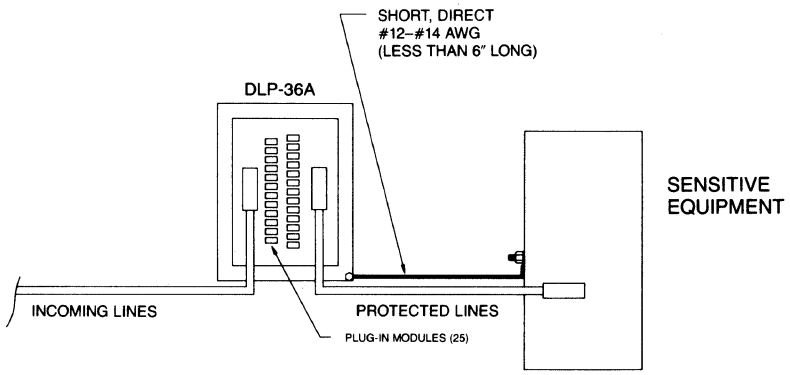
DLP-36A 15V 25

Model
Clamping Voltage
Series Resistance

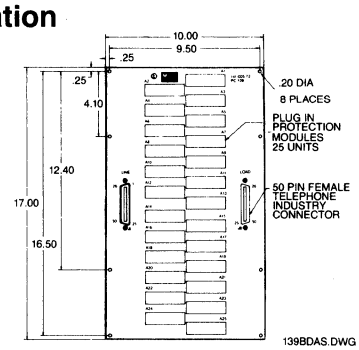
Installation

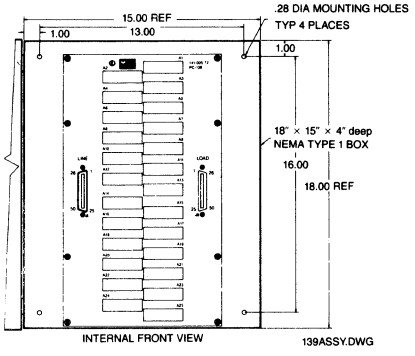
Preferred Installation: Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12AWG) as short as possible, less than 6 inches is highly preferred.
Alternate Installation: Locate the protector close to the building's structural steel at the building entry point. The protector terminal marked "ground" must be connected to the structure with a direct, short (less than 6 inches) #12AWG lead. It is essential that the building structure be grounded—verification is vital.

Application



Mounting Information





NOTE: Had the need been for less than 50 wires protected, the user would have the option (because of the modular design) of buying only the number of protection modules required. If the unit is purchased fully-packed, the extra modules may be kept as spares or for expansion. Each module protects 2 wires.

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DATA LINE PROTECTORS

DLP-45 SERIES

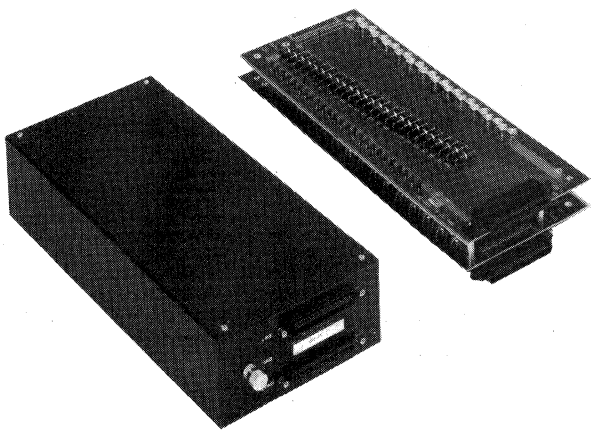
MINI PABX PROTECTOR–SMALLEST AVAILABLE ANYWHERE

Guards PABX systems, CPU's, key systems, security systems, etc. from damaging transients.

The DLP-45, a 50 wire (25 pair) protector, guards sensitive instrumentation that uses dial-up telephone lines, RS232, 423 and 20 ma loops. Lightning, surges and transients are rapidly diverted away from your equipment, thus preventing damage. The DLP-45's small size (H-12″, W-6″, D-2.94″) makes it ideally suited where space is a limiting factor.

Combining fast-acting Avalanche diodes and brute force gas tubes, the DLP-45 ensures continued protection even under severe transient situations. This field-proven technology has a failure rate of only 32 failures in 132,000 wires.

Installation is in series between external telephone/data lines and internal systems. The unit utilizes a M/F 50 pin Telco connector for easy termination to 66 blocks.



$775.

Model DLP-45 offers high speed, brute force protection in a compact case.

General Specifications

Clamp voltages available	+/–6, 10, 15, 25, 50, 200V peak
Energy handling capability	50 joules/line
Gas Discharge Tube	
Life	100 coulombs (amp/sec)
Energy handling	5000 joules (one time)
Current	5000 amps
Series resistance	25 ohms (standard)
Response time	less than 1 nanosecond
Effectively clamps	IEEE 587 Cat. B, 2KV (10/50μs, 8/20μs) IEEE Std. 472 (SWC) 1KV (10 × 1000μs) waveform
Connectors	M/F 50 pin Telco Connectors
Dimensions	H-12″, W-6″, D-2.94″
Operating temperature	–55 to +125 degrees C
Circuit attenuation (db)	–3db/3MHz (R = 25, RL = 1K, Cs = 2000pf)

All MCG Data Line Protectors come with a two-year, no nonsense warranty. Consult factory for details.

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2 year warranty

Technical Assistance:

800-851-1508

DATA LINE PROTECTORS

DLP-45 SERIES (con't)

To Specify the DLP-45

Determine the signal voltage of the system:
a) look in the service manual
b) call your service company
c) use an oscilloscope
The most effective protection will be attained by clamping overvoltages as close to the normal signal voltage as possible (i.e. for a data line with a signal level of 12V, choose a clamping voltage of 15V).

DLP-45 - 15V 25

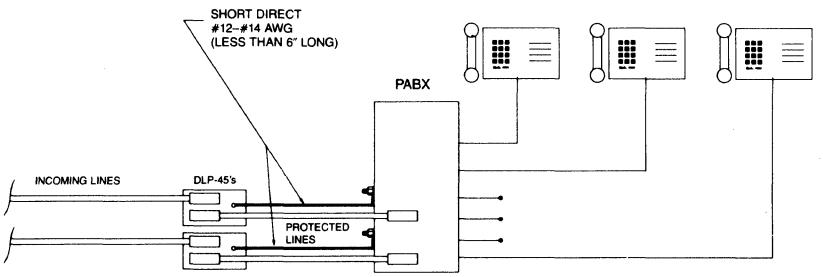
Model
Clamping Voltage
Series Resistance

Installation

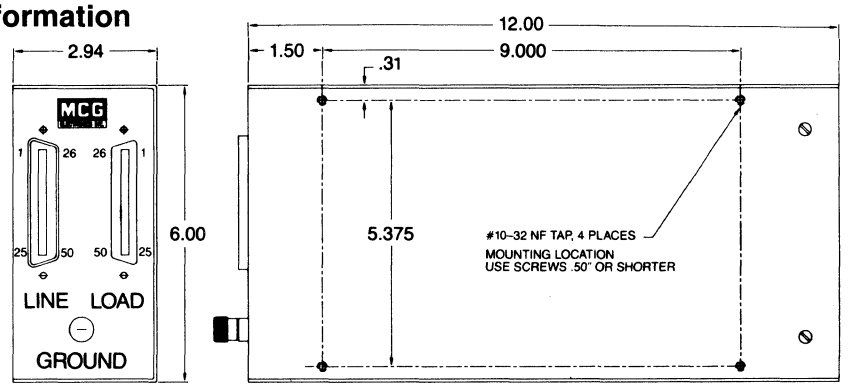
Preferred Installation: Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12AWG) as short as possible, less than 6 inches is highly preferred.

Alternate Installation: Locate the protector close to the building's structural steel at the building entry point. The protector terminal marked "ground" must be connected to the structure with a direct, short (less than 6 inches) #12AWG lead. It is essential that the building structure be grounded—verification is vital.

Application



Mounting Information



NOTE: CONNECTOR, LINE, 50 PIN PLUG (MALE) PHONE TYPE
CONNECTOR, LOAD, 50 PIN SOCKET (FEMALE) PHONE TYPE

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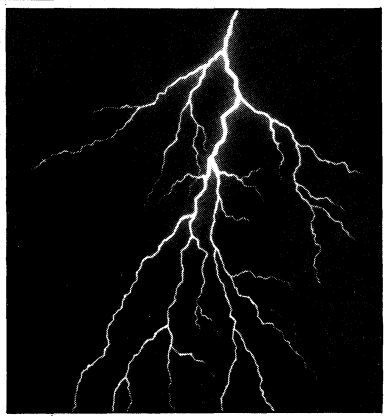
DATA LINE PROTECTORS



DLP-50 SERIES

MULTI-WIRE TRANSIENT PROTECTION FOR OVER 2000 PAIRS!

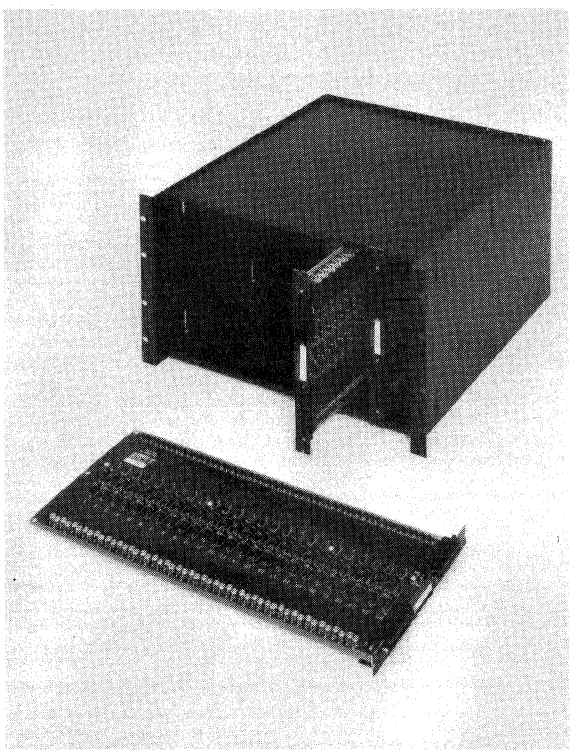
Protects PABX systems, mainframes, multiplexers, CPU's, etc. from damaging transients

Sensitive equipment using dial-up telephone lines, RS232, 423 or 20 ma loops is vulnerable to cumulative damage and serious disruption from high speed transients. The DLP-50 System transient protector offers reliable, cost-effective protection for multiple communication lines.

The DLP-50 System consists of a card cage assembly and protection cards. Each card cage holds up to 17 cards capable of protecting 25 pairs each or 425 pairs total. A fully loaded standard 19″ rack equipped with five DLP-50 systems will protect 2,125 pairs.

Incorporating field proven technology (32 failures in 132,000 wires), the protector combines fast acting Avalanche diodes and brute force gas tubes, ensuring continued protection even under severe transient situations.

The DLP-50 System comes standard with 50 pin telephone industry connectors for easy installation.



General Specifications

Clamp voltages available	+/−6, 10, 15, 25, 50, 200V peak
Energy handling capability	50 joules/line
Gas Discharge Tube	
Life	100 coulombs (amps/sec)
Energy handling	5000 joules (one time)
Current	5000 amps
Series resistance	25 ohms (standard)
Response time	less than 1 nanosecond
Effectively clamps	IEEE 587 Cat. B, 2KV (10/50μs, 8/20μs) IEEE Std. 472 (SWC) 1KV (10 × 1000μs) waveform
Connectors	M/F 50 Pin Telco Connectors
Dimensions	Fits standard 19″ rack 10.5″ (6U) high, 19″ deep.
Operating temperature	−55 to +125 degrees C
Circuit attenuation (db)	−3db/3MHz (Rs = 25, RL = 1K, C_S = 2000pf)

DLP-50 card cage (rack mountable) **$150** each

PICA-50-200V25 protection card **$630** each

All MCG Data Line Protectors come with a two-year, no nonsense warranty. Consult factory for details.

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2 year warranty

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DATA LINE PROTECTORS

DLP-50 SERIES (con't)

To Specify the DLP-50 System

The DLP-50 System includes a card cage plus up to 17 protection cards.

To Specify Protection Cards

Determine the signal voltage of the system:
a) look in the service manual
b) call your service company
c) use an oscilloscope

The most effective protection will be attained by clamping overvoltages as close to the normal signal voltage as possible. If you were protecting dial-up telephone lines, for example, with tip and ring voltages totalling 190V, a 200V clamping is appropriate. For this application, specify protection cards PICA-50-200V25.

PICA-50 200V 25

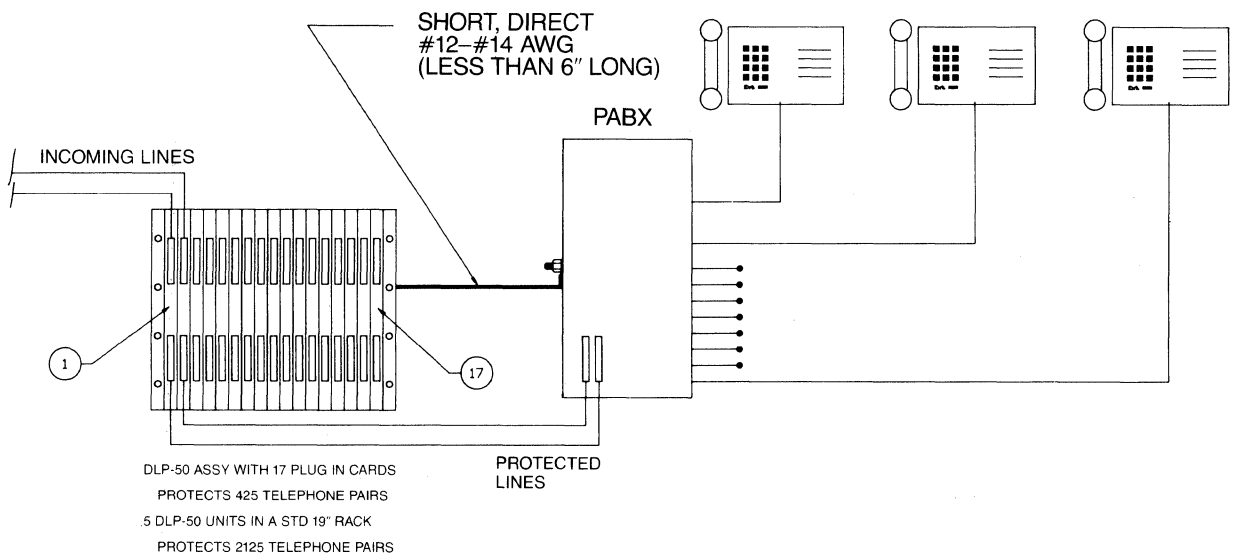
Model
Clamping Voltage
Series Resistance

Installation

Preferred Installation: Important, connect protector terminal marked "ground" to frame, case or chassis of equipment being protected. Keep lead (#12AWG) as short as possible, less than 6 inches is highly preferred.

Alternate Installation: Locate the protector close to the building's structural steel at the building entry point. The protector terminal marked "ground" must be connected to the structure with a direct, short (less than 6 inches) #12 AWG lead. It is essential that the building structure be grounded—verification is vital.

Application



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series 1600

LOW AMP MODELS

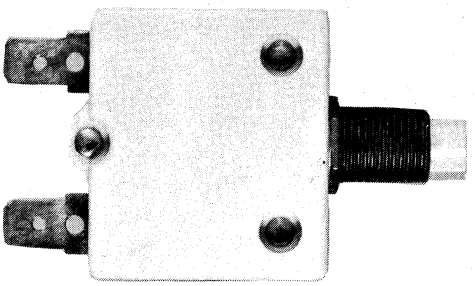
1691 3/8" mounting bushing, .05 - 1 amps
1681 3/8" mounting bushing, .5 - 4.0 amps
1601 7/16" mounting bushing, .5 - 4.0 amps
Voltage: 250VAC/50VDC
Standard Amp Ratings: .05, .07, .08, .09, .10, .150, .250, .500, .750, 1.0, 1.5, 2.0, 25, 3.0, 3.2. 3.5, and 4.0 amps

MID-AMP MODELS

1600 7/16" or 15/32" mounting bushing, 5 to 35 amps
1680 3/8" mounting bushing for universal interchangeability
1610 Special mid-amp series. 7/16" mounting bushing, 3AG fuse replacement, clip terminal, auto or manual reset, not UL or CSA approved.
Voltage: 250VAC/50VDC
Standard Amp Ratings: 5, 6, 7, 8, 9, 10, 12, 14, 15, 18, 20, 25, 30 and 35 amps (special ratings available upon request)

HIGH AMP MODELS

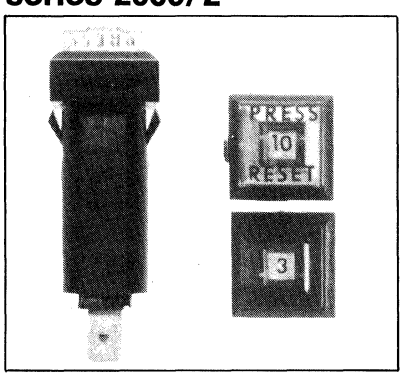
1648 3/8", 7/16" and 15/32" mounting bushings are available.
Voltage: 250VAC/32VDC
Standard Amp Ratings: 40, 45, 50, 60 and 70 amps



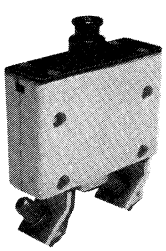
Model 1600-actual size.

UL 1077 recognized #E66224 in 5 - 25 amp versions
CSA: LR27156 in 5 - 25 amp versions
VDE on certain models
Minimum Ultimate Trip; 100% at 77°F
Maximum Ultimate Trip: 125% at 77°F
Interrupt Capacity: 1000A
Overload Capacity: 10X Rating
Voltage Drop: .25 Volt Maximum
Dielectric Strength: 1500VAC

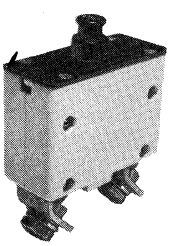
series 2000/2



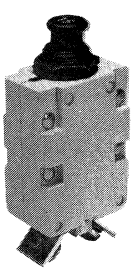
	Model 2000	Model 2002
Std. Amp Rating	3, 4, 5 Other on request	3, 4, 5, 7½, 8, 10, 12 & 15 Other on request.
Voltages	3-5A 240VAC/50VDC	3-10A 240VAC/50VDC 12, 15A 120VAC
U.L. Recognized	1077 Motor Load E 66224	1077 General Load E 66224
CSA Certified	LR 27156	LR 27156
Minimum Ultimate Trip	100% @ 77°F	100% @ 77°F
Maximum Ultimate Trip	135% @ 77°F	135% @ 77°F
Interrupt Capacity	1000A (UL 1077)	1000A (UL 1077)
Overload Capacity	6-10X Rating	6-10X Rating
Voltage Drop	.25 Volts Max.	.25 Volts Max.
Dielectric Strength	1500VAC	1500VAC
Recommended Panel Thickness	.020"-.075"	.020"-.075"



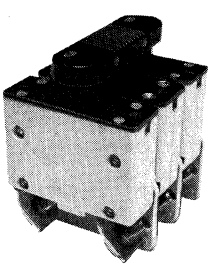
160 Series
50 to 100 amp
MS25361
Single Phase
Heavy Duty



170 Series
125 to 200 amp
Single Phase
Heavy Duty



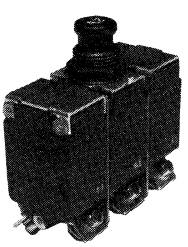
700 Series
5 to 50 amp
MS25244
Single Phase
Rugged Performer



940 Series
50 to 100 amp
Three Phase
Heavy Duty

4200-004 Series
1 to 20 amp
MS26574A
Single Phase
Aux. Terminals
Subminiature
½ & 25A MS pending

4310 Series
1 to 20 amp
MS3320
Single Phase
Ambient Compensated
Subminiature
Lightweight
½ & 25A MS pending



4330 Series
1 to 20 amp
MS14154
Three Phase
Ambient Compensated
Subminiature
Lightweight

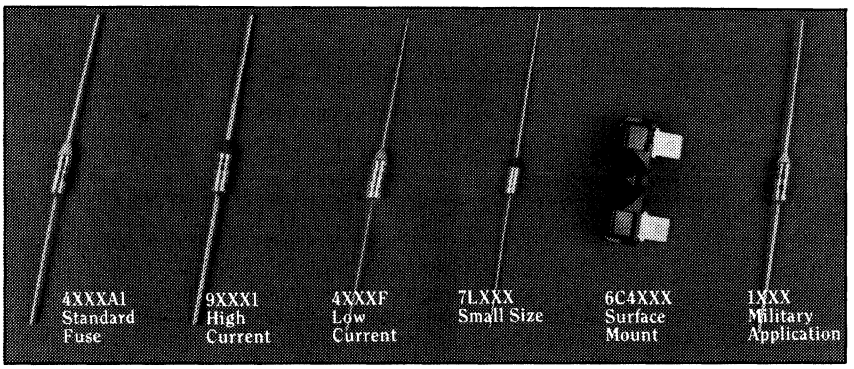
4200 Series
1 to 20 amp
MS26574
Single Phase
Subminiature
Lightweight
½ & 25A MS
pending

MILITARY SPECIFICATION BREAKERS • Qualified to MIL-C-5809

	Series		Series		Series		Series		Series
MS3320	4310-001 AMP	MS14154	4330-001 AMP	MS22073	4001-001 AMP	MS25361	160-012 AMP	MS26574V	4200-008 AMP
MS3320V	4310-019 AMP	MS14154V	4330-008 AMP	MS22073V	4001-008 AMP	MS25361V	160-086 AMP	MS26574D	4200-006 AMP
MS3320L	4310-005 AMP	MS14154L	4330-007 AMP	MS25244	700-001 AMP	MS26574	4200-001 AMP	MS26574A	4200-004 AMP
MS3320VL	4310-024 AMP	MS14154VL	4330-009 AMP	MS25244P	700-089 AMP	MS26574L	4200-003 AMP		

MICROTEMP® Thermal Cutoffs

MICROTEMP Thermal Cutoffs provide permanent over-temperature protection for motors, transformers, appliances, HVAC equipment and electronic equipment. Once a MICROTEMP Thermal Cutoff opens a circuit, it remains open until the fault is corrected and the fuse is replaced.



Thermal Cutoff Series Selection

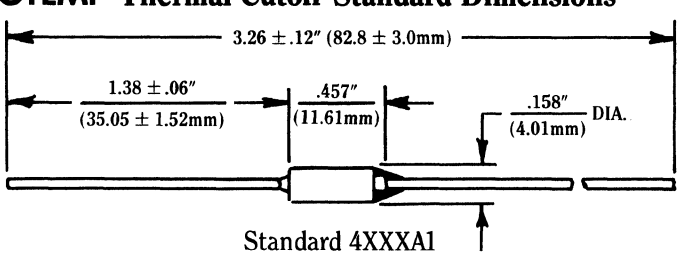
To determine which series is best for your application, remember:

- To consider the normal and abnormal electrical currents and voltages of your product.
- That the current passing through a MICROTEMP Thermal Cutoff can generate I^2R, self heating. This must be considered when selecting the proper series and opening temperature for your application.
- That the outer case of the MICROTEMP Thermal Cutoff is electrically live and may require insulation. Additionally, since insulation can reduce heat transfer, it also must be considered in selecting the final opening temperature.
- That custom configurations and packages are available.
- That a thermocoupled dummy should be installed in the product circuit to determine the correct temperature setting.

MICROTEMP® Thermal Cutoff Types

Type No.	Temp. (°C) Calibration Range	Wire Size AWG	Maximum Recommended Operating Current and Voltage (Resistive)
4XXXA1	60-240	18	15 Amp/240 VAC
9XXX1	60-240	15	25 Amp/240 VAC
4XXXF	60-240	23	5 Amp/240 VAC
7LXXX	72-184	23	6 Amp/240 VAC
6C4XXX	60-184	—	15 Amp/240 VAC
1XXX	60-240	18	15 Amp/240 VAC

MICROTEMP® Thermal Cutoff Standard Dimensions



Standard 4XXXA1

MICROTEMP® Thermal Cutoff Temperature Ratings

Reading the temperature chart.
All MICROTEMP Thermal Cutoffs are identified by their Type No. (4XXXA1, 9XXX1, etc.). The "XXX" digits are determined by the opening temperature you specify. For example: A 4136A1 is a MICROTEMP Thermal Cutoff with an opening temperature of 60°C.

Model # (XXX)	Max. Opening Temp. °C*
136	60
146	66
158	72
168	77
178	84
191	91
194	93
204	98
208	100
218	104
227	109
239	117
244	121
257	128
283	141
300	152
333	167
358	184
377	192
415	216
438	228
468	240

*Tolerance +0 -4°C

For further information on your specific design application, contact a Micro Devices Sales Engineer at our factory.

MICRO DEVICES PRODUCT GROUP

Thermo-O-Disc, Inc.
1320 South Main Street • Mansfield, Ohio 44907
Phone: (419) 525-8500 Telex: 987 455
Cable: TOD MFL FAX: (419) 525-8344
Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.

EMERSON®

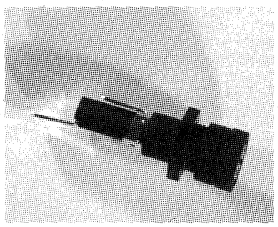
International Fuseholders & Fuse Blocks

Panel-mount Fuseholders with dual-size fuse carriers

These fuseholders accommodate either the North American 1/4 x 1-1/4" fuse or the international 5 x 20 mm fuse by simply selecting the correct fuse carrier, and are "touchproof" in accordance with European agency requirements.

Approvals: UL recognition (20A/250VAC);CSA certification (16A/250VAC); VDE (10A/250VAC) (SEMKO pending).

Front-mount fuseholder, high profile (other models available)

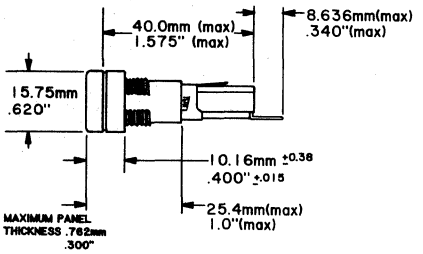


Front mounting, high-profile fuseholder in four contact styles:

80910050: In-line, solder contact
80910060: Right-angle, solder contact
80910070: In-line, 1/4" Q.D.
80910080: Right-angle, 1/4" Q.D.

Select fuse carrier (available separately):

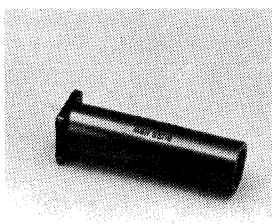
80910300: for 1/4 x 1-1/4" fuse
80910310: for 5 x 20 mm fuse



PC-board mount Fuseholders

Pc-board mounting fuseholders; specify fuse carrier (available separately) for international 5 x 20 mm fuse or North American 1/4 x 1-1/4" fuse.

Approvals: UL recog. 12A/250VA; CSA cert. 12A/250VAC; VDE 6.3A/250VAC; SEMKO 6.3A/250VAC.

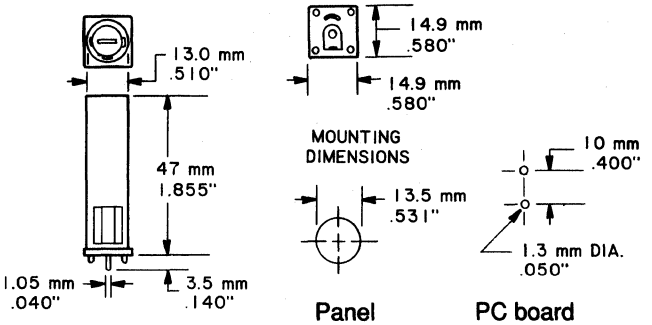


Model HBW: Vertical pc-board mount fuseholder without stabilizer pins

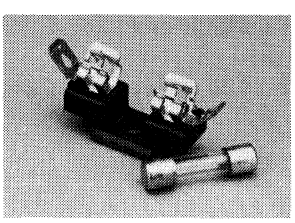
Model HBH: Horizontal pc-board mount fuseholder (not pictured)

Select fuse carrier (available separately):

FBI: for 1/4 x 1-1/4" fuse
FBM: for 5 x 20 mm fuse



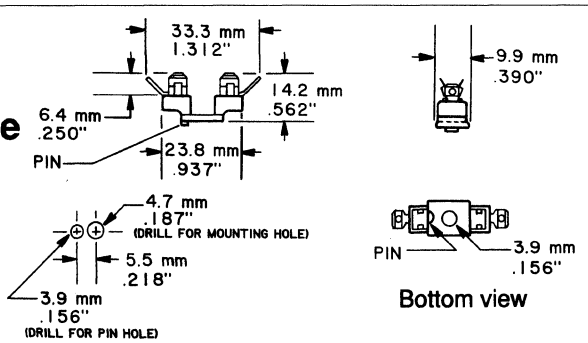
Fuse Blocks

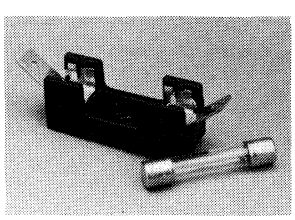


For 5 x 20 mm fuse

Fuse block for single 5 x 20 mm fuse:

P/N 2000-1:
solder contacts



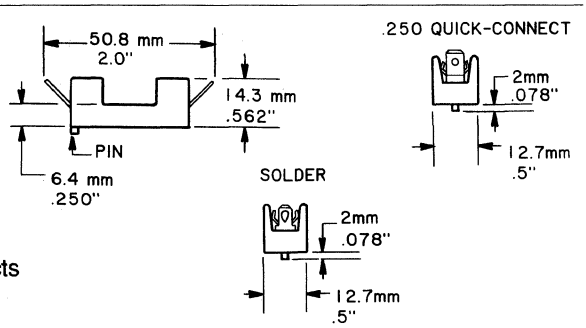


For 1/4 x 1-1/4" fuse

Fuse block for single 1/4 x 1-1/4" fuse:

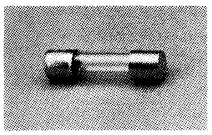
P/N S-8002-01:
with 40° angled solder contacts

P/N S-8202-01:
with 40° angled 1/4" Q.D. contacts



PANEL COMPONENTS CORPORATION
Telephone: (707) 523-0600 • FAX (707) 578-5478 • Telex 176-747
P. O. Box 6626 • Santa Rosa, CA 95406-0626

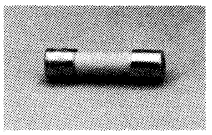
Interpower™ IEC 127 International 5 x 20mm Fuses



Quick-acting low-breaking capacity

to IEC 127–II; DIN 41661; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cos 1
81411101	32* mA	
81411181	71	
81411221	100	
81411241	125	
81411261	160	
81411281	200	
81411301	250	
81411321	315	35 A
81411341	400	
81411361	500	
81411381	630	
81411401	800	
81411421	1 A	
81411441	1.25	
81411461	1.4	
81411481	1.6	
81411501	2	
81411521	2.5	
81411541	3.15	
81411561	4	
81411581	5	10 I_n
81411601	6.3	

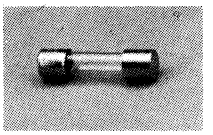


Quick-acting high-breaking capacity

to IEC 127–I; DIN 41660; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cos 1
81413421	1 A	
81413441	1.25	
81413481	1.6	
81413501	2	
81413601	6.3	

* Not included in applicable standards



Time-lag low-breaking capacity

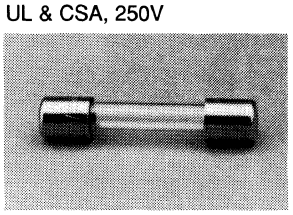
to IEC 127–III; DIN 41662; SEMKO 104-1976; SEMKO app.; 250VAC

Model Number	Rated Current I_n	Breaking Capacity at 250V cos 1
81412161	63	
81412181	71	
81412221	100	
81412241	125	
81412261	160	
81412281	200	
81412301	250	
81412321	315	35 A
81412341	400	
81412361	500	
81412381	630	
81412401	800	
81412421	1 A	
81412441	1.25	
81412461*	1.4	
81412481	1.6	
81412501	2	
81412521	2.5	
81412541	3.15	
81412561	4	
81412581	5	10 I_n
81412601	6.3	

North American 1/4 x 1-1/4" fuses

Non-time delay

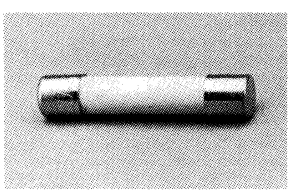
UL & CSA, 250V



Model Number	Rated Current I_n
AGC-1/8	1/8A
AGC-1/4	1/4
AGC-1/2	1/2
AGC-3/4	3/4
AGC-1	1
AGC-1-1/2	1-1/2
AGC-2	2
AGC-3	3
MTH-4	4
MTH-5	5
MTH-6	6

Time delay

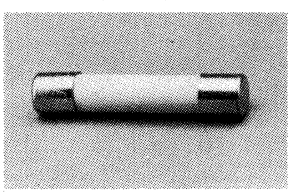
UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
ABC-1/2	1/2
ABC-1	1
ABC-2	2
ABC-3	3
ABC-5	5
ABC-6	6
ABC-8	8
ABC-10	10
ABC-15	15
ABC-20	20

Time delay

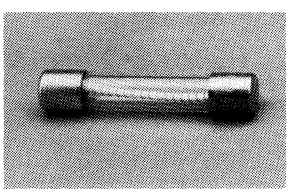
UL & CSA, 250V; ceramic



Model Number	Rated Current I_n
MDA-1/2	1/2
MDA-3/4	3/4
MDA-1	1
MDA-2	2
MDA-3	3
MDA-4	4
MDA-5	5
MDA-7	7
MDA-8	8
MDA-10	10
MDA-15	15
MDA-20	20

Time delay

UL & CSA listed, 250V; glass*



Model Number	Rated Current I_n
MSL-1/4	1/4
MSL-1/2	1/2
MSL-3/4	3/4
MSL-1	1
MSL-2	2
MSL-3	3
MSL-4	4
MSL-5	5
MSL-6	6
MSL-8	8

*spiral wound element for moderate inrush I.

PANEL COMPONENTS CORPORATION
Telephone: (707) 523-0600 • FAX (707) 578-5478 • Telex 176-747
P. O. Box 6626 • Santa Rosa, CA 95406-0626

Perma Power®

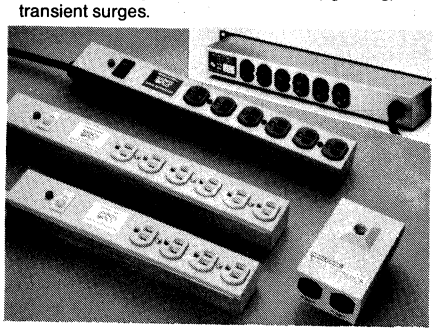
- **SURGE SUPPRESSORS**
- **POWER CONTROL CENTERS**
- **POWER CONDITIONERS**
- **STANDBY POWER SYSTEM**

AUTOMATIC SHUTDOWN

If surge supressor wears or burns out, Perma Power stops all power to your system . . . as completely as if the plug was disconnected . . . unlike light or buzzer "Warnings" which still let raw unprotected power through to the computer. Only Perma Power's patented Automatic Shutdown keeps your equipment safe from damaging raw power.

Perma Power® Surge Suppressors with Automatic Shutdown

Perma Power Surge Suppressors feature low let-through voltage and high energy suppression ratings. Unlike many other surge suppressors in their price range, they protect against both normal-mode (switching) and common-mode (lightning) transient surges.



Perma Power Extended Life Surge Suppression offers the extra protection of two four-element, two-stage filters, with an almost unlimited operating life, through a coordinated circuit using both metal oxide varistors and silicon avalanche diodes.

Standard models feature

- Protection against both normal-mode (switching) and common-mode (lightning) transients.
- 600 V. max. let-through voltage.
- 70 joule single-surge energy rating.
- Positive Shutdown Mechanism protects equipment if surge suppressor fails.
- Performance specifications based on IEEE Std. 587, Test Waves.
- One-year warranty.

Extended Life models provide these extras

- 400 V. max. let-through voltage.
- 5 Watt steady state (repetitive surges) power rating.
- 100,000-pulse lifetime.
- Enhanced RF/EMI noise protection.
- Five-year warranty.

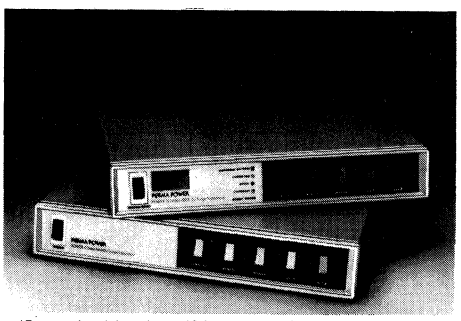
SURGE SUPPRESSOR MODEL SELECTOR CHART

Model No.	Number of Outlets	Master Switch	Indicator Light	Case Length (Inches)
PT 209	2	—	1	3⅛ x 4¾ x 2¼
RT 410	4	1	1	12
KT 410	4	1	1	12
RT 610	6	1	1	15
KT 610	6	1	1	15
JT 06B0	6	1	1	19
JT 06B2*	6	1	1	19
Perma Power Extended Life Surge Suppressors				
PS 209	2	—	1	3⅛ x 4¾ x 2¼
RT 410	4	1	1	12
KS 410	4	1	1	12
RT 610	6	1	1	15
KS 610	6	1	1	15
JS 06B0	6	1	1	19
JS 06B2*	6	1	1	19

Case Style and Color: (prefix)
P—Tan plastic case
R—Tan and plastic walnut on steel, beige components
K—Silver and textured black plastic on steel
J—Black baked enamel on steel/rack mount
*12 foot power cord

Perma Power Power Commander™ and Power Commander II™ Computer Power Control Center/Surge Suppressor

Control your computer and four peripherals separately or together. Protect against spikes, transients and noise with Perma Power's Extended Life Surge Suppressor.



15 amp circuit breaker • 12 ft. power cord
12" w x 2¼" h x 13" d

Power Commander Model RS562 and Power Commander II Model RS562-4

- Master on/off, plus individual control of up to five components.
- Protect against transient voltage surges and spikes.
- Reduce line noise caused by RF/EMI and static.
- Protect against overload . . . built-in circuit breaker.
- Five-year warranty.

Power Commander II extra features

- Protects modems and other equipment from voltage transients on the phone line.
- Monitors power line to warn of data-disturbing sags and surges; detects power line disturbances which go undetected by typical utility company and electricians' voltmeters.
- Protects equipment against burnout when electrical distribution accidents result in severe overvoltages.
- Provides safe discharge of static build up.

specifications

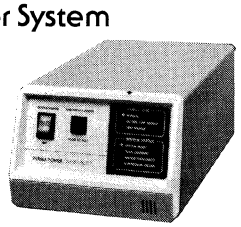
	Perma Power Surge Suppressors	Extended Life Surge Suppressors
Electrical Rating	1875 watts	1875 watts
Resettable Circuit Breaker	15 amperes	15 amperes
Protection Modes	Normal (line-to-neutral) Common (line-to-ground) Common (neutral-to-ground)	Normal (line-to-neutral) Common (line-to-ground) Common (neutral-to-ground)
Response Time[1]	1 nanosecond	5 picoseconds
Energy Dissipation	70 joules each mode (210 total)	70 joules each mode (210 total)
Clamping Threshold (Nominal)	225 Volts DC	225 Volts DC
	156 Volts RMS	156 Volts RMS
Let-Through Voltage[2]	400 Volts	270 Volts
Pulse-Life[3]	10^6 cycles	10^6 cycles
Pulse Life[4]	10^4 cycles	10^6 cycles
Steady State Power	0.8 watts	5.0 watts
Maximum Transient Voltage[5]	Greater than 6000 Volts	Greater than 6000 Volts
Noise Filtering	More than 10 dB, 5-50 MHz	More than 20 dB, 2-100 MHz
Warranty	1 year	5 years

TEST WAVES

1. Manufacturer's specification for the intrinsic component material.
2. UL Std. 1449, Revisions effective July, 1987; 1.2 x 50 μs, 6000 Volt; 8 x 20 μs, 500 Amp.
3. ANSI Std. C62.41 (IEEE 587-1980); 0.5 μs, 100KHz., 6000 Volt, 200 Amp., ringwave.
4. 5 KW peak, 10 x 1000 μs, exponential. (Accepted industry test impulse for inductive load switching transients.)
5. Limited in 120 VAC distribution systems by wiring devices arc-over to 6000 Volts peak (ANSI Std. C62.41).

Perma Power Standby Power System

- For mini/micro computers, LAN and telephone equipment.
- Protects from all power line anomalies: blackouts, sags and brownouts, plus high line voltages, spikes, surges, and RFI/EMI noise.
- 40 minutes battery back-up for typical desk-top computers.
- Panel lights always tell system and power line status.
- Automatically prevents overload.
- Unique sensors permit start-up and reset only when line is safe.
- 2-year warranty.



Model SPS-500 Wt. 37 lbs.
8"h x 6"w x 16"d

SPECIFICATIONS

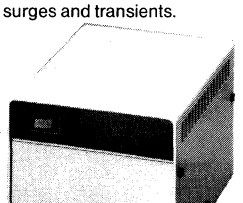
Backup Rating	500 VA (4.3 amps) Max.
Transfer Time	Less than 1 millisecond total sense and transfer.
Recharge Time	3.5 hours maximum.
Surge Suppression	Normal and common modes; let-through voltage less than 600 Volts; response time 1 nanosecond.
Noise Filtering	20 dB, 50 kHz-100 MHz.

Perma Power Power Conditioner

Protects your computer and peripherals from all power line problems short of total blackout.

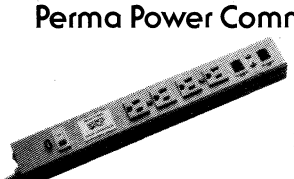
Perma Power Power Conditioners are high isolation ferroresonant transformers with supplementary surge suppression. They maintain 120 VAC constant output, even when power lines fall as low as 95 V or rise as high as 130 V, and protect against power line voltage surges and transients.

- Responds instantly to power line overvoltages and undervoltages; provides clean 120V regulated power to your computer and peripherals.
- Provides surge suppression comparable to Extended Life surge suppressors.
- Filters out RF/EMI noise.
- Protects against power interruptions up to 3 milliseconds.
- 250VA and 550VA models, to suit your desktop computer.



Model RV-250 Wt. 20 lbs. 5½" h x 6½" w x 9½" l
Model RV-550 Wt. 45 lbs. 6¼" h x 8½" w x 9½" l

Perma Power Communications Surge Suppressors



Protects your modem, computer, terminal or electronic telephone equipment from surges on the phone line and the power line.

Bypass high voltage lightning-induced and other transient voltage surges that occur on your incoming telephone line and power line to protect modems, terminals, computers, electronic telephones, and data transmission equipment.

Model RTD-410

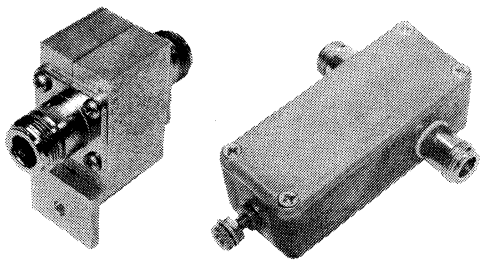
- 12" case, 4 outlets; 7' jumper cord for connection to phone line
- Let-through Voltage 350 V max, Tele-Line; 600 V, Power Line
- Response Time 1 nanosecond

Model PD-200

- Tele-Line Suppressor only
- 3⅛" w x 4¾" h x 2¼" d

Manufactured in U.S.A. by PERMA POWER® Electronics inc. **5601 West Howard Avenue • Chicago, Illinois 60648**
PHONE 312/647-9414 • FAX 312/647-1472 • TELEX 494 8559 PRM PWR

Nano-Fast Coax Protection from PolyPhaser Corporation



The patented PolyPhaser Impulse Suppressor Family is your best answer for protecting those vital communication links from lightning and static induced impulses (as well as high altitude nuclear blasts-EMP).

With over 44 models of patented Impulse Suppression, PolyPhaser Corporation makes more reliable, longer lasting, faster, better VSWR, lower loss and having less throughput energy to your valuable equipment than air-gap type arrestors. Designed using the time proven controlled gas ionization discharge tube, these family members can handle tens-of-thousands of amperes time after time. They are made from quality, highly conductive aluminum with 18-8 stainless fasteners and weather-coated for marine applications.

BULKHEAD MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-B50LU	Low power "UHF"	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50LN	Low power "N"	125-220 MHz 220-700 MHz 700-1 GHz	325 W 125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HU	Hi power "UHF"	30-220 MHz 220-700 MHz	500 W 250 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-B50HN	Hi power "N"	125-220 MHz 220-700 MHz 700-1 GHz	500 W 250 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-CT50HN	Cellular "N"	806-890 MHz	10 ch @ 70 W ea	N**	10,000 A	≤ 10uJ	0.1	1.1 to 1
IS-PT50HN	890-980 MHz	890-980 MHz	10 ch @ 70 W ea	N**	10,000 A	≤ 10uJ	0.1	1.1 to 1
IS-UT50HN	"UHF" Combiner/out	450-512 MHz	3-200 W trans. 5-100 W trans.	N† **	10,000 A	≤ 20uJ	0.1	1.1 to 1
IS-IE50LN	Isolated Equipment	125-220 MHz 220-500 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.2 to 1

BULKHEAD MOUNTABLE RECEIVE ONLY

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-GF50LN	GaAs Fet	125 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.1	1.2 to 1
IS-GC50LN	DC Pick-off +15VDC	400 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.3	1.2 to 1
IS-DC50LN	DC Injector +15VDC	400 MHz-1 GHz	N/A	N† **	10,000 A	≤ 150 pJ	0.3	1.2 to 1

FLANGE MOUNTABLE - TRANSMIT/RECEIVE

Model	Description	Frequency	Power	Connector	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-50UX-C0	HF transceive	1.5-50 MHz	2 KW	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50UX-C1	Similar to IS-B50LU	30-220 MHz 220-700 MHz	325 W 125 W	UHF	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C1	Like IS-50UX-C1-"N"	30-220 MHz 220-700 MHz	325 W 125 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1
IS-50NX-C2	Similar to IS-B50LN	220-700 MHz 700-1GHz	125 W 50 W	N**	20,000 A	≤ 600uJ	0.1	1.1 to 1

DATA/VIDEO/NEMP

Model	Description	Frequency	Impedance Ω	Connector	Max. Surge*	Clamp Voltage	Loss dB	VSWR
IS-50BB	HF-NEMP-R.O.	DC to 30 MHz	50	BNC	5,000 A	5.4	0.1	1.1 to 1
IS-75BB	CCTV	DC to 20 MHz	75	BNC***	5,000 A	5.4	0.1	1.1 to 1
IS-93BB	Data	DC to 20 MHz	93	BNC	5,000 A	5.4	0.1	1.1 to 1
IS-TWAX	IBM-34-36-38 Data	DC to 9 MHz	100	Twin Ax	5,000 A	2.8	0.1	1.1 to 1
IS-NEMP	HF-NEMP	1 to 1,000 MHz	50	BNC† **	5,000 A	200	0.1	1.1 to 1

POWER LINE/TV

Model	Description	Frequency	Impedance & Misc.	Max. Surge*	Thru put Energy	Loss dB	VSWR
IS-PSP/240	120/240 VAC	50-60 Hz	3 wire (solder)	12,000 A	N/A	N/A	N/A
IS-75F-C1	Ch 2-83 TV	50-750 MHz	75 Ω F58	20,000 A	≤ 600uJ	0.2	1.2 to 1
IS-300T-C2	TV Ribbon line	50-750 MHz	300 Ω Screws	10,000 A	≤ 600uJ	1.0	1.5 to 1
IS-RCT	Rotor Cable 8 lines	N/A	24 VAC Max 8 Screws/lugs	2 KA ea. line	N/A	N/A	N/A
IS-PLDO	120 VAC line	50-60 Hz	Duplex Outlet	15,000 A	N/A	N/A	N/A

*Based on 8us rise/20us decay wave form; †also available in UHF; **also available in N/Male on Antenna port; ***also available in type F connector

Other products include: **Ground Interconnect Resistance/Inductance Tester, Field Impulse Suppressor Tester, EMP - Coaxial Protectors, Dedicated Line/Telephone Line Protectors, Protectors for 1.7 GHz - 2.3 GHz.**

For complete information and application assistance contact:

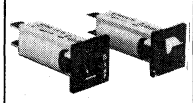
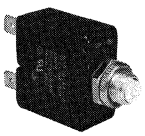
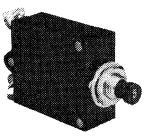
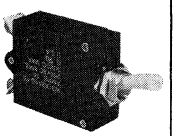
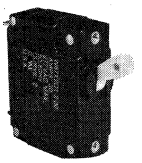
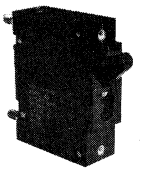
PolyPhaser Corporation

1425 Industrial Way • P.O. Box 1237 • Gardnerville, NV 89410-1237
Phone: 800-325-7170 • (702) 782-2511 • FAX: (702) 782-4476
RCA TELEX: 272718 POLYPHASER

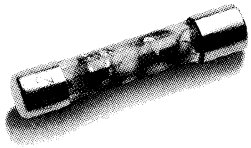
Potter & Brumfield A Siemens Company

200 S. Richland Creek Dr., Princeton, Indiana 47671-0001 • 812/386-1000 • FAX 812-386-2335

Circuit Breakers

						
Series	**W28**	**W58**	**W23**	**W31**	**W67-W69**	**W91-W93**
Type	Thermal	Thermal	Thermal	Thermal	Magnetic-hydraulic	Magnetic-hydraulic
Number of Poles	1	1	1	1	1 to 3	1 to 3
Circuit Function	Series trip	Series trip	Series trip	Series trip	Series trip; Series trip w/aux. switch	Series trip
Current Rating	0.25-15A	1-35A	0.5-50A	0.5-50A	0.5-30A	1-50A
Maximum Operating Voltage	32 VDC 250 VAC	50 VDC 250 VAC	50 VDC 250 VAC	50 VDC 250 VAC	65 VDC 277 VAC	65 VDC 277 VAC
Trip Time at 200% of Rating	(0.25-2A) 4.5-28 sec. (3-15A) 2.2-15 sec.	(1-4A) 10-45 sec. (5-35A) 6-30 sec.	(0.5-4A) 11-30 sec. (5-50A) 6-22 sec.	(0.5-4A) 11-30 sec. (5-50A) 6-22 sec.	Various trip times available	Various trip times available
Interrupt Capacity	1,000 @ 32 VDC or 250 VAC	2,000A @ 50 VDC 1,000A @ 250 VAC	(0.5-25A) 2,500A @ 50 VDC 1,000A @ 250 VAC (26-50A) 1,000A @ 50 VDC or 250 VAC	(0.5-25A) 2,500A @ 50 VDC 1,000A @ 250 VAC (26-50A) 1,000A @ 50 VDC or 250 VAC	3,500A @ 65 VDC 5,000A @ 277 VAC	3,500A @ 65 VDC 5,000A @ 277 VAC
Actuator	Push-to-reset button	Push-to-reset button	Push/Pull button	Toggle	Toggle	Toggle
Approx. Dimensions inch (mm)	.54 x .63 x 1.54d (13.7 x 15.9 x 39.0d)	.66 x 1.38 x 1.38d (16.8 x 34.9 x 34.9d)	.69 x 1.38 x 1.60d (17.5 x 34.9 x 40.6d)	.69 x 1.38 x 1.60d (17.5 x 34.9 x 40.6d)	.75 x 2.00 x 1.50d (19.1 x 50.8 x 38.1d)	.75 x 2.50 x 2.00d (19.1 x 63.5 x 50.8d)
Terminals	.250″ (6.35mm) quick connect	.250″ (6.35mm) quick connect #6–32 screw type	#8–32 screw type	#8–32 screw type	.250″ (6.35mm) quick connect	#10–32 threaded studs
Mounting	Snaps into 5/8″ (15.9mm) panel cutout from front	7/16″–28 threaded bushing 15/32″–32 threaded bushing	3/8″–24 threaded bushing	15/32″–32 threaded bushing (double D)	#6–32 tapped holes	#6–32 tapped holes
Component Recognition	ⓊⓁ Ⓒ㊊ Ⓓ Ⓢ	ⓊⓁ Ⓒ㊊	ⓊⓁ Ⓒ㊊	ⓊⓁ Ⓒ㊊	ⓊⓁ Ⓒ㊊	ⓊⓁ Ⓒ㊊

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.



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No sooner does a fuse go to work than it quits forever. But when a PolySwitch® device stops overcurrent, it can reset itself. And go on protecting your product again and again.

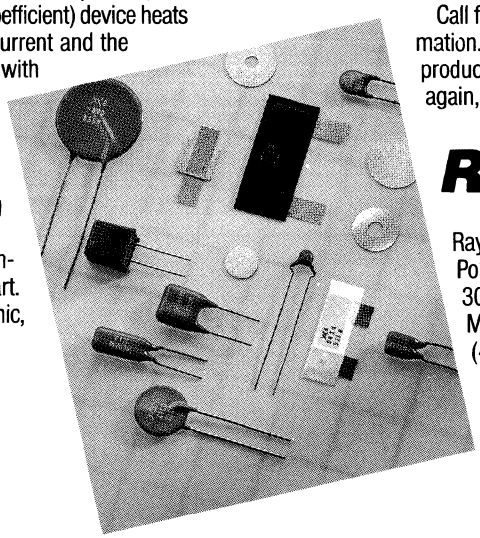
PolySwitch circuit protectors do it with technology so elegant it makes other approaches look burnt out. When a current overload hits its conductive polymer compounds, the PolySwitch PTC (positive temperature coefficient) device heats and turns nonconductive. Lower the current and the device's conductivity resumes. Along with your product's reputation for reliability.

PolySwitch PTCs accomplish all this without manual resetting or replacement. Thereby eliminating any chance of going from a bad fuse to something worse—the wrong fuse.

But solving your product's most common reliability problem is only the start. PolySwitch PTCs are also small, monolithic, board-mountable, and testable. And they're available in hundreds of optimized designs—for everything from rechargeable batteries to telephones to stereo speakers.

Finally, PolySwitch PTCs are from Raychem. Which means they're reliable, and backed by experience and support that never shuts down.

Call for a free sample and more information. Because this is one time your product can clearly benefit from on-again, off-again performance.



Raychem

Raychem Corporation
PolySwitch Division
300 Constitution Drive
Menlo Park, CA 94025-1164
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SIEMENS

Transient/Surge Protectors

Protect electronic and telecommunications equipment from harmful voltage spikes arising from lightning and inductive kickbacks.

Siemens offers the industry's most complete line of products:

Metal Oxide Varistors (SI0Vs)
Gas-filled Surge Voltage Protectors (SVPs)

BENEFITS:

- Eliminates Dangerous Voltage Transients
- Lowers Overall System Costs by Reducing Downtime and Maintenance Costs
- Improves Component and System Reliability
- Reduces Lightning Effects
- Reduces EMP/RFI Interference
- Promotes Personal Safety

WHAT IS AN SVP?

Surge Voltage Protectors (SVPs) are hermetically sealed gas discharge tubes consisting of two or three electrodes properly spaced by insulators, and filled with a rare gas. The main purpose of the Surge Voltage Protector is to provide a conductive path for unwanted and excessive transients, thereby preventing the transient energy and associated voltages from damaging equipment and components, and causing harm to personnel.

Siemens has the broadest line of transient protectors in the industry, resulting in the ability to provide cost-effective protection whether the transient energy is moderate or severe. Devices are available for both general-purpose application in electronic equipment and specific telecommunications applications governed by REA specifications.

It is the combination of current carrying capability, size and price that makes SVP's unique among transient protection components.

TYPICAL PROTECTION APPLICATIONS:

- Protection of semiconductors (diodes, transistors, thyristors, ICs etc.)
- Appliances connected to 110V or 220V AC.
- Industrial equipment vulnerable to transients on the AC power line (computers, traffic controls, motor controllers, etc.)
- Protection of equipment connected to telephone or signal lines, such as security systems, railroad equipment, fire alarm systems, etc.
- Arc suppression across relay and switch contacts.
- Protection of instrument input terminals from accidentally connected high voltages.
- Power control equipment for power distribution lines.
- GFI (Ground Fault Interrupters).

DIMENSIONAL OUTLINES

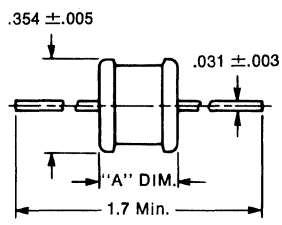


Figure 1

All dimensions in inches
Tolerances unless other wise noted: 2 dec. ±.02
3 dec. ±.010

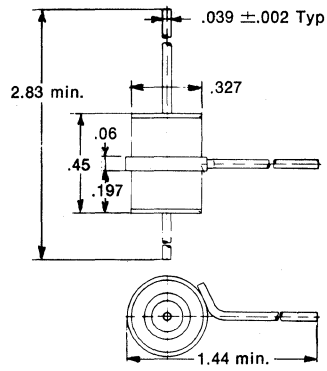


Figure 2

Part Number 2-electrode	D.C. Breakdown Voltage (Volts)	Impulse Breakdown Voltage (Volts) 100V•μs	Impulse Breakdown Voltage (Volts) 10KV/μs	D.C. Holdover Voltage (Volts)	Max. Single Impulse Discharge (K Amp)	Impulse Life (# of pulses)	A.C. Discharge Current (Amps rms)	A.C. Follow Current (Amps pk)	SVP Outline Drawing (Fig.)	Dimension "A" (Inches)
B1-C75	75 ±20%	< 700	< 1000	> 60	5	> 200	20	20	1	.272 ±.012
B1-C90/20	90 ±20%	< 700	< 1000	> 60	5	> 200	20	20	1	.272 ±.012
B1-F90	90 - 130	< 700	< 1000	> 60	5	> 200	20	20	1	.272 ±.012
B1-C145	145 ±20%	< 750	< 1100	> 100	5	> 200	20	35	1	.276 ±.012
B1-A230	230 ±15%	< 750	< 1200	> 130	5	> 200	20	25	1	.238 ±.008
B2-B270	270 ±15%	< 1000	< 2000		5	> 200	20	35	1	.276 ±.020
B1-A350	350 ±15%	< 750	< 1200	> 150	5	> 200	20	25	1	.236 ±.012
B2-B470	470 ±15%	< 1200	< 2500		5	> 200	20	35	1	.295 ±.012
B2-B600	630 ±15%	< 1200	< 2500	> 180	5	> 200	20	25	1	.256 ±.012
B2-B800	800 ±15%	< 1500	< 3000		5	> 200	20	35	1	.315 ±.012
B2-H10	1000 ±20%	< 1800	< 3000		5	> 200	20	25	1	.281 ±.008
B2-H25	2.5KV ±20%	< 4000	< 6000		2.5		10		1	.433 ±.02
B2-H45	4.5KV ±20%	< 5000	< 8000		10		0.4		1	.433 ±.02
B2-H80X	6.4KV — 8.8KV	< 10,000	< 12,500		1				1	.433 ±.02
B2-H100X	9KV min.	< 12,000	< 14,000		1				1	.455 Max.

3-electrode	D.C. Breakdown Voltage (Volts)	Impulse Breakdown Voltage (Volts) 100V/μs	Impulse Breakdown Voltage (Volts) 10KV/μs	D.C. Holdover Voltage (Volts)	Max. Single Impulse Discharge (K Amp)	A.C. Discharge Current (A.rms)	Impulse Life (# of pulses)	Insulation Resistance (M Ohm)	Capacitance (pF)	Transition Time (typ) (μsec)	Delay Time (μsec)	Outline Drawing (Fig.)
T61-C350	300-500(L-G)	< 750	< 1200	> 150	2 x 12	2 x 90	> 600	≥10,000	2.2	< 0.1	< 2	2
	300-650(L-L)	< 1200	< 1800	> 300	N/A	N/A	N/A	≥10,000	1.2	N/A	N/A	

L-G = line to ground, L-L = line to line; N/A = Not Applicable.

NOTE:

Due to space limitations, only a partial listing is shown.
To obtain complete catalog, call Siemens at **1-800-222-2203, X4395.**

Special Products Division
186 Wood Avenue South, Iselin, New Jersey 08830 U.S.A. Telephone (201) 906-4300

Siemens Components, Inc.

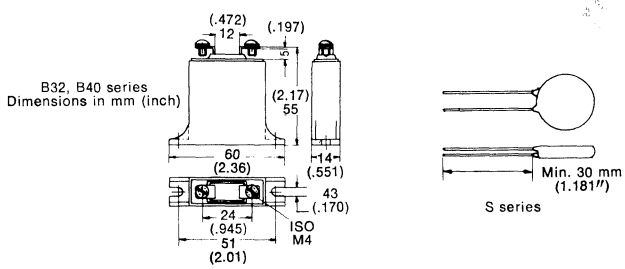
SIEMENS

SIOV's Metal Oxide Varistors for Transient Suppression

FEATURES:

- Nanosec. Switching Response Time, <15 nsec. with minimal lead length.
- High Transient Current Capability (up to 70,000 Amps).
- No Extinguishing or Follow-on Current Limitations.
- Small Size for Compact Designs.
- Wide Operating Temperature Range −40 to +85 degrees C.
- Compatible with Automatic Insertion. Tape and reel configuration available on SO5 and SO7 series. Contact marketing for details.
- Excellent Clamping Characteristics.
- Low Standby Power Consumption.

OUTLINE DIMENSIONS



SPECIFICATIONS (Partial Listing)

Part Number	Rated voltage AC Volts (RMS)	Rated voltage DC Volts	Varistor voltage (±10%) Volts	Rated peak single pulse transient current Amps	Rated single pulse transient energy Joules	Rated transient average power dissipation Watts	Maximum clamping voltage Volts
S05K11	11	14	18	100	0.3	0.1	47 @ 5A
S07K11				250	0.7	0.25	39 @ 5A
S10K11				500	1.8	0.4	40 @ 10A
S14K11				1000	3.4	0.6	36 @ 10A
S20K11				2000	80	1.0	36 @ 20A
S05K25	25	31	39	100	0.6	0.1	102 @ 5A
S07K25				250	1.5	0.25	85 @ 5A
S10K25				500	3.8	0.4	85 @ 10A
S14K25				1000	7.2	0.6	75 @ 10A
S20K25				2000	160	1.0	80 @ 20A
S05K130	130	175	205	400	4.2	0.1	355 @ 5A
S07K130				1200	15	0.25	340 @ 10A
S10K130				2500	32	0.4	365 @ 50A
S14K130				4500	55	0.6	340 @ 50A
S20K130				6500	80	1.0	340 @ 100A
B32K130				25,000	350	1.5	350 @ 300A
B40K130				40,000	520	2.0	380 @ 1000A
S05K150	150	200	240	400	5.0	0.1	425 @ 5A
S07K150				1200	17	0.25	400 @ 10A
S10K150				2500	40	0.4	420 @ 50A
S14K150				4500	65	0.6	395 @ 50A
S20K150				6500	95	1.0	395 @ 100A
B32K150				25,000	425	1.5	410 @ 300A
B40K150				40,000	680	2.0	430 @ 1000A
S05K275	275	370	430	400	8.4	0.1	750 @ 5A
S07K275				1200	28	0.25	700 @ 10A
S10K275				2500	60	0.4	770 @ 50A
S14K275				4500	100	0.6	710 @ 50A
S20K275				6500	150	1.0	710 @ 100A
B32K275				25,000	950	1.5	770 @ 300A
B40K275				40,000	1680	2.0	815 @ 1000A

NOTE: Due to space limitations, only a **partial listing** is shown. (SIOVs are available with rated voltage from 11V to 1100V AC)

Special Products Division
186 Wood Avenue South, Iselin, New Jersey 08830 U.S.A. Telephone (201) 906-4300

Siemens Components, Inc.

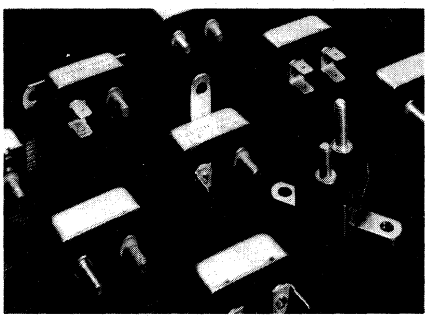
COOPER INDUSTRIES **USD**

Circuit Protection Devices

"Shortstop" Circuit Breakers 12 & 24 volts

"Shortstop" low voltage DC Circuit Breakers are rapidly replacing fuse installations in automotive applications, appliances and other direct current circuitry. The benefits of these breakers include automatic reset and modified reset capability, permanence of installation and a low rate of replacement in contrast to fuses.

"Shortstop" Circuit Breakers operate on the positive principle of bimetallic snap action. Overcurrents will heat the bimetal and open the breaker. In the automatic reset version (Type I), the



breaker will close when the bimetal cools. In the modified reset version (Type II), the built-in heaters heat the air inside the breaker and keep the bimetal from cooling, therefore keeping the circuit open until the voltage source is removed. Using these circuit breakers, the circuit is actually interrupted. In contrast, the circuit would be permanently broken if a fuse had been employed.

The many benefits of the USD Shortstop Circuit Breaker make it a valuable alternative to fuse installations.

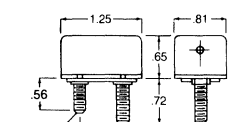
Part Numbering System

a	*b*	*c*	–	*d*	–	*e*	–	*f*

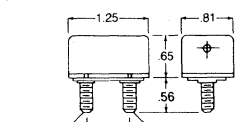
a OPERATING VOLTAGE	***12*** 12 VDC Type I ***S2*** 12 VDC Type II	***24*** 24 VDC Type I ***S4*** 24 VDC Type II
b TERMINAL STYLE	***A*** Two 10–32 Studs; (Aux) 21/32 & (Bat) ½ ***B*** Two 10–32 Studs; ½ ea. (Aux & Bat) ***C*** Two 10–32 Studs; 21/32 ea. (Aux & Bat) ***D*** Two Single .25 Quick Connect (Aux & Bat) ***E*** One 10–32 Stud; ½ (Bat) & One Single .25 Quick Connect (Aux) ***H*** One 10–32 stud; ½ (Bat) & One Double .25 Quick Connect (Aux) ***L*** Two 10–32 Studs; 5/16 (Aux & Bat) ***M*** Two 10–32 Studs; (Aux) 21/32 (Bat) 9/16	
c AMPERE RATING	***05*** 5 AMP ***08*** 8 AMP ***12*** 12 AMP ***20*** 20 AMP ***30*** 30 AMP ***40*** 40 AMP ***06*** 6 AMP ***10*** 10 AMP ***15*** 15 AMP ***25*** 25 AMP ***35*** 35 AMP ***50*** 50 AMP (12 V Only)	

d COVER STYLE	*00 (No Bracket)*	*A*	*B*	*C*
	Cover Style Number	**Hole Dia.**	**Hole Spacing**	
	A0, B0, C0	.196	1 9/16	
	A1, B1	.140	1 9/16	
	A2, B2	.237	1 9/16	
	Standard cover plating is zinc with yellow dichromate			
e SPECIALS (Omit if not Required)	***0001*** Hermetic Seal ***0002*** Splash Proof Consult factory for additional options.			
f HARDWARE	**PA** WHIZ-LOCK Nut Assembled **PB** WHIZ-LOCK Nut Bulk **HA** Hardware (Nut and 'L' Washer) Assembled **HB** Hardware (Nut and 'L' Washer) Bulk			

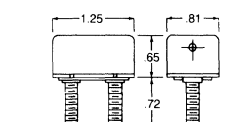
12AXX-00
50 AMP MAX



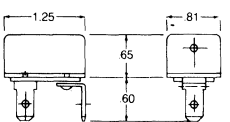
12BXX-00
50 AMP MAX



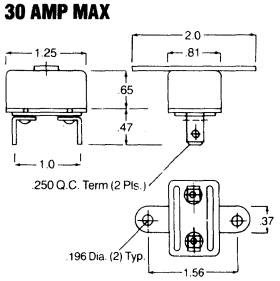
12CXX-00
50 AMP MAX



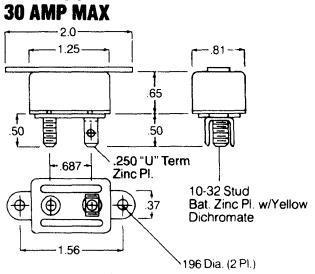
12DXX-00-011
30 AMP MAX



12DXX-A0
30 AMP MAX



12HXX-B0
30 AMP MAX



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Chicago, Illinois 60656
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COOPER INDUSTRIES

USD

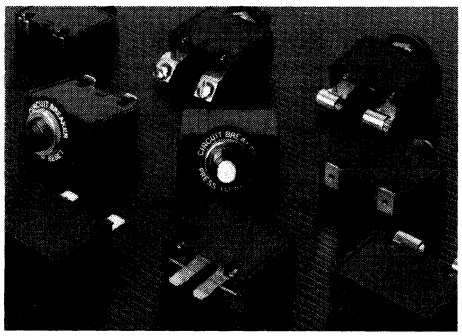
Circuit Protection Devices

Manual Reset Circuit Breakers
174XX Series

Automatic Reset Circuit Breakers
171XX Series

USD thermal circuit breakers have been designed as an alternative for 3AG fuses. They offer you the advantage of resettable circuit protection, in either manual or automatic formats.

USD circuit breakers can be used in many electrical applications to protect an electric circuit, replacing fuses, except in certain solid-state situations.



Applications include: electronic video games, multiple outlet strips, industrial controls, appliances, battery chargers, recreation vehicles, trucks, buses, tractors, motorcycles, etc.

Part Numbering System

	a		b	c	d	e	f	g
1 7 1	☐☐	– 1	C	☐☐	K	3	–	☐☐

AUTO RESET VERSION, SEE NOTE 1.

	a		b	c	d	e	f	g
1 7 2	☐☐	– 1	C	☐☐	K	3	–	☐☐

AUTO RESET VERSION, SEE NOTE 2.

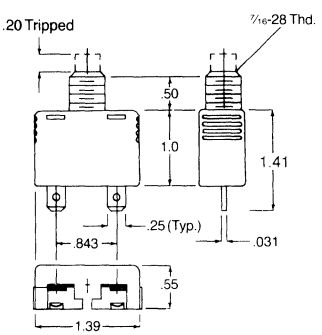
	a		b	c	d	e	f	g
1 7 4	☐☐	– 4	☐	☐☐	☐	☐	☐	☐☐

MANUAL RESET VERSION, SEE NOTE 3.

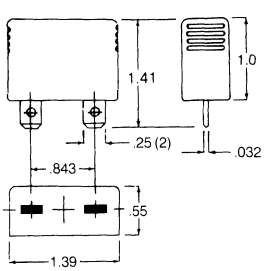
a CURRENT RATING	***08*** 08 AMP	***15*** 15 AMP	***25*** AMP	***35*** 35 AMP
	10 10 AMP	***20*** 20 AMP	***30*** 30 AMP	***40*** 40 AMP
c BUSHING CONFIGURATION	***C*** None (Auto Reset)		***G*** 3/8-24 x .500 Molded, Consult Factory	
	E 7/16-28 x .500 Molded		***J*** 15/32-32 x .500 Molded, Consult Factory	
	F 7/16-28 x .340 Molded w/Shoulder		***S*** Snap-In Bushing	
c TERMINAL CONFIGURATION	***01*** 1/4 " Dia. Fuse Ferrule (Long)		***08*** 1/4 " Q.C. 90°–30A Max	
	02 1/4 " Q.C. Straight–30A Max		***09*** .206 Q.C. Straight Auto Reset	
	03 6–32 Screw–90°		***10*** PC Tab 90°–10A Max	
	04 8–32 Screw–90°		***11*** 1/4 " Dia. Fuse Ferrule (Short)	
	05 6–32 Screw–45°		***12*** 1/4 " ST. Q.C. & 6-32 Screw 90°	
	06 8–32 Screw–45°		***13*** 1/4 " ST. Q.C. & 6-32 Screw 45°	
	07 1/4 " Q.C. 45°–30A Max			
d BUTTON CONFIGURATION	***A*** White w/Black Rate Marking		***L*** Black w/No Rate Marking	
	E White w/Red Rate Marking		***M*** Black w/White Rate Marking	
	F White w/No Rate Marking		***N*** Red w/No Rate Marking	
	K No Button (Auto Reset)		***P*** Red w/Black Rate Marking	
e MTG HARDWARE PACKAGING	***1*** Assembled to Bushing		***3*** No Mounting Hardware	
	2 Bulk–Unassembled			
f MOUNTING HARDWARE	***A*** Knurled Nut & Palnut		***E*** Knurled Nut, Palnut & Push to Reset Disc (White)	
	B Knurled Nut, Palnut & Push to Reset Disc (Black)		***F*** Knurled Nut & Push to Reset Disc (White)	
	C Knurled Nut		***G*** Snap-in Attachment to Bushing	
	B Knurled Nut & Push to Reset Disc (Black)		***H*** Black Knurled Nut	
g SPECIALS	***XX*** Specials are anything not listed above			

Note 1 – 12VDC AUTO RESET PER SAE J553.
Note 2 – 24VDC AUTO RESET PER SAE J553.
Note 3 – 250VAC/50VDC MANUAL RESET PER UL 1077, 12-24 VDC PER SAE J553.

174XX Series



171XX Series



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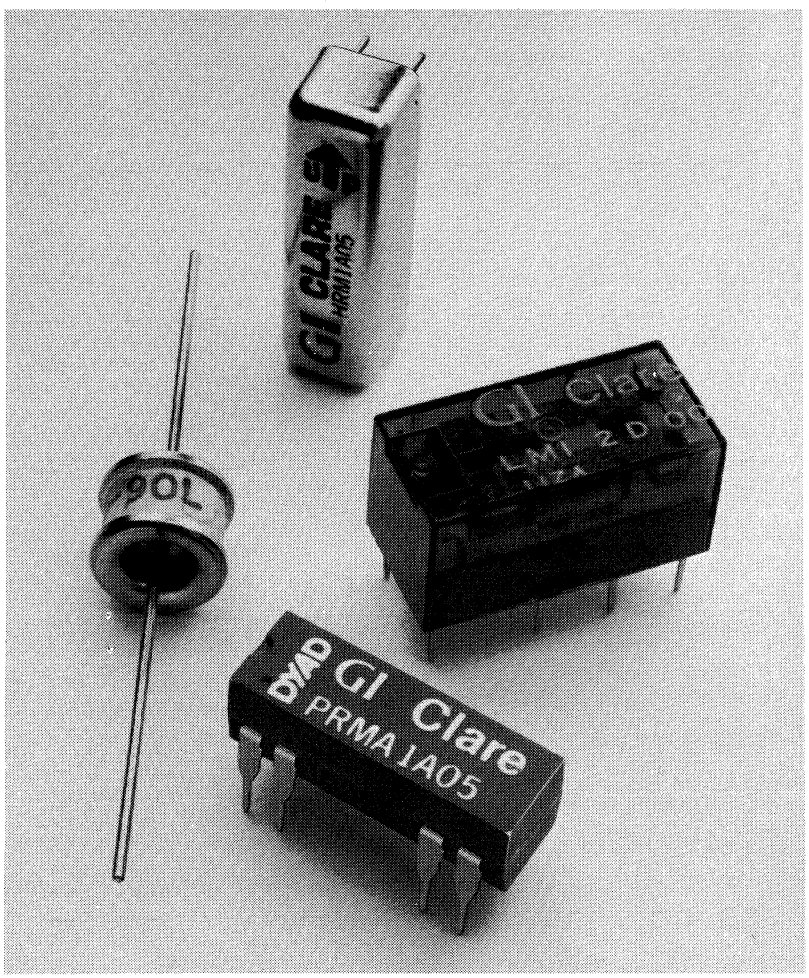

Quality in the Clare Tradition.

Clare Division has earned the position of being the world's largest supplier of mercury-wetted and dry reed relays.

This leadership position has not come easy, but has come as a result of Clare Division's total commitment to products offering improved technology through innovation . . . and to the quality and performance you expect from the leader in switching technology.

Couple this with high volume manufacturing capabilities, and you get superior quality products, at competitive prices, with fast off-the-shelf delivery.

Call your local Clare Representative or authorized Clare Distributor for more information about:

- Mercury-wetted contact relays
- Dry reed relays
- Electromechanical relays
- Surge arresters

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General Instrument Corporation
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GENERAL INSTRUMENT

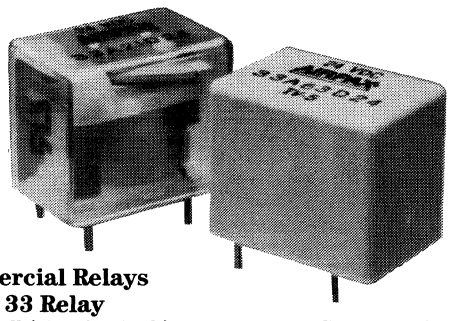
Manufacturer	Starting EEM Page No.	Reed: Mercury Wetted Contacts	Reed: Dry Contacts	Solid State	Hybrid	Thermal	Time Delay	Vacuum	I/O Mdl.	General Purpose	Latch	Current Sensing	Sensitive	High Power	Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Crystal Can	Std.	Ratings/Approvals: UL	CSA	MIL
Airpax	B•1357					¤				¤	¤	¤	¤		¤		¤	¤			¤	¤	¤	¤	¤
Alllied Control	B•1359			¤			¤			¤	¤	¤			¤		¤	¤	¤	¤	¤	¤			¤
Altech Corp.	B•1365						¤					¤			¤	¤		¤							
American Relays	B•1366	¤	¤								¤	¤	¤	¤	¤			¤	¤	¤			¤		
American Zettler	B•1372									¤	¤		¤	¤			¤	¤	¤	¤		¤	¤	¤	
Aromat	B•1375		¤	¤§	¤				¤	¤§	¤§		¤§			¤	¤	¤§	¤	¤	¤	¤§	¤	¤	
AT&T	B•1383			¤											¤				¤				¤		
Clare Division	B•1384	¤	¤§								¤					¤§		¤§	¤§	¤§		¤§	¤	¤	
Communications Instruments	B•1386									¤	¤		¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤
Computer Components	B•1394	¤	¤			¤	¤			¤	¤		¤		¤	¤	¤	¤	¤	¤	¤	¤	¤		¤
Coto Corp.	B•1395	¤	¤§		¤	¤				¤	¤	¤	¤		¤	¤§	¤§	¤§	¤	¤		¤§	¤		
Crydom	B•1396			¤			¤		¤	¤			¤	¤	¤			¤	¤						
Deltrol Controls	B•1400									¤	¤			¤		¤	¤					¤	¤	¤	
Douglas Randall	B•1402	¤	¤	¤		¤	¤		¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤		¤	¤	¤	
Eichhoff Elctrnc.	B•1412									¤	¤							¤				¤	¤	¤	
Elec-Trol	B•1414	¤	¤					¤			¤							¤	¤				¤	¤	¤
Electronic Specialty	B•1416						¤			¤	¤		¤	¤	¤	¤	¤	¤			¤	¤			¤
Fifth Dimension	B•1420		¤							¤	¤					¤		¤				¤			¤
FL Jennings	B•1422	¤					¤	¤	¤		¤	¤		¤	¤	¤	¤	¤				¤			¤
Fujitsu America	B•1427	¤§	¤§							¤	¤		¤	¤			¤	¤	¤	¤		¤	¤	¤	
Genicom	B•1448				¤					¤	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤			¤
Gordos Corp.	B•1452	¤§	¤	¤	¤	¤			¤	¤				¤	¤	¤		¤	¤	¤		¤			
Grayhill	B•1464			¤§					¤	¤				¤			¤	¤		¤		¤	¤	¤	
Hamlin	B•1467	¤§	¤§									¤			¤			¤	¤			¤	¤	¤	
Hasco Components	B•1468		¤§							¤§							¤	¤	¤	¤		¤	¤	¤	
Hi-G Nytronics	B•1478			¤	¤		¤					¤	¤			¤	¤	¤		¤	¤	¤			¤
IDEC	B•1494	¤§		¤	¤		¤		¤	¤		¤		¤		¤	¤	¤	¤	¤	¤		¤	¤	
Instrumentation & Control Systems	B•1499			¤			¤					¤					¤						¤	¤	

Manufacturer	Starting EEM Page No.	Reed: Mercury Wetted Contacts	Reed: Dry Contacts	Solid State	Hybrid	Thermal	Time Delay	Vacuum	I/O Mdl	General Purpose	Latch	Current Sensing	Sensitive	High Power	Voltage	RF	Plug-in	PC Mount	DIP/SIP	Low Profile	Crystal Can	Sld.	Ratings/Approvals: UL	CSA	MIL
International Rectifier	B-1501			¤	¤														¤	¤			¤	¤	
ITT Components	B-1502			¤						¤	¤		¤			¤	¤	¤	¤	¤		¤	¤	¤	
Kilovac	B-1510							¤							¤								¤		¤
Leach Control Prods	B-1516			¤	¤		¤					¤					¤				¤	¤			¤
Leach/Relays Div.	B-1524			¤	¤		¤			¤		¤	¤	¤	¤	¤	¤	¤	¤			¤			¤
Line Electronics	B-1531							¤		¤	¤		¤	¤			¤					¤			
Logitek	B-1532			¤		¤	¤				¤	¤					¤								¤
Magnecraft	B-1535	¤§	¤§	¤	¤		¤			¤	¤	¤	¤	¤	¤	¤	¤	¤	¤	¤		¤	¤	¤	¤
Mallory Timers	B-1536																	¤					¤		
Midtex Relays	B-1538	¤	¤	¤§		¤	¤			¤	¤	¤	¤				¤	¤				¤	¤	¤	
NEC Electronics	B-1544	¤	¤							¤	¤				¤			¤	¤	¤		¤	¤	¤	
Omron	B-1550			¤					¤	¤	¤		¤	¤		¤	¤	¤	¤	¤		¤	¤	¤	
Opto 22	B-1556			¤					¤	¤				¤	¤		¤	¤		¤			¤	¤	
Potter & Brumfield	B-1559		¤§	¤§			¤		¤	¤	¤		¤				¤	¤	¤§	¤		¤	¤	¤	
Ross Engineering	B-1577														¤										
Schrack North America	B-1578								¤	¤	¤	¤	¤	¤			¤	¤	¤	¤	¤	¤	¤	¤	
Sharp Electronics	B-1585			¤														¤	¤				¤	¤	
Silicon Power Cube	B-1586			¤	¤									¤	¤			¤	¤						
SSAC	B-1589					¤	¤																		
Standex	B-1576	¤	¤							¤	¤			¤	¤	¤		¤	¤			¤	¤	¤	
STI-Control Comps	B-1590			¤				¤		¤			¤		¤										¤
Struthers-Dunn	B-1592	¤	¤			¤	¤			¤	¤	¤	¤	¤			¤	¤§	¤§	¤§		¤	¤	¤	¤
Teledyne Relays	B-1598			¤§	¤				¤	¤	¤		¤			¤	¤	¤	¤	¤		¤	¤	¤	¤
Wabash Relay & Elctrns.	B-1610		¤															¤	¤	¤					

§ Surface Mount

RELAYS AND SOLENOIDS

Airpax relays and solenoids are specified around the world for hundreds of PC board applications. In standard or custom designs. Contact Airpax Company, Husky Park, Frederick, MD 21701. (301) 663-5141. A division of North American Philips Corporation.

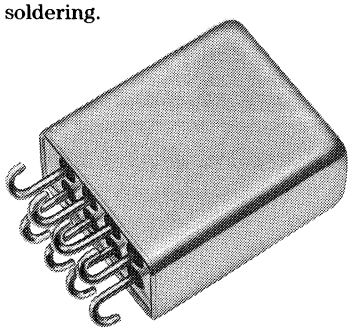


Commercial Relays
Series 33 Relay

This small (1/2 cubic inch) relay is especially suited for use as an output device for remote control and cable television, office equipment, appliances, door openers, automotive controls and various types of instruments. It offers complete isolation from noisy environments and can also handle high-inductive and tungsten filament loads. Coil voltages from 3 VDC to 48 VDC may be specified. Sensitive models, requiring as little as 180 mW of coil power, are available. Terminals are designed for PC board installation.

Features:

- Small size — 1/2 cubic inch.
- Sensitive — as little as 180 milliwatts coil power.
- TV 5 rating available.
- Approval — ᵁᴸ Ⓒ
- Inexpensive — typically under $1.00.
- 4KV Dielectric available.
- Sealed for wave soldering.

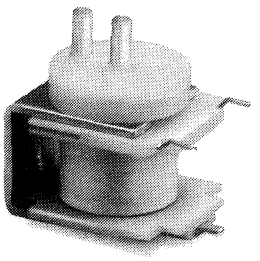


Military Relays
Series 07 — Crystal Can

Developed specifically for the aerospace industry. The standard unit features a solder terminal arrangement, 26.5 VDC coil voltage and 10 amp contacts.

Features:

- Qualified to MIL-R-5757, M 5757/23, MS 27245, MS 27247 and MIL-R-6106.
- Withstands severe vibration and shock.
- DPDT Contacts.



Custom Solenoids
Series 7150 — Vacuum Solenoids

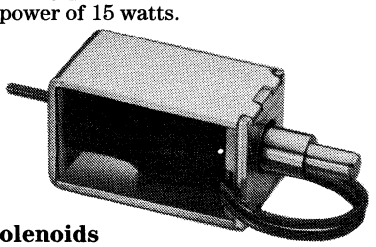
Applications for these custom solenoids include control functions for vacuum operated climate control modules and vacuum operated cruise control for the automotive industry. Our designers will work with you to develop a durable low cost package that will meet the requirements of your most difficult applications.

Features:

- PC board mounting available.
- Leakage rate of 10 cc/min. maximum @ 20 in. Hg vacuum to as low as −20°C.
- Sensitive: as little as 85 milliwatts coil power consumption.
- Duty cycle: continuous.
- Ambient temperature range: −40°C (−40°F) to +125°C (+257°F).

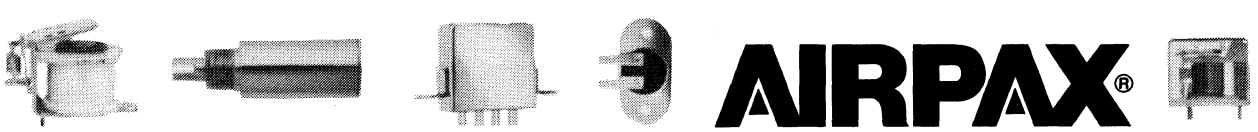
Custom Solenoids
7019 Solenoid

This direct Current Tubular Pull Type Solenoid is designed to provide up to 50 ozs. of force with a maximum stroke of .437″. Actual usable force will depend on the stroke and power level. Coils are available from 6 VDC to 115 VDC with a continuous duty power level of 5 watts and an intermittent (25%) duty power of 15 watts.



Custom Solenoids
7007ED33-0013 D.C. Box-Frame Push-Type Solenoid

Provides up to 20 ozs. of force with a maximum stroke of .200″. Actual usable force will depend on the stroke and power level. Coils are available from 6 to 115 VDC with a continuous duty power level of 3.0 watts and an intermittent (25%) duty power level of 9.0 watts.



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FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories .... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary .. **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide .... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide .... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
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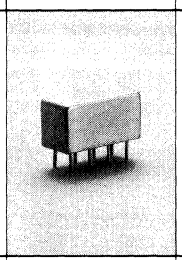
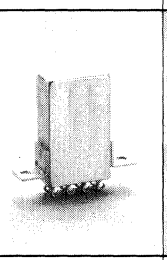
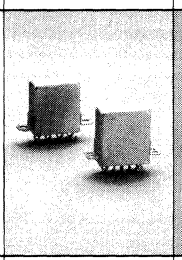
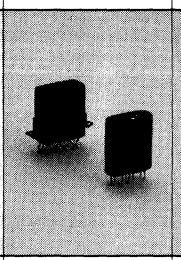
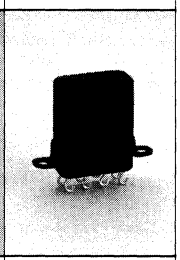
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph .. **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

Allied Control® Relays

MILITARY RELAYS

	RELAY TYPE	1/2 Size Crystal ERS & S	Long Coil Sensitive Crystal WJS	Full Size Crystal WKJ WKY	Full Size Crystal KHJ KHY	Miniature Round Sensitive RSH	Full Size Crystal 2 Pole JH
							
Contacts	Arrangement	2PDT	1PDT 2PDT	2PDT	2PDT	1PDT 2PDT	2PDT
	Amps DC	2	3	3	2	2	5
	Volts DC	28	29	29	29	29	29
	Amps AC	0.3 or 0.7	0.3	0.3	0.3	0.3	0.3
	Volts AC	115	115	115	115	115	115
Coil	DC Nominal Volts	6, 12, 26.5 or 48V	—	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	—	6, 12, 26.5, 48 or 115V
	AC Nominal Volts	—	—	—	—	—	—
	Operate Sensitivity Milliwatts DC	240	25 40	260	260	22 40	260
Mounting	Plain — No Mtg. Bkts.	X	X	X	X	X	X
	Flange Mtg.	X	X	X	X	X	X
	Stud Mtg.	X	X	X	X	—	X
	Side Bkts.	X	X	X	X	—	X
Terminals	Printed Ckt.	X	X	X	X	—	X
	Solder	X	X	X	X	X	X
	Plug-In	X	X	X	X	X	X
	Wire Leads	X	X	X	X	—	X
	Dielectric All Points VRMS	1000	1000	1000	1000	1000	1000
	Across Open Gap VRMS	500	500	500	500	500	500
	Coil to Frame	500	500	500	500	500	500
		S ERS					
	Vibration g's	20 30	15	20	20	10	20
	Hz	2000 3000	2000	2000	2000	500	2000
	Shock g's	50	50	100	100	50	50
Enclosure	Sealed by Welding	X	X	X	—	—	—
	Sealed by Solder	—	—	—	X	X	X
	Metal Dust Cover	—	—	—	—	—	—
	Plastic Dust Cover	—	—	—	—	—	—
	Open Frame	—	—	—	—	—	—
	Temperature Range °C	−65 +125	−65 +125	−65 +125	−65 +125	−65 +125	−65 +125
Dimensions	Length Inches	0.8	0.8	0.8	0.8	1.223	0.8
	Width Inches	0.4	0.4	0.4	0.4	0.343	0.4
	Height Inches	0.410	1.281	0.875	0.890	1.843	0.890
	MIL-Spec.	Mil-R-39016/6	Mil-R-5757/13	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757

Telemecanique

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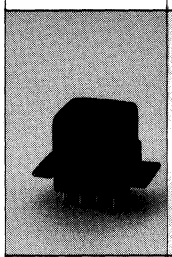
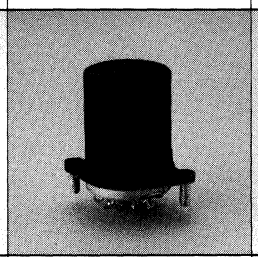
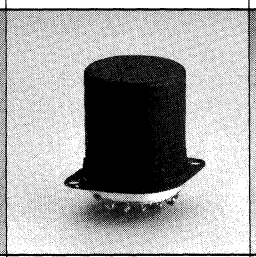
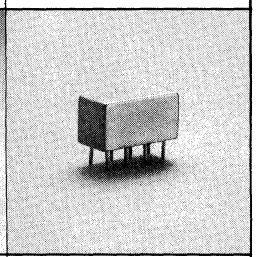
FAX No. 203-621-4932
TWX No. 710-473-0079

Allied Control® Relays

MILITARY RELAYS

Full Size Crystal 4 Pole JH	Miniature Round 2 Pole MH-6 MHB-6	Miniature Round 4 Pole MH-12 MHB-12 MHJ-12	Miniature Round 6 Pole MH-18 MHB-18 MHJ-18	Miniature Round 4 Pole 10 Amp MHY	Military Type — Commercial Version for Industrial Use 1/2 Size Crystal ST
					
4PDT	2PDT	4PDT	6PDT	4PDT	2PDT
2	5	5	5	10	2
29	29	29	29	29	28
0.3	0.3	0.3	0.3	0.5	0.3
115	115	115	115	115	115
6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	6, 12, 26.5, 48 or 115V	26.5V
—	— 115V	— — 115V	— — 115V	115V	—
480	525 520	700 675 675	875 845 845	875V	240
X	X	X	X	X	X
X	X	X	X	X	—
—	X	X	X	X	—
—	—	—	—	X	—
X	—	—	—	—	X
X	X	X	X	X	—
X	X	X	X	X	—
—	—	—	—	—	—
1000	1000	1000	1000	1000	1000
500	1000	1000	1000	1000	500
500	1000	1000	1000	1000	500
20	15	15 15 20	15 15 20	20	20
2000	1000	1000 1000 2000	1000 1000 2000	500	2000
50	50	50	50	50	50
—	—	—	—	—	X
X	X	X	X	X	—
—	—	—	—	—	—
—	—	—	—	—	—
—	—	—	—	—	—
−65 +125	−55 +85 −65 +125	−55 +85 −65 +125 −65 +125	−55 +85 −65 +125 −65 +125	−65 +125 DC −55 +85 AC	−55 +125
1.360	1.062	1.656	1.812	1.812	0.8
0.8	0.712	1.125	1.312	1.265	0.4
0.890	1.796	1.75	1.75	1.953	0.410
Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	Mil-R-5757	

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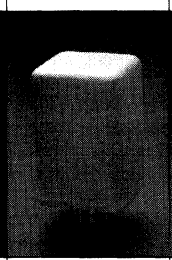
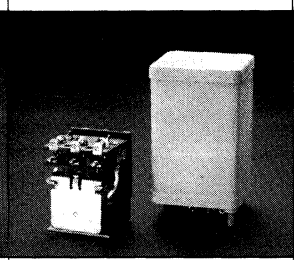
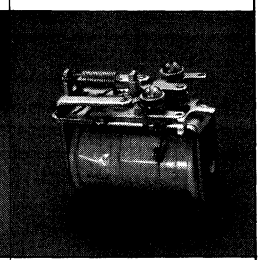
Allied Control® Relays

GENERAL PURPOSE RELAYS

	RELAY TYPE	Miniature Power BOT/BOHR/BODR		Miniature Power BOY/BOYHR/BOYDR Sensitive		Miniature Power PO/POHR/PODR				Sensitive As Low As .003 Watts SWS	SWN	SWP
												
Contacts	Arrangement	1PDT	2PDT	2PDT		2PDT		3PDT/4PDT		1PDT	1PDT/2PDT	1PDT/2PDT
	Amps DC	15		10		15				1	2.5	5.0
	Volts DC	28		26.5		29				24	24	24
	Amps AC	15		10		15				1	2.5	5.0
	Volts AC	115		110		115				115	115	115
Coil	DC Nominal Volts or	6, 12, 24, 48 or 115V		5.5, 13, 24, 62, 87 or 115V		6, 12, 26.5, 48 or 115V				—	—	—
	AC Nominal Volts	6, 12, 24, 48, 115 or 230V		—		6, 12, 24, 48, 115 or 230V				—	—	—
	Operate Sensitivity	4.2VA AC	1.4W DC	360mW		4.2VA AC		1.4W DC		3mW	12mW	50mW
Mounting	Plain - - No Mtg. Bkts.	—		—		—					—	
	Flange Mtg.	X		X		X					X	
	Stud Mtg.	X		X		X					X	
	Side Bkts.	—		—		—					—	
Terminals	Printed Ckt.	—		—		—					—	
	Solder	X		X		X					X	
	Plug-In	X		X		X					X	
	Wire Leads	—		—		—					—	
	Dielectric All Points VRMS	1250		1250		1250					1000	
	Across Open Gap VRMS	1250		1250		1250					500	
	Coil to Frame	1250		1250		1250					500	
	Vibration g's	10		10		10				N/R	10	
	Hz	55		55		55				N/R	55	
	Shock g's	25		25		25				N/R	25	
Enclosure	Sealed by Welding	—		—		—					—	
	Sealed by Solder	X		X		X					X	
	Metal Dust Cover	X		X		X					X	
	Plastic Dust Cover	—		—		—					—	
	Open Frame	X		X		X					X	
	Temperature Range °C	0 +71		0 +71		0 +71				0 +71		
Dimensions						2 & 3 Pole		4 Pole				
		Open Frame	Enclosed	Open Frame	Enclosed	Open Frame	Enclosed	Open	Enclosed			
	Length Inches	1.62	1.796	1.843	1.796	1.906	1.906	1.906	2.281		1.625	
	Width Inches	1.5	1.672	1.5	1.672	1.718	1.906	2.281	2.156		1.141	
	Height Inches	1.937	2.687	1.937	2.687	2.81	3.218	2.281	3.515		1.406	
	Mil-Spec.											

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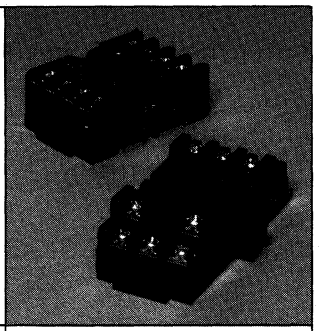
Allied Control® Relays

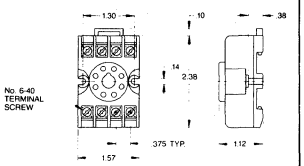
INDUSTRIAL RELAY SOCKETS

SNAP TRACK MOUNTED

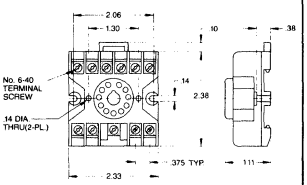


Construction	Self-extinguishing, black polycarbonate body with integral molded barrier.
Terminals	Combination slot/phillips head screws and captive self lifting terminal clamps.

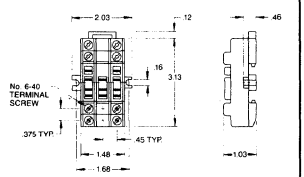
H50SL608S
8-pin octal socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



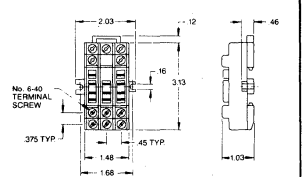
H50SL611S
11-pin magnol socket. Rating: U/L and CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw.



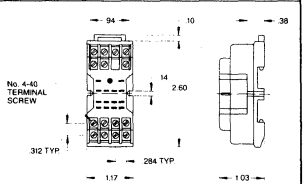
H50SL708S
8-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes, 300VAC. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.



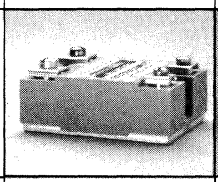
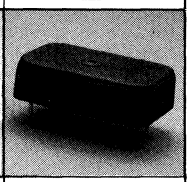
H50SL711S
11-pin blade type socket. Rating: U/L, 15 amperes, 300VAC; CSA, 10 amperes. Wire sizes: up to #12 AWG. Terminals: pan head 6-40 screw. Cascading mounting center 1.74 ± .010.

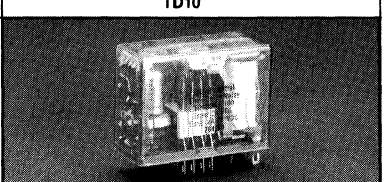


H50SL715S
14-pin blade type socket. Rating: U/L and CSA, 5 amperes, 300VAC. Wire sizes: up to #14 AWG. Terminals: pan head 4-40 slot.



Mounting Track	Standard Track SL601 and SL602 will accept either regular and snap track sockets.
U/L CSA	E48784 LR28098

	RELAY TYPE	**E3**	**E22**
	SOLID STATE RELAYS		
Output	Arrangement	1PST NO 1PST NC	1PST NO
	Amps AC	10, 25 or 40	4
	Volts AC	280	240
	Amps DC		
	Volts DC		
Input	DC Nominal Volts	3-32VDC	5, 12, 24 or 32
	AC Nominal Volts	20-28VAC 100-135VAC	—
Mtg	Panel	X	—
	Printed Ckt.	—	X
	Isolation	2500V	2500V
	Vibration g's	20	20
	Hz	2000	2000
	Shock g's	50	50
	Temperature Range °C	−30 +80	−30 +80
	Length Inches	2.250	1.6
	Width Inches	1.75	1.0
	Height Inches	1.0	.05
	Photo Isolation	X	X
	Zero Crossing	X	X
	U/L	E57093	
	CSA	LR34171	

	TIMER TYPE	**TD10**	
	SOLID STATE TIMER		
	Arrangement	2PDT	4PDT
	Amps	2 or 5	
	Volts	28VDC	115VAC
	Nominal Coil Voltage DC	12, 24 or 48	
	Nominal Coil Voltage AC	24 , 115	
	Timer Delay — Operate Delay	0.1 to 300 sec.	
	Timing Adj.	Fixed or Adjustable (Internal or External)	
	Mounting	Printed Circuit Board Mounting Socket Mounting Chassis Mounting	
	Housing	Plastic Dust Cover	
	Vibration g's	10	
	Hz	55	
	Shock g's	25	
	Temperature	0°C to 55°C	
	Dimensions — Length	1.391	1.594
	Width	0.735	0.735
	Height DC	1.187	1.187
	Height AC	1.968	1.968

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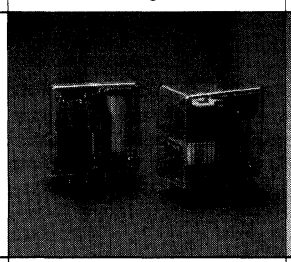
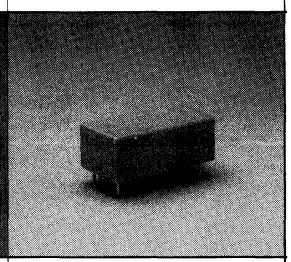
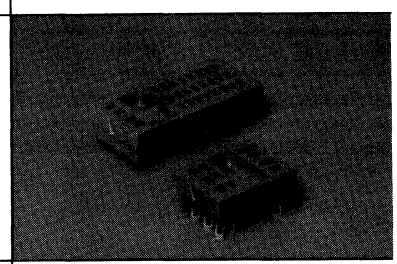
Allied Control® Relays

CRADLE & LOW PROFILE RELAYS

	RELAY TYPE	Miniature General Purpose Cradle Relay T154/T163/T351/T362 Incl. Mag Latch				Flat Pack MPC/MPCL Incl. Mag Latch	
							
Contacts	Arrangement	1PDT up to 8PDT				2PDT	4PDT
	Amps DC	1, 2, 5 or 10				1 or 2	
	Volts DC	29				28	
	Amps AC	1, 2, 5 or 10				0.5 or 1	
	Volts AC	115				120	
Coil	DC Nominal Volts	3 to 115				5, 6, 12, 20, 24 or 48	
	AC Nominal Volts	6 to 220				—	
	Operate Sensitivity Milliwatts	20 to 1000				160 to 550	
Mounting	Plain — No Mtg. Bkts.	X				X	
	Flange Mtg.	—				—	
	Stud Mtg.	X				—	
	Side Bkts.	—				—	
Terminals	Printed Ckt.	X				X	
	Solder	X				—	
	Plug-In	X				—	
	Wire Leads	—				—	
	Dielectric All Points VRMS	1000				1000	
	Across Open Gap VRMS	500				500 (350 btwn. ckts.)	
	Coil to Frame	500				500	
	Vibration g's	10				10	
	Hz	55				55	
	Shock g's	25				30	
Enclosure	Sealed by Welding	—				—	
	Sealed by Solder	X				—	
	Metal Dust Cover	X				—	
	Plastic Dust Cover	X				X	
	Open Frame	X				—	
	Temperature Range °C	−55 +71				−55 +80	
Dimensions		2-P	4-P	6-P	8-P	2-P	4-P/2-P Mag Latch
		Plastic Dust Cover					
	Length Inches	.937	1.172	1.391	1.594	1.10	1.10
	Width Inches	.735	.735	.735	.735	0.6	0.780
	Height Inches	1.187	1.187	1.187	1.187	0.425	0.425
	Mil-Spec.						
	U/L	E20604				E20604	
	CSA	LR34171				LR34171	

Cradle Socket and Accessories



Construction

Body molded of glass filled flame retardant polyester (PBT). Meets UL94VO and is fungus resistant.
One piece contact/terminal construction of berylium copper.
Selectively plated gold over nickel on contact area. 60/40 Brite-Tin on terminal area.

Arrangement

Number of Poles
2 = 2-pole socket
4 = 4-pole socket
6 = 6-pole socket
8 = 8-pole socket

Terminal/Mounting

Type of Terminal
1 = Solder lug/chassis mounted
3 = Standard PC in-line mounting
5 = PC mounting .100″ x .100″ grid throughout
7 = PC mounting .100″ x .100″ grid in contact
.100″ x .150″ grid in coil

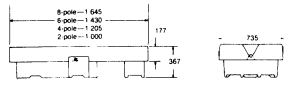
Accessories

Socket Assemblies
10 = Socket only
11 = Socket with ground spring installed
12 = Socket with ground spring installed and retainer
13 = Socket with retainer

Part Name	Part No.	Diagram	Retainer-Part No.	Diagram
Ground Spring for Solder Lug/Chassis	T-00101		T-00102 2-pole T-00104 4-pole T-00106 6-pole	to be inserted into recesses on narrow sides of sockets
Ground Spring for all P.C. mounted sockets	T-00105		T-00108 8-pole Flat Retainer	

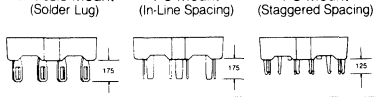
Dimensions

Body



Terminals

Chassis Mount (Solder Lug) | PC Mount (In-Line Spacing) | PC Mount (Staggered Spacing)



U/L	E20604
CSA	LR34171

Telemecanique

Telemecanique Inc.
100 Relay Road
Plantsville, CT 06479
(203) 621-6771

FAX No. 203-621-4932
TWX No. 710-473-0079

eem MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

Encapsulated: Imbedded in a suitable potting compound.

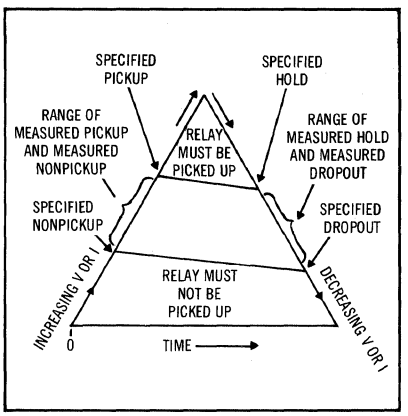
Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.



OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

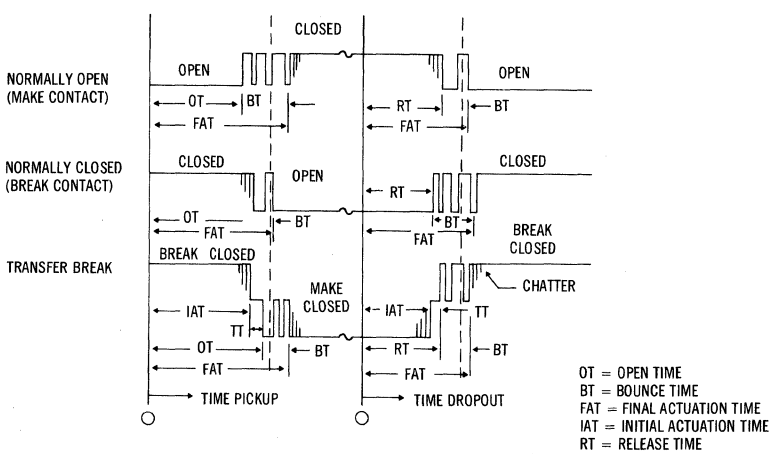
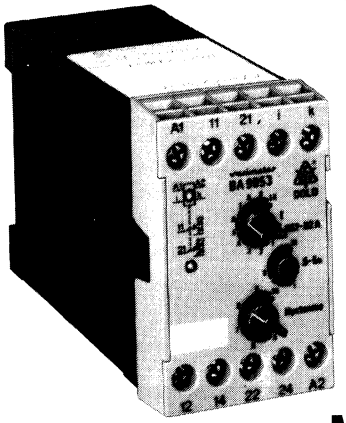


Fig. 2. Typical time vs. current (non-inductive load)

Altech ....Supplying Solutions

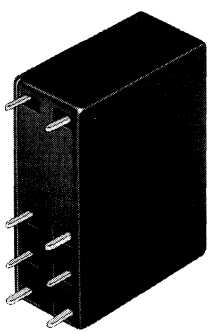


- Mini PC Board Mounted Relays
- Panel Mount Timing Relays
- DIN Rail Mount Measuring Relays
- Electronic Relay Housing
- Relays for....
  - Voltage Parameter Sensing
  - Over or Under Current Sensing
  - Motor Load Monitoring
  - Phase Imbalance Sensing
  - Loss of Phase Protection
  - Power Factor Monitoring
  - Speed Sensing
  - Thermistor Alarm System

Measuring Relays

Model	BA 9053	BA 9054	BA 9036	BA 9043	BA 9041	BA 9038	BA 9055	BA 9042	BA 7632
FUNCTION	Current	Voltage	Voltage	Voltage	Phase sequence	Thermistor	Speed	Asymmetry	Current

Consult Altech for Max. Nom. Volts & Configuration



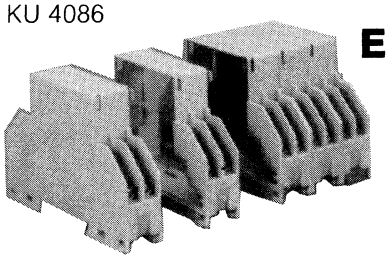
Mini-Sized Relays...

Model	OW 5651	OA 5651 OA 5661	OA 5652 OA 5662/OA 5692	OA 5672 OW 5672	OA 5682 OW 5682	OA 5681 OW 5681
VOLTS DC	6, 12, 15, 20 24, 48, 60	6, 12, 15, 20, 24, 48, 60		6, 12, 15, 20 24, 48, 60	6, 12, 15, 20, 24, 48, 60	
MAX AMPS	8	8		10	16	
MAX BREAK KVA	1.75	1.75		2.2	3.5	
WxHxL	1.16x0.43x1.04″	1.46x0.43x0.98″		1.14x0.98x0.43″	1.16x1.00x0.47″ OR 1.16x0.47″	

Timed Response Relays

Model	BA 7811	BA 7903	BA 7905	BA 7901	BA 7954	BA 7962	BA 7981	BA 7983	BA 7985
FUNCTION	Multifunction relay	Timer	Timer	Timer	Timer	Timer	Flasher	Fleeting action relay	
MIN.... MAX....	0.05s... 1000 min.	0.05s... ...100 s	0.05s... ...300 s	005s... ...100 h	0.05s... ...300 s	0.05s... ...100 h	0.3s... ...3 s	0.3s... ...0.6 s	0.05s... ...100 s
NOM VOLTS	AC...220V DC... 60V	AC...240V DC... 60V	AC...240V DC...220V	AC...240V DC... 24V	AC...240V DC... 24V	AC...240V DC...240V	AC...240V DC... 24V	AC...240V DC... 42V	AC...240V DC... 42V

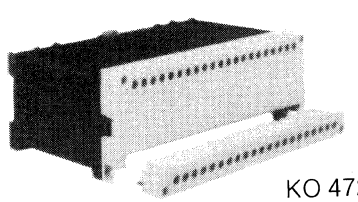
KU 4086



Electronic Relay Housings

- DIN Specifications
- UL 94 VO Materials
- Panel or DIN Rail Mount
- PC Board Guides
- Safe, Hi-Density Terminals

....Other Models Available



KO 4720

For immediate assistance, call 201-359-4454 or FAX: 201-359-8178

Altech Corp. **"Puts it all-together" by**

Supplying Modern Solutions...to current problems.

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REED RELAYS

From American Relays, Inc.

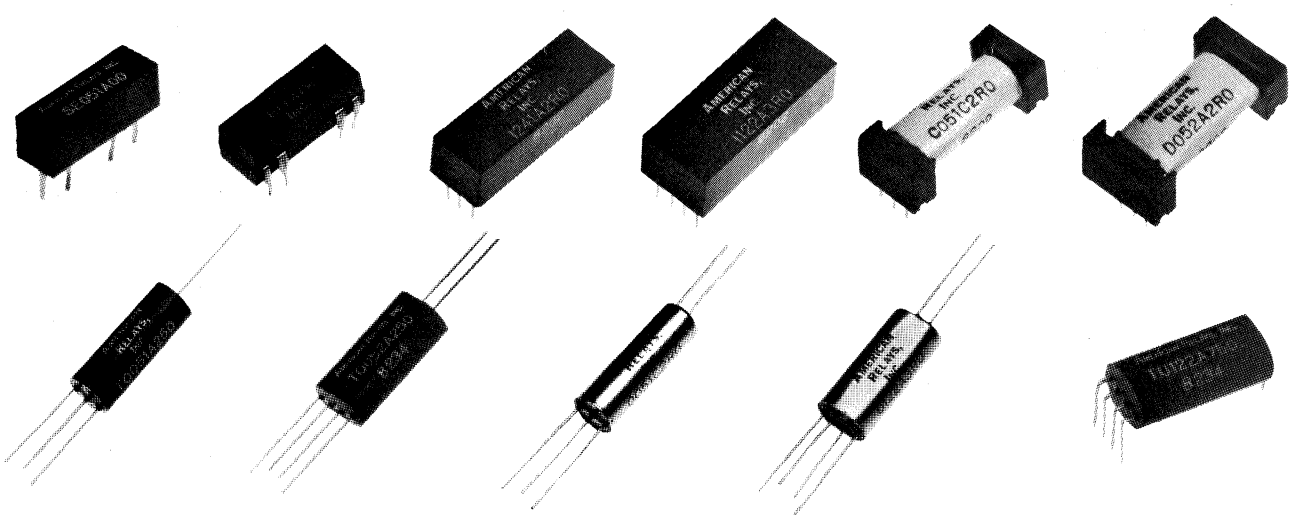
Whether you're looking for a **REED RELAY** that will meet FCC surge requirements, or a sensitive Low-Level **REED RELAY** to switch ATE signal...

AMERICAN RELAYS HAS IT ALL

High Quality — Low Price — On time Delivery

Dry and Mercury Wet contacts
With High Voltage, High Power or Low Level switching

Standard or Specified to YOUR Application,
AMERICAN RELAYS can Build the **REED RELAY** you need.



American Relays, Inc., offers a comprehensive line of super-reliable reed relays. American Relays, Inc., 100% tests all reed switches **AND** 100% final tests all reed relays. We are specialists in **"THE REED RELAY INDUSTRY".**

PACKAGE STYLES

- **Encapsulated**
- **Open Frame**
- **Axial Leeds**
- **DIP**
- **SIP**

SWITCHING TYPE

- **General Purpose Dry Reed**
- **Low Level Switching**
- **High Power**
- **High Voltage**
- **Mercury Wetted Contacts**

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TEL (213) 944-0447 • FAX (213) 944-0590 • TELEX 3710614

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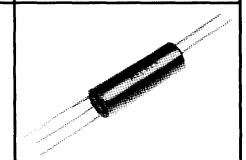
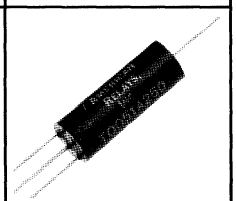
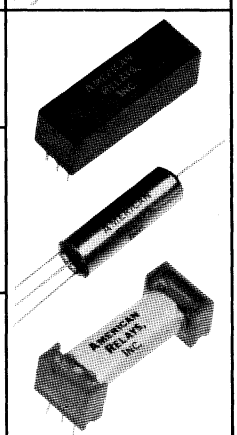
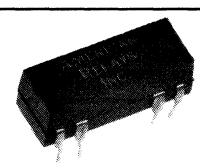
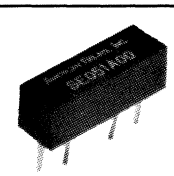
REED RELAY INDEX

RELAY TYPE	DESCRIPTION	TERMINAL GRID	CONTACT FORMS AVAILABLE POLES	PACKAGE
ENCAPSULATED	Epoxy encapsulated. Total Environmental protection. Wide range of contact forms and coil voltages are available.	1.000 × .100 1.000 × .150	Form A (1 to 6) Form B (1 & 2) Form A/B (1 & 2) Form C (1 to 4) Form A Latching (1 & 2)	
OPEN FRAME	Durable glass filled polyester bobbin construction. Switch and coil leads are securely held with epoxy potting. Cost efficient plug-in type reed relay.	1.000 × .100 1.000 × .150	Form A (1 to 4) Form B (1 & 2) Form C (1, 2, 3) Form A Latching (1)	
AXIAL	Rugged axial lead tubular relay. Nickel plated metal jacket provides magnetic shield. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1) Form C (1 & 2) Form A Latching (1)	
T SERIES	Most economical, high performance tubular relay. Completely sealed in a flame retardant plastic tube. 1.000″ center formed leads are available.	Axial 1.000 × .100	Form A (1 & 2) Form B (1)	
HIGH POWER	50W contact rating. Available with encapsulated, open frame and axial lead packages.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
HIGH VOLTAGE	25W, 1000 VDC switching. 2500 VDC breakdown voltage. Miniature size. Available with encapsulated, open frame and axial lead package.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2)	
MERCURY WETTED	Mercury wetted contact relay. 50W contact rating. Extremely long life expectancy. No contact bounce. Stable low contact resistance.	Axial 1.000 × .100 1.000 × .150	Form A (1 & 2) Form C (1 & 2)	
DIP RELAYS	Epoxy molded DIP reed relay. Logic compatible. Stable contact resistance. Fits all standard DIP sockets and is automatic insertion compatible.	DIP .300 × .100	Form A (1 & 2) Form B (1) Form C (1)	
SIP RELAYS	High quality economical Single-In-Line package reed relays. Open frame and encapsulated packages. Various contact ratings are available.	SIP .2 × .4 × .2 .2 × .2 × .2	Form A (1) Form B (1) Form C (1)	
SPECIAL RELAYS	Let us design reed relays for your application. Special relays are cost competitive with standard relays in most cases. Consult the factory or your local representative with your specific requirements.			

American Relays, Inc.

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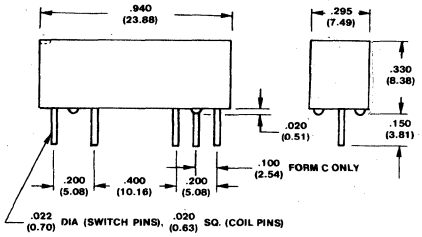
REED RELAYS

SINGLE-IN-LINE SERIES (S SERIES)



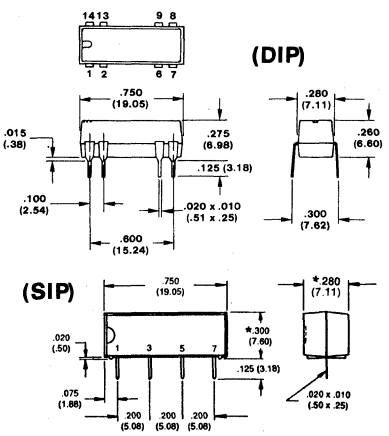
- High Quality Low Cost Single-In-Line
- Sturdy Bobbin and Encapsulated in a Polyester Case

GENERAL SPECIFICATIONS

Contact resistance: .150 ohms max.
Operate time: 0.5 ms typ.
Release time: 0.2 ms typ.
Bounce time: (Form A & B) 0.25 ms typ. (form C, NO/NC) 0.5/1.5 ms typ.
Insulation resistance: 10^{10} ohms min. (form A), 10^{9} ohms min. (form C)
Operating temperature: −40° to +85°C
Vibration: 20G (10 — 2000 Hz)
Shock: 50G @ 11 ms duration

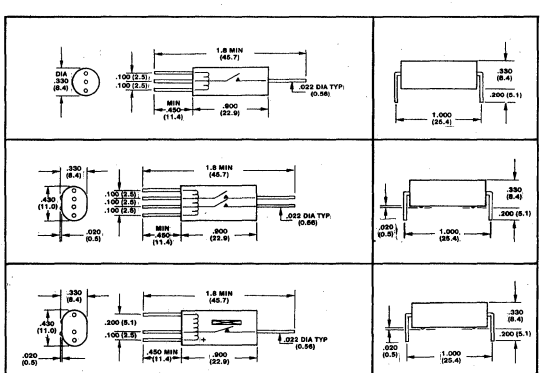
Contact Form	Part Number	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A Standard	SE051A00	5-6	500	3.8	0.5	10 Watts	250	
	SE061A00	5-6	125	3.8	0.5	200 VDC		
	SE121A00	12	500	8.0	1.0	0.5 Amps		
	SE241A00	24	2000	16.0	2.0			
1A High Power	SE051A10	5-6	300	3.8	0.5	50 Watts	500	
	SE061A10	5-6	125	3.8	0.5	200 VDC		
	SE121A10	12	500	8.0	1.0	1.0 Amps		
	SE241A10	24	2000	16.0	2.0			
1A High Voltage	SE051A20	5-6	300	3.8	0.5	10 Watts	1500	
	SE061A20	5-6	125	3.8	0.5	500 VDC		
	SE121A20	12	500	8.0	1.0	0.5 Amps		
	SE241A20	24	2000	16.0	2.0			
1A Mercury	SE051A30	5-6	200	4.0	0.5	50 Watts	1500	
	SE061A30	5-6	125	4.0	0.5	500 VDC		
	SE121A30	12	500	9.0	1.0	1.0 Amps		
	SE241A30	24	2000	18.0	2.0			
1A Low Level Ruthenium Contact	SE051A40	5-6	500	3.8	0.5	10 Watts	300	
	SE061A40	5-6	125	3.8	0.5	200 VDC		
	SE121A40	12	500	8.0	1.0	0.5 Amps		
	SE241A40	24	2000	16.0	2.0			
1B	SE051B00	5-6	300	3.8	0.5	10 Watts	250	
	SE061B00	5-6	125	3.8	0.5	200 VDC		
	SE121B00	12	500	8.0	1.0	0.5 Amps		
	SE241B00	24	2000	16.0	2.0			
1C	SE051C00	5-6	200	3.8	0.5	3 Watts	200	
	SE061C00	5-6	125	3.8	0.5	100 VDC		
	SE121C00	12	500	8.0	1.0	0.25 Amps		
	SE241C00	24	2000	16.0	2.0			

DIP AND SIP REED RELAYS



*MICRO SIP WIDTH .200
*MICRO SIP HEIGHT .225

Contact Form	Part Number: No Diode	Part Number: With Diode	Coil VDC	Coil Res. (Ohms)	Must Operate VDC	Must Release VDC	Contact Ratings	Break Down Voltage	Schematic
1A	AD1A05	AD1A05D	5	500	3.8	0.5	10 Watts	250	
	AD1A12	AD1A12D	12	850	8.0	1.0	150 VDC		
	AD1A24	AD1A24D	24	2200	16.0	2.0	0.5 Amps		
2A	AD2A05	AD2A05D	5	200	3.8	0.5	10 Watts	250	
	AD2A12	AD2A12D	12	500	8.0	1.0	150 VDC		
	AD2A24	AD2A24D	24	1750	16.0	2.0	0.5 Amps		
1B	AD1B05	AD1B05D	5	500	3.8	0.5	10 Watts	250	
	AD1B12	AD1B12D	12	500	8.0	1.0	150 VDC		
	AD1B24	AD1B24D	24	1750	16.0	2.0	0.5 Amps		
1C	AD1C05	AD1C05D	5	200	3.8	0.5	3 Watts	250	
	AD1C12	AD1C12D	12	500	8.0	1.0	100 VDC		
	AD1C24	AD1C24D	24	1750	16.0	2.0	0.25 Amps		
1A Hg Wet	AD1A05HG	AD1A05HGD	5	90	4.0	0.5	50 Watts	1000	
	AD1A12HG	AD1A12HGD	12	360	9.0	1.0	100 VDC		
	AD1A24HG	AD1A24HGD	24	1440	18.0	2.0	2.0 Amps		
1A SIP	SD1A05	SD1A05D	5	500	3.8	0.5	10 Watts	250	
	SD1A12	SD1A12D	12	850	8.0	1.0	150 VDC		
	SD1A24	SD1A24D	24	2200	16.0	2.0	0.5 Amps		
1A Micro SIP	SH1A05	N/A	5	500	3.8	0.5	10 Watts	200	
	SH1A12		12	1000	8.0	1.0	100 VDC		
	SH1A24		24	2000	16.0	2.0	0.5 Amps		



"T" SERIES

- Most Economical High Quality Relay
- Axial Leads for Flexible Mounting
- Formed Leads for P.C. Board Mounting

Contact Form	Part Number: Axial	Part Number: Formed (1.00" Center)	Coil VDC	Coil Res.	Must Operate	Must Release	Contact Ratings	Break Down Voltage
1A	T0051A500	TU051A500	5	500	4.0	0.5	10 Watts	300
	T0121A500	TU121A500	12	500	9.0	1.2	200 VDC	
	T0241A2K0	TU241A2K0	24	2000	18.0	2.4	0.5 Amps	
2A	T0052A250	TU052A250	5	250	4.0	0.5	10 Watts	300
	T0122A1K0	TU122A1K0	12	1000	9.0	1.2	200 VDC	
	T0242A2K0	TU242A2K0	24	2000	18.0	2.4	0.5 Amps	
1B	T0051B250	TU051B250	5	250	4.0	0.5	10 Watts	300
	T0121B1K0	TU121B1K0	12	1000	9.0	1.2	200 VDC	
	T0241B2K0	TU241B2K0	24	2000	18.0	2.4	0.5 Amps	

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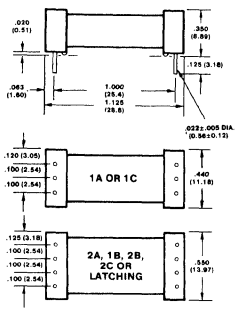
REED RELAYS

OPEN FRAME REED RELAYS (SERIES C AND D)



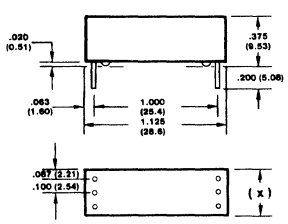
- High Performance, Low Cost Open Frame, PC Mount Dry Reed Relays
- Popular 1.000″ x .100″ or 1.000″ x .150″ Pin Spacing
- Rigid Polyester Relay Body with Epoxy Filled Ends

Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	28 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf.
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

Contact Form	Part Number C End Coil	Part Number D Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width	Schematic Top View C End Coil	Schematic Top View D Side Coil
1A	C051A2R0	D051A2R0	5	500	3.8	0.5	.440		
	C121A2R0	D121A2R0	12	1000	9.0	1.2			
	C241A2R0	D241A2R0	24	2000	18.0	2.4			
2A	C052A2R0	D052A2R0	5	300	3.8	0.5	.550		
	C122A2R0	D122A2R0	12	750	9.0	1.2			
	C242A2R0	D242A2R0	24	1500	18.0	2.4			
4A	C054A2R0	D054A2R0	5	150	3.8	0.5	.640		
	C124A2R0	D124A2R0	12	375	9.0	1.2			
	C244A2R0	D244A2R0	24	1000	18.0	2.4			
1B	C051B2R0	D051B2R0	5	500	3.8	0.5	.550		
	C121B2R0	D121B2R0	12	1000	9.0	1.2			
	C241B2R0	D241B2R0	24	2000	18.0	2.4			
1C	C051C2R0	D051C2R0	5	500	3.8	0.5	.440		
	C121C2R0	D121C2R0	12	1000	9.0	1.2			
	C241C2R0	D241C2R0	24	2000	18.0	2.4			
2C	C052C2R0	D052C2R0	5	300	3.8	0.5	.550		
	C122C2R0	D122C2R0	12	750	9.0	1.2			
	C242C2R0	D242C2R0	24	1500	18.0	2.4			
1A Latching	C051K3R0	D051K3R0	5	375	3.8	0.5	.550		
	C121K2R0	D121K2R0	12	500	9.0	1.2			
	C241K3R0	D241K3R0	24	2000	18.0	2.4			

ENCAPSULATED REED RELAYS (SERIES I AND J)

- Total Environmental Protection
- A Wide Variety of Coil and Contact Arrangement Available



Specifications	Form A/B	Form C
Power (Resistive Load)	10 Watts	3 Watts
Voltage (Max. Switching)	200 VDC	28 VDC
Voltage (Min. Breakdown)	300 VDC	200 VDC
Current (Max. Switching)	0.5 Amps	0.25 Amps
Current (Max. Carry)	2.0 Amps	1.2 Amps
Capacitance (Typical)	0.2 Pf	0.8 Pf
Contact Resistance (Max. Initial)	0.2 Ohms	0.2 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms
Release Time (Typical)	0.2/0.5 ms	0.5 ms
Insulation Resistance (Min.)	10^{10} Ohms	10^{9} Ohms
Life (Low Level)	100 x 10^{6} Oper.	50 x 10^{6} Oper.
Life (Rated Load)	10 x 10^{6} Oper.	5 x 10^{6} Oper.
Temperature	−40°C to +85°C	
Vibration	20G to 2000 Hz	
Shock	50G @ 11 MS Duration	

NOTE:
1. Electro-static shielding (E) is optional.
2. On latching relays, (+) indicates set positive.

Contact Form	Part Number I End Coil	Part Number J Side Coil	Nom. Coil VDC	Coil Res. (Ohms) ±10%	Max. Pick-up VDC	Min. Drop-out VDC	Width (X)	Schematic Top View I End Coil	Schematic Top View J Side Coil
1A	I051A2R0	J051A2R0	5	500	3.8	0.5	.375		
	I121A2R0	J121A2R0	12	1000	9.0	1.2			
	I241A2R0	J241A2R0	24	2000	18.0	2.4			
2A	I052A2R0	J052A2R0	5	300	3.8	0.5	.475		
	I122A2R0	J122A2R0	12	750	9.0	1.2			
	I242A2R0	J242A2R0	24	1500	18.0	2.4			
3A	I053A2R0	J053A2R0	5	250	3.8	0.5	.575		
	I123A2R0	J123A2R0	12	500	9.0	1.2			
	I243A3R0	J243A3R0	24	2000	18.0	2.4			
4A	I054A2R0	J054A2R0	5	150	3.8	0.5	.700		
	I124A2R0	J124A2R0	12	375	9.0	1.2			
	I244A2R0	J244A2R0	24	1000	18.0	2.4			
1B	I051B2R0	J051B2R0	5	500	3.8	0.5	.475		
	I121B2R0	J121B2R0	12	1000	9.0	1.2			
	I241B2R0	J241B2R0	24	2000	18.0	2.4			
1A1B	I052F2R0	J052F2R0	5	250	3.8	0.5	.575		
	I122F2R0	J122F2R0	12	500	9.0	1.2			
	I242F3R0	J242F3R0	24	2000	18.0	2.4			
1C	I051C2R0	J051C2R0	5	500	3.8	0.5	.375		
	I121C2R0	J121C2R0	12	1000	9.0	1.2			
	I241C2R0	J241C2R0	24	2000	18.0	2.4			
2C	I052C2R0	J052C2R0	5	300	3.8	0.5	.500		
	I122C2R0	J122C2R0	12	750	9.0	1.2			
	I242C2R0	J242C2R0	24	1500	18.0	2.4			
4C	I054C2R0	J054C2R0	5	50	3.8	0.5	.875		
	I124C2R0	J124C2R0	12	300	9.0	1.2			
	I244C2R0	J244C2R0	24	800	18.0	2.4			
1A Latching	I051K3R0	J051K3R0	5	375	3.8	0.5	.475		
	I121K2R0	J121K2R0	12	500	9.0	1.2			
	I241K3R0	J241K3R0	24	2000	18.0	2.4			

American Relays, Inc.

10306 Norwalk Blvd., Santa Fe Springs, CA 90670 • (213) 944-0447 • TELEX 3710614 • FAX (213) 944-0590

REED RELAYS

HIGH POWER SERIES

- Miniature High Power Reed Relays. 50W Contact Rating.
- Open Frame, Encapsulated and Axial Lead Packages are Available

HIGH VOLTAGE SERIES

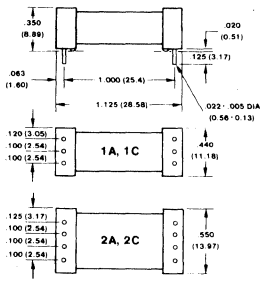
- Miniature High Voltage Reed Relays
- Meets FCC Part 68 Voltage Breakdown Requirement
- Open Frame, Encapsulated and Axial Lead Packages are Available

MERCURY WETTED SERIES

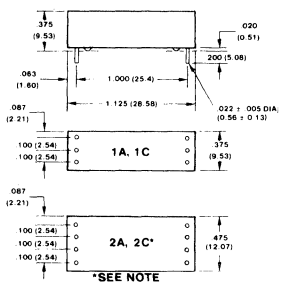
- Miniature Reed Relay with Mercury Wetted Contacts
- No Contact Bounce
- 50 Watts Contact Rating
- Open Frame, Encapsulated and Axial Lead Packages are Available

Specifications	High Power	High Voltage	Mercury Wetted	
			Form A	Form C
Power (Resistive Load)	50 Watts	25 Watts	50 Watts	50 Watts
Voltage (Max. Switching)	200 VDC	1000 VDC	500 VDC	500 VDC
Voltage (Min. Breakdown)	300 VDC	2500 VDC	1500 VDC	1500 VDC
Current (Max. Switching)	1 Amp	1 Amp	2 Amps	1 Amp
Current (Max. Carry)	2 Amps	2 Amps	3 Amps	2 Amps
Capacitance (Typical)	0.2 Pf	0.2 Pf	0.3 Pf	0.7 Pf
Contact Resistance (Max. Initial Typ.)	0.5 Ohms	0.2 Ohms	0.07 Ohms	0.07 Ohms
Operate Time (Typical)	0.5 ms	0.5 ms	1.5 ms	2.0 ms
Release Time (Typical)	0.5 ms	0.2 ms	1.0 ms	2.0 ms
Insulation Resistance (Min. Typ)	10^{10} Ohms	10^{10} Ohms	10^{10} Ohms	10^{9} Ohms
Life (Medium Load)	10 x 10^{6} Oper	100 x 10^{6} Oper.	10^{9} Oper.	10^{9} Oper.
Life (Rated Load)	1 x 10^{6} Oper	10 x 10^{6} Oper	5 x 10^{7} Oper.	5 x 10^{7} Oper.

OPEN FRAME

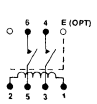
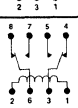


ENCAPSULATED



Note: Dimension for 2 Form C Mercury Encapsulated Relays. Length: 1.175, Width: .600, Height: .375.

PART NUMBERS AND OPERATING CHARACTERISTICS (@ 25°C)

Contact Form	Nom. Coil VDC	Max. Pick-up VDC	Min. Drop-out VDC	High Power			High Voltage			Mercury Wetted*			Schematic Top View
				Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		Coil Res. (Ohms) ±10%	Part Number		
					Open Frame	Encapsulated		Open Frame	Encapsulated		Open Frame	Encapsulated	
1A	5	3.8	0.5	500	C051A2TO	I051A2TO	500	C051A2HO	I051A2HO	125	C051A1MO	I051A1MO	
	6	4.5	0.6	125	C061A1TO	I061A1T0	125	C061A1HO	I061A1HO	125	C061A1MO	I061A1MO	
	12	9.0	1.2	750	C121A1TO	I121A1TO	1000	C121A2HO	I121A2HO	750	C121A1MO	I121A1MO	
	24	18.0	2.4	2000	C241A2TO	I241A2TO	2000	C241A2HO	I241A2HO	2000	C241A2MO	I241A2MO	
2A	5	3.8	0.5	100	C052A1TO	I052A1TO	100	C052A1HO	I052A1HO	100	C052A1MO	I052A1MO	
	6	4.5	0.6	100	C062A1TO	I062A1TO	100	C062A1HO	I062A1HO	100	C062A1MO	I062A1MO	
	12	9.0	1.2	300	C122A1TO	I122A1TO	750	C122A2HO	I122A2HO	300	C122A1MO	I122A1MO	
	24	18.0	2.4	1500	C242A2TO	I242A2TO	1500	C242A2HO	I242A2HO	1500	C242A2MO	I242A2MO	
1C	5	4.0	0.5	—	NA	—	—	—	—	100	C051C1MO	I051C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	350	C121C1MO	I121C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1500	C241C1MO	I241C1MO	
2C	5	4.0	0.5	—	NA	—	—	—	—	75	C052C1MO	I052C1MO	
	12	9.0	1.2	—	NA	—	—	—	—	300	C122C1MO	I122C1MO	
	24	18.0	2.4	—	NA	—	—	—	—	1200	C242C1MO	I242C1MO	

* Mercury wetted relays should be mounted within ±30° from vertical position.

AXIAL LEAD SERIES

- Encapsulated Axial Lead Reed Relays
- Axial Leads Allows Various Mounting Configurations.
- Total Environmental Protection
- Nickel Plated Metal Tube Provides Magnetic Shielding
- Formed Leads are Also Available
- 1 Form A, 2 Form A, 1 Form B, 1 Form C and 2 Form C Types are Available
- Various Contact Ratings Available
- Contact American Relays, Inc. for Specific Part Numbers and Additional Options

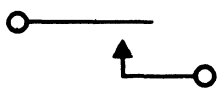
SPECIAL RELAY DESIGN

American Relays, Inc. is a custom relay specialist. Our major objective is to design and build parts that fulfill special requirements for the reed relay user.

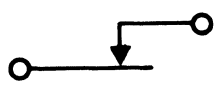
Our facility is designed and equipped for prompt, systematic processing of samples, prototype and production orders.

MINIGLOSSARY
RELAY CONTACT FORMS

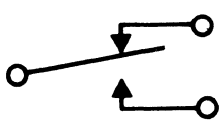
A
Make
SPST-NO



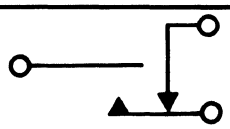
B
Break
SPST-NC



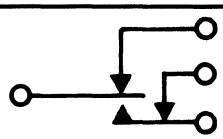
C
Break, Make
(Transfer)
SPDT



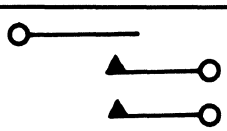
D
Make, Break
(Continuity
Transfer)



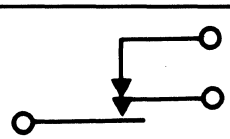
E
Break,
Make,
Break



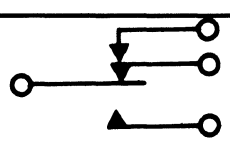
F
Make,
Make



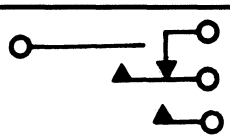
G
Break,
Make



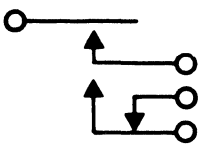
H
Break,
Break,
Make



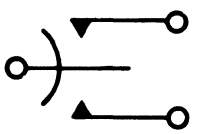
I
Make,
Break,
Make



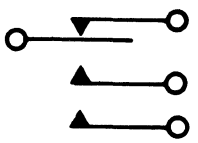
J
Make,
Make,
Break



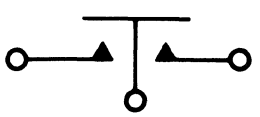
K
Center off
SPDT



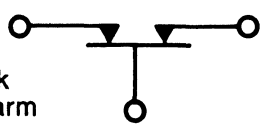
L
Break,
Make,
Make



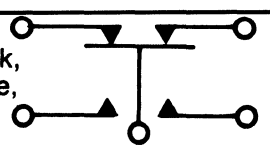
U
Double
make
Contact
on arm



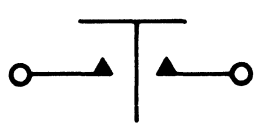
V
Double break
Contact on arm



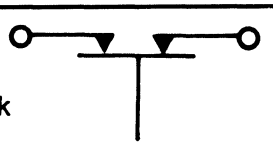
W
Double break,
Double make,
Contact
on arm



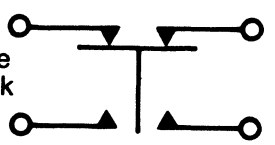
X
Double
make



Y
Double break



Z
Double make
Double break
SPDT-DB



GENERAL PURPOSE RELAYS

On the following pages you'll find summary specifications for our most popular relays. For additional technical information on these relays, or those marked (*), which are not covered here, call (800) 854-8474. In California call (714) 660-1670. For ordering information, call local sales office listed in the eem yellow section.

SERIES		AZ 3	AZ 4	AZ 5	AZ 7	AZ 8	AZ 420
FEATURES		-Ultra High Sensitivity -Wide Switching Range -Rugged Construction	-Subminiature Size -Low Cost -Rugged Construction -Meets FCC Part 68.302 and 68.304 -Wide Switching Range -Class F (155°C) version available	-High Sensitivity -Subminiature Size -Low Cost -Meets FCC Part 68.302 and 68.304	-Meets FCC 1500V Surge Requirement -Low Profile -High Sensitivity -Ag-Pd Contacts Available	-High Sensitivity -Subminiature Size -Low Cost -Wide Switching Range -Class F (155°C) version available	-Versatile Contact Configurations -Wide Switching Range -High Sensitivity -Long Life
EPOXY SEALED		Yes	Yes	Yes	Yes	Yes	Yes
CONTACTS	FORM	1 Form C	1 Form C	1 Form C	2 and 4 Form C Form D available	1 Form A and C	1-6 Form C Forms A, B, & D available
	RATING (RESISTIVE)	3A @ 30 VDC or 240 VAC 5A @ 30 VDC or 240 VAC 10A @ 30 VDC or 240 VAC	3A @ 30 VDC or 125 VAC 5A @ 30 VDC or 125 VAC 10A @ 30 VDC or 125 VAC	1A @ 30 VDC or 125 VAC	2A @ 30 VDC 0.5A @ 125 VAC	Form A — 10A @ 30 VDC or 120 VAC Form C — 3A @ 30 VDC or 200 VAC 6A @ 300 VDC or 300 VAC	2A @ 28 VDC or 115 VAC 3A @ 30 VDC or 115 VAC 7.5A @ 30 VDC or 115 VAC
COIL VOLTAGE		6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24V (DC)	5, 6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	3 thru 115V (DC)
OPERATING POWER AT PICK UP VOLTAGE		3 & 5A Contact: 50 to 70 mW 10A Contact: 150 mW	230 mW	Standard Coils: 220 mW Sensitive Coils: 100 mW	2 Pole: 190 mW 4 Pole: 310 mW	110 to 210 mW	Standard: 450 to 850 mW Sensitive: 40 mW per pole 25 mW per pole available
DIELECTRIC STRENGTH		Between All Points: 1500 Vrms Contact to Contact: 750 Vrms	Contact to Contact: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 1000 Vrms Coil to Contact: 1500 Vrms	Between All Points: 1500 Vrms Between Open Contacts: 750 Vrms	Contact to Contact: 750 Vrms Contact to Coil: 2000 Vrms	Between All Points: 1000 Vrms 1500 Vrms Versions Available
TYPICAL LIFE OPERATIONS	ELECTRICAL	2×10^5 (at rated load)	10^5	5×10^5 1A/30 VDC 5×10^5 0.5A/125 VAC	5×10^6 — 1A/30 VDC 10^6 — 2A/30 VDC	(LD) 10^5 — 3A/120 VAC 5×10^5 — 3A/24 VDC (MD) 10^5 — 6A/24 VDC or 120 VAC (HD) 5×10^4 10A/30 VDC or 120 VAC	1×10^8 — 10 mA/6 VDC 1.5×10^6 — 2A/28 VDC or 115 VAC 2×10^5 — 5A/28 VDC or 115 VAC 1×10^5 7.5A/28 VDC or 115 VAC
	MECHANICAL	5×10^6	10^7	5×10^6	10^8	2×10^7	10^8
MAXIMUM SIZE IN INCHES L x W x H		1.210 x 0.750 x 1.190	0.866 x 0.635 x 0.745	0.630 x 0.430 x 0.450	2 Pole 1.200 x 0.826 x 0.458 4 Pole 1.200 x 0.965 x 0.458	0.830 x 0.630 x 0.560	2 Pole 0.940 x 0.735 x 1.230 6 Pole 1.395 x 0.735 x 1.230
TERMINALS	PC	X	X	X	X	X	X
	SOLDER PLUG-IN	—	—	—	—	—	X
UL, CSA, VDE		UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

For more detailed information, request individual data sheets.

AMERICAN ZETTLER, INC.
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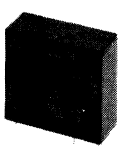
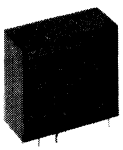
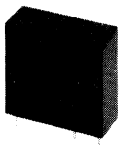
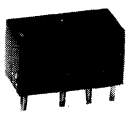
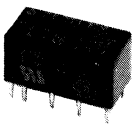
FROM AMERICAN ZETTLER

							
AZ 690	**AZ 730**	**AZ 735**	**AZ 820**	**AZ 830**	**AZ 830 P**	**AZ 2100**	**AZ 2530/2531***
-High Dielectric Strength, 4000 Vrms -Complete List of International Approvals -10 Amp Switching Capability in Compact Size	-High Dielectric Strength, 4000 Vrms -Complete List of International Approvals -8 Amp Switching Capability in Compact Size	-High Dielectric Strength, 5000 Vrms -Complete List of International Approvals -16 Amp Switching Capability in Compact Size	-Meets FCC Part 68.302 and 68.304 -Bifurcated Pd-Ag Contacts -Low Profile -Dip Package	-Meets FCC Part 68.302 and 68.304 -Polarized Coil -Dip Package -Bifurcated Contacts -PdAg Contacts Available	-Polarized Magnetic Latching Relay -Meets FCC Part 68.302 and 68.304 -Dip Package -Bifurcated Contacts -Pd-Ag Contacts Available	-Oversize Contact Switching Up To 30 Amps -Versatility Of Both PC and .250" Fast-On Tabs For Contacts -Complete UL and CSA Approvals -Class F (155°C) Version Available	-Low Profile -High Insulation Resistance -High Sensitivity -Long Life
Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
1 Form A, B or C	2 Form A, B or C	1 Form A or C	2 Form C	2 and 4 Form C	2 and 4 Form C	1 Form A, B or C	1 and 2 Form C
10A @ 30 VDC or 200 VAC ¼ HP 120 VAC Motor Load	8A @ 24 VDC or 115 VAC ⅛ HP 120 VAC Motor Load	16A @ 30 VDC or 120 VAC ½ HP 120 VAC Motor Load A 300 Pilot Duty TV 5 Rating	2.0A @ 15 VDC or 30 VAC 1.0A @ 30 VDC or 60 VAC 0.5A @ 60 VDC or 125 VAC	2 Pole 2.0A @ 30 VDC or 60 VAC 1.0A @ 60 VDC or 125 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole 1.0A @ 30 VDC 0.5A @ 120 VAC	2 Pole 2.0A @ 30 VDC or 60 VAC 1.0A @ 60 VDC or 120 VAC 0.5A @ 120 VDC or 240 VAC 4 Pole 1.0A @ 30 VDC 0.5A @ 120 VAC	Form A — 30A @ 125 or 240 VAC Form B — 15A @ 125 or 240 VAC Form C (NO) — 20A @ 125 or 240 VAC	2A @ 26 VDC 1A @ 120 VAC
5, 6, 12, 24, 48V (DC)	5, 6, 12, 24, 48V (DC)	6, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5, 6, 9, 12, 24, 48V (DC)	5,6,9,12,15,18,24, 48, 70, 110V (DC)	5, 6, 12, 24, 48V (DC)
Standard Coils: 350 mW Sensitive Coils: 250 mW	Standard Coils: 350 mW Sensitive Coils: 250 mW	350 mW	250 mW	Standard: 200 mW Sensitive: 100 mW	Standard Coils: 200 mW 1 Coil Latching 180 mW 2 Coil Latching Sensitive Coils: 100 mW 1 Coil Latching 90 mW 2 Coil Latching	500 mW	Standard 1 Form C: 125 mW Sensitive 1 Form C: 80 mW Standard 2 Form C: 270 mW
Coil to Contact: 4000 Vrms Between Open Contact: 1000 Vrms	Coil to Contact: 4000 Vrms Contact to Contact: 2500 Vrms Between Open Contacts: 1000 Vrms	Coil to Contact: 5000 Vrms Between Open Contact: 1000 Vrms 10,000 V Surge, Max., 40 micro seconds, contact tocoil	Between All Points: 1500 Vrms Between Open Contacts: 500 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Between Open Contacts: 1000 Vrms Between Contact Sets: 1000 Vrms Contact to Coil: 1500 Vrms	Coil to Contact: 2500 Vrms Between Open Contacts: 1500 Vrms	Contact to Contact: 500 Vrms Contact to Coil: 500 Vrms
5×10^4 — 10A/30 VDC or 115 VAC 2×10^5 — 8A, 250 VAC	10^5 — 8A/30 VDC 2×10^5 — 8A/ 115 VAC or 6A/250 VAC	10^5 — 16A/30 VDC 2×10^5 — 16A/120 VAC 10^5 — 14A/250 VAC	5×10^5 — 1A/30 VDC 2×10^5 — 0.5A/120 VAC	5×10^5 — 2A/30 VDC 1A/125 VAC 2×10^6 — 1A/30 VDC 0.5A/125 VAC	5×10^5 — 2A/30 VDC 1A/125 VAC 2×10^6 — 1A/30 VDC 0.5A/125 VAC	10^5 (at rated load)	10^6 — 1A/26 VDC or 0.5A/115 VAC 2×10^5 — 2A/26 VDC or 1A/115 VAC
3×10^7	3×10^7	10^7	10^7	10^8	10^8	10^7	10^7
SLIMPAK- 1.110 x 0.476 x 1.030 THINPAK- 1.110 x 1.030 x 0.441	1.110 x 0.496 x 1.030	1.110 x 0.496 x 1.030	0.795 x 0.394 x 0.453	2 Pole 0.787 x 0.390 x 0.366 4 Pole 1.387 x 0.390 x 0.390	2 Pole 0.787 x 0.390 x 0.366 4 Pole 1.387 x 0.390 x 0.390	Open 1.200 x 0.960 x 0.618 Encased 1.270 x 1.080 x 1.100	1 Pole 1.090 x 0.593 x 0.445 2 Pole 1.090 x 0.888 x 0.445
X	X	X	X	X	X	X	X
—	—	—	—	—	—	"Quick Connect"	—
UL/CSA/VDE	UL/CSA/VDE	UL/CSA/VDE	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

All listed data are for the type with the minimum number of contacts. For more detailed information, request individual data sheets.

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

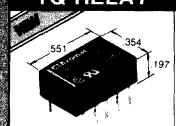
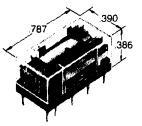
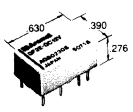
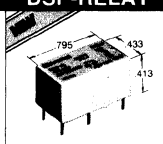
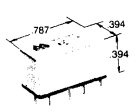
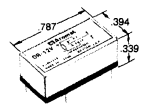
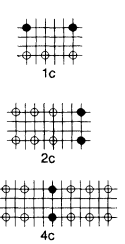
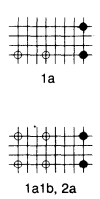
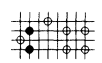
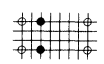
V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Aromat Relay Selector Chart

	TQ-RELAY	DS-RELAY	DF-RELAY	DSP-RELAY	R-RELAY	DR-RELAY
• Type of relay		 IC Relay option			 IC Relay option	 IC Relay option
• Features	• Ultra-small size • High sensitivity • 1500V FCC	• 1500V FCC surge satisfied • High sensitivity • High switching power	• Smaller than most 2 form C relays • High sensitivity • DIL	• High switching capacity • High sensitivity • High contact welding resistance • High breakdown voltage	• Magnetically shielded • High sensitivity • High speed operation	• High sensitivity • High sticking resistance • High breakdown voltage • High speed operation
• Sealed types availability	●	●	●	●	●	●
• Latching types availability	●	●	●	●	●	●
• Contact material (Optional material)	Gold-clad silver	Gold-clad silver (Silver palladium)	Gold-clad silver	Gold flash over silver alloy	Gold cobalt	Gold cobalt
• Contact rating chart Maximum (cos φ = 1)	15 A 10 A 8 A 5 A 3 A 2 A 1 A 1 A 30 V DC	2 A 30 V DC	1 A 30 V DC	8 A 250 V AC 5 A 30 V DC 5 A 250 V AC 5 A 30 V DC 1a 1a1b, 2a	1 A 20 V DC	1 A 20 V DC
Minimum	1 mA 100 μA 10 μA 10 μA 10 mV DC	10 μA 10 mV DC	1 mA 1 V DC		10 μA 100 mV DC	100 μA 100 mV DC
• Contact arrangement	2C	1C, 2C, 4C	2C	1a, 1a1b, 2a	1C	1C
• Life (Min. operation) Electrical	2×10^5	5×10^5	10^5	10^5	10^6	10^6
• Life (Min. operation) Mechanical	10^8	10^8	(Single) 5×10^6 (Latching) 10^6	5×10^7	10^9	10^9
• Breakdown voltage Between open contacts	750Vrms	1000Vrms (500 Vrms for DS1-S)	500Vrms	1000Vrms	350Vrms or 500VDC	750Vrms
• Breakdown voltage Between contact sets	1000Vrms	1000Vrms		2000Vrms	—	—
• Breakdown voltage Between contacts and coil	1000Vrms	1500Vrms (1000 Vrms for DS1-S)	500Vrms	3000Vrms	1000Vrms	1500Vrms
• Breakdown voltage Between live parts and ground	—	—	1000Vrms	—	1000Vrms	1000Vrms
• Surge withstand voltage	1500V FCC	1500V FCC	1500V FCC	1500V FCC		1500V FCC
• Coil voltage	(DC) 3, 5, 6, 9, 12, 24 V	(DC) 1.5, 3, 5, 6, 9, 12, 24, 48V	(DC) 1,5, 3, 5, 6, 9, 12, 24V	(DC) 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V
• Nominal operating power	(Single) 140 mW (−L2) 200 mW	S: (Single) 200mW (−SL2) 180mW	(Single) 200mW (−L) 100mW (−L2) 200mW	(Single) 300mW (−L2) 300mW	(Single) 150 to 280mW (−L) 70 to 100mW (−L2) 150 to 230mW	(Single) 96 to 209mW (−L) 56 to 109mW (−L2) 111 to 290mW
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid)	2c	 1c 2c 4c		 1a 1a1b, 2a		
• Mounting method						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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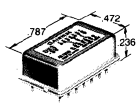
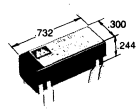
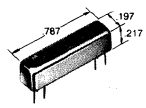
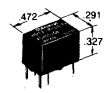
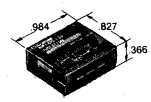
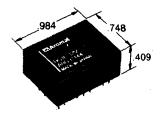
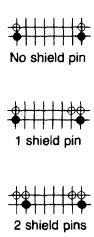
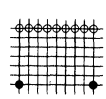
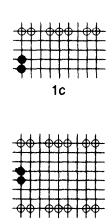
Mississauga, Ontario
Tel: (416) 624-3777

Advanced switching technology.

Aromat
Member of Matsushita Group

Aromat Relay Selector Chart

	Hermetically Sealed	Economical Reed	High Quality Reed	Ultra-Miniature Single Pole	High Frequency	1C and 2C High Frequency
	DX-RELAY	DA-RELAY	DB-RELAY	HD-RELAY	RF-RELAY	RG-RELAY
• Type of relay (inch)						
• Features	• DX2-HT types with 200°C resistance available • High radio frequency characteristics • High shock and vibration resistance	• DIL terminal • Glass encapsulated reed switch	• High insulation resistance • High sensitivity • High speed operation	• Ultra-small type • High sensitivity • Sealed construction	• Excellent high frequency • High reliability and long life • Flux-resistant molded construction	• Excellent high frequency • Wide selection • 1A 24VDC
• Sealed types availability	●	●	●	●	●	●
• Latching types availability	●					●
• Contact material	Gold-clad silver alloy	Rh-plated nickel-iron alloy	Rhodium	Gold-clad silver	(Stationary contact) Gold-plated nickel silver (Movable contact) Gold-clad phosphorus bronze	Gold-clad silver
• Contact rating chart Maximum (cos φ = 1) 15 A / 10 A / 8 A / 5 A / 3 A / 2 A / 1 A	1 A 30 V DC	0.2 A 48 V DC	0.4 A 24 V DC	1 A 30 V DC	0.01 A 24 V DC	1 A 24 V DC
Minimum 1 mA / 100 µA / 10 µA	10 µA 30 mV DC	1 mA 100 mV DC	100 µA 5 V DC	1 mA 1 V DC	30 µA 3 mA DC	
• Contact arrangement	2C	1a, 2a	1a	1C	1C	1C, 2C
• Life (Min. operation) Electrical	2×10^5	10^5	10^6	10^5	10^5	10^5
• Life (Min. operation) Mechanical	3×10^7	10^8	2×10^8 (2 shield pin)	5×10^6	5×10^6	5×10^6
• Breakdown voltage: Between open contacts	500Vrms	200VDC	200VDC (1 min.)	500Vrms	1000Vrms	1000Vrms
• Breakdown voltage: Between contact sets	500Vrms	—			—	
• Breakdown voltage: Between coil parts and case	500Vrms	500VDC	500VDC (1 min.)	500Vrms	2000Vrms	
• Breakdown voltage: Between live parts and ground	—	—	500VDC (1 min.)		—	2,000Vrms
• Surge withstand voltage					—	500Vrms
• Coil voltage	(DC) 3, 5, 6, 12, 24V	(DC) 5, 6, 12, 24V	(DC)1.5, 3, 5, 6, 9, 12, 15, 18, 24V	(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 3, 5, 6, 9, 12, 24, 48V
• Nominal operating power	(Single) 125 to 144mW (−L) 125 to 144mW (−L2) 250 to 288mW	(1a) 230mW (2a) 325mW	(Standard) 130mW (High sensitivity for 5V type) 80mW	280 to 300mW	450mW	(Single) 350 to 400mW (−L) 180 to 200mW (−L2) 350 to 400mW
• Terminal layout (Bottom View) • coil terminal (.100 inch grid)						
• Mounting method						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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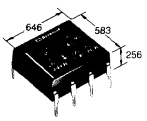
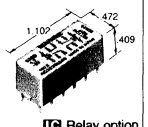
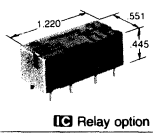
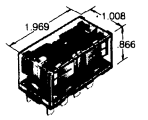
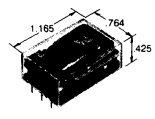
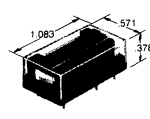
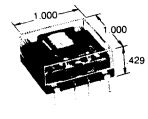
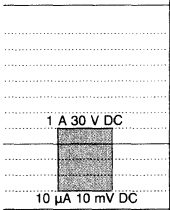
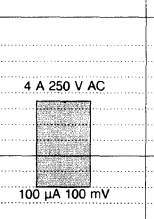
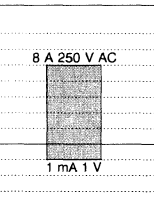
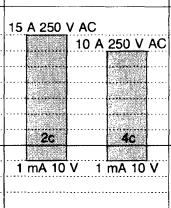
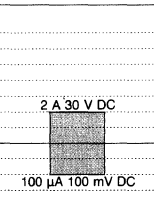
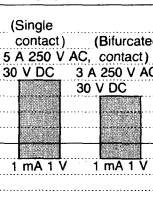
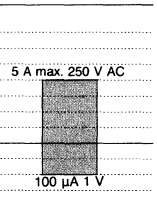
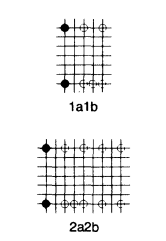
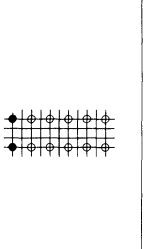
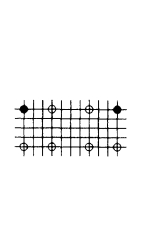
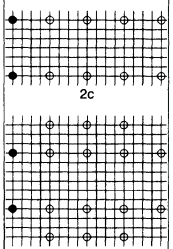
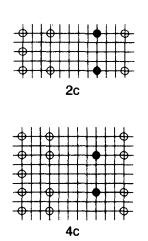
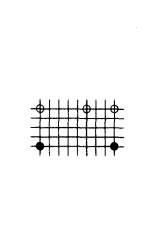
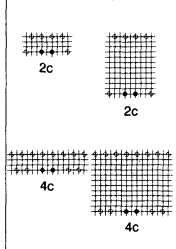
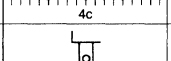
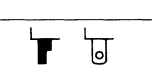
SA-RELAY	SEB-RELAY	STE-RELAY	SP-RELAY	NF-RELAY	NB-RELAY	NC-RELAY
	 IC Relay option	 IC Relay option	 IC Relay option			
• Ultra thin package • Ultra high sensitivity • Low thermal EMF	• High sensitivity • High vibration and shock resistance • Low thermal electromotive force	• Large capacity in small size • Capable of switching field inductive loads • High inrush capability	• High sensitivity • High vibration and shock resistance • Wide switching range	• 1500V FCC surge satisfied • Low profile • High sensitivity • MBB contacts available	• 1500V FCC surge staisfied • Thin height • 5A contact rating	• Flatpack and Lean line • DIL terminal • Bifurcated contacts
●	●	●		●	●	●
●	●	●	●		●	●
Gold-clad silver	Gold-clad silver alloy	Silver alloy	Silver alloy/gold-plated silver alloy	Gold-clad silver	(Single) Silver nickel (Bifurcated) Gold-clad silver nickel	Gold-clad Silver nickel
						
1a1b, 2a2b	2a2b, 4a	1a1b, 2a	2C, 4C	2C, 4C, 2D, 4D	1C	2C, 4C
2×10^5	10^5	10^5	10^5	10^6	2×10^5	(2C) 10^5 (4C) 10^5
5×10^7	10^8	10^7	5×10^7	(2C) 3×10^8 (4C) 10^8	10^7	2×10^7
750Vrms	750Vrms	1200Vrms	1500Vrms	750Vrms	1000Vrms	1000Vrms
1,000Vrms (2a2b)	1000Vrms	2000Vrms	3000Vrms	1000Vrms	—	1000Vrms
1,500Vrms	1500Vrms	3750Vrms	3000Vrms	1000Vrms	2000Vrms	2000Vrms
1,500Vrms	—	—	—	1000Vrms	—	—
1500V FCC				1500V FCC	1500V FCC	
(DC) 1.5, 3, 5, 6, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V	(DC) 3, 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V
(1a1b) 80mW (2a2b) 100mW	192 to 355mW	240mW	300mW	(2C) 300mW (4C) 480mW	400mW	(Single) (2C) 360mW (4C) 720mW (−L2) (2C) 800mW (4C) 1,600mW
						
						

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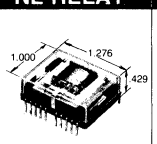
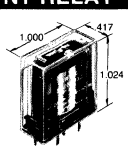
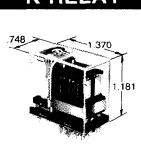
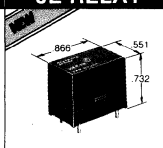
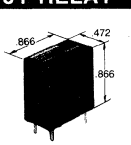
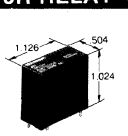
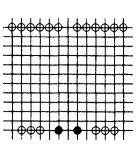
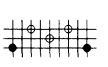
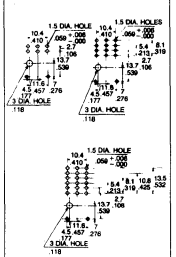
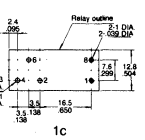
Aromat Relay Selector Chart

	6PDT Flatpack DIL	Lean Line	High sensitivity Cradle	Compact Economical Power	Compact Power	Slim Type Power
	NL-RELAY	**NT-RELAY**	**K-RELAY**	**JE-RELAY**	**JY-RELAY**	**JR-RELAY**
• Type of relay (inch)						
• Features	• 6PDT Flat-pack • Low operating power • MBB contacts available	• Large capacity 8A • Compact size	• Patented magnetic system • Long life • Bifurcated contact	• Compact size • High contact capacity • Safety-oriented design	• 3A, 5A, 10A types available • Ease of PC board artwork • High dielectric withstanding: 5,000V surge	• 16A type available • Wide insulation distance • High inrush current capability
• Sealed types availability	●		●	●		
• Latching types availability	●					
• Contact material (Optional material)	Gold-clad silver	Gold-clad silver nickel	Gold-clad silver/ silver	Silver alloy	Silver alloy	Silver alloy
• Contact rating chart Maximum (cos φ = 1)	2 A 30 V DC	8 A 250 V AC	5 A 125 V AC (K2F) 1 A 50 V AC, 2 A 250 V DC	3 A 277 V AC 5 A 125 V AC 5 A 30 V DC	10 A 125 V AC 5 A 125 V AC 3 A 125 V AC	10 A 250 V AC 10 A 30 V AC 5 A 250 V AC 5 A 30 V AC 1a, 1c 2a, 2c 1c
Minimum	100 μA 100 mV DC	1 mA 1 V	100 μA 100 mV			16 A 250 V AC 16 A 30 V AC
• Contact arrangement	6C, 6D	1C	2C, 4C, 6C	1a, 1C	1C	1a 1C / 2a 2C / 1a
• Life (Min. operation) Electrical	5×10^5	10^5	10^6	10^5	10^5	10^5
• Life (Min. operation) Mechanical	5×10^7	10^7	10^8	5×10^6	5×10^6	5×10^6
• Breakdown voltage: Between open contacts	1000Vrms	1000Vrms	750Vrms	750Vrms	800Vrms	1,000Vrms
• Breakdown voltage: Between contact sets	1000Vrms	—	750Vrms	1500Vrms	—	3,000Vrms
• Breakdown voltage: Between contacts and coil	2000Vrms	2000Vrms	1500Vrms	—	2,000Vrms	5,000Vrms
• Breakdown voltage: Between live parts and ground	—	—	1250Vrms	—	—	—
• Surge withstand voltage					5,000V surge	10,000V surge
• Coil voltage	(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 6, 12, 24, 48, 60, 110V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48 V	(DC) 6, 12, 24, 48V
• Nominal operating power	(single) 720mW (−L2) 1,600mW	(DC) 290mW (AC) 0.75VA	(2C) 200 to 400mW (4C) 500 to 700mW (6C) 1,300mW	400mW	400mW	530mW
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch						
• Mounting method	⊤	⊤	⊤ ⊤	⊤	⊤	⊤ ⊤ ⊤

Note: Meaning of symbol marks ⊤: PC board terminal; ⊤: Plug-in; ⊤: Top-mounting; ⊤: Top-mounting with PC board terminals

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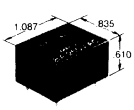
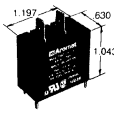
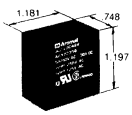
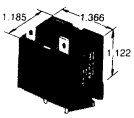
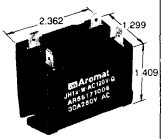
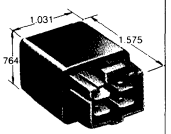
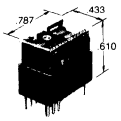
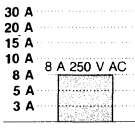
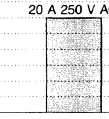
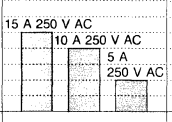
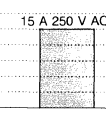
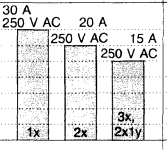
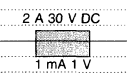
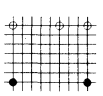
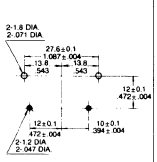
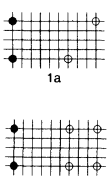
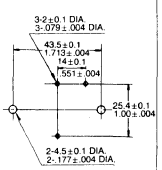
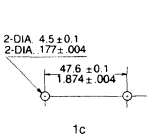
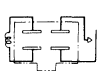
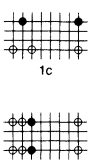
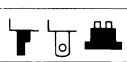
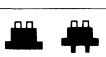
Compact Power	Miniature High Power	Compact High Power	1 HP Compact Power	Compact High Power	Automotive Power	Subminiature DIL
JB-RELAY	**JN-RELAY**	**JC-RELAY**	**JA-RELAY**	**JH-RELAY**	**CA-RELAY**	**HB-RELAY**
						
• High dielectric withstanding 10,000V surge • Large capacity 8A in compact size	• High switching capacity 70A inrush 20A steady • High contact welding resistance	• High inrush current capability • TV-rated type available • High dielectric withstanding: 10,000V surge	• High switching capacity 55A inrush, 15A steady • TV-rated type available	• High dielectric withstanding: 10,000V surge • High inrush resistance	• Small size • Light weight • Completely water tight • Automotive direct plug-in	• DIP terminal • Flux-resistant • Ag-Pd contacts type available
						●
Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver alloy	Silver nickel (Silver palladium)
						
1C	1a	1a | 2a | 1a1b	1a, 1b, 1C	1X | 1Y | 3X 2X1Y	1a, 1b	1C, 2C
10^5	10^5	10^5	10^5	10^5	10^5	2×10^5
10^7	10^6	5×10^6	5×10^6	5×10^6	5×10^5	10^7
1000Vrms	1,000Vrms	2000Vrms	1000Vrms	2000Vrms	500Vrms	500Vrms
—	—	2000Vrms	—	2000Vrms	—	500Vrms
2500Vrms	3,000Vrms	4000Vrms	2000Vrms	5000Vrms	500Vrms	1000Vrms
—	—	—	—	—	—	—
10,000V surge	5,000V surge	10,000V surge	5,000V surge	10,000V surge		
(DC) 5, 6, 12, 24, 48V	(DC) 5, 6, 9, 12, 24, 48V	(DC) 6, 12, 24, 48V	(DC) 6, 12, 24V (AC) 6, 12, 24, 115V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 120, 220, 240V	(DC) 5, 9, 12, 24V	(DC) 5, 6, 12, 24, 48V
(Up to DC24V) 480mW (DC48V) 560mW	0.9W	(1a) 0.9W (2a) 1W	(DC) 1.2W (AC) 1.3VA	(DC) 1.9W (AC) 3.2VA	1.8W	(1C) 360mW (2C) 580mW
						
						

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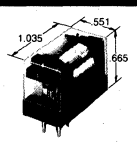
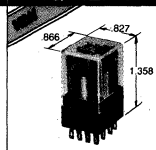
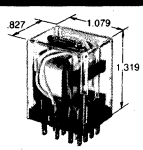
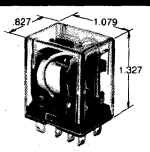
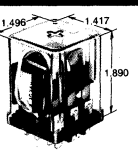
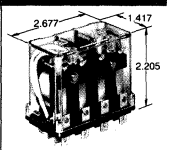
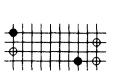
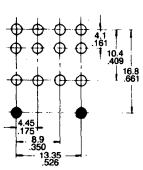
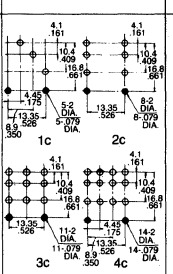
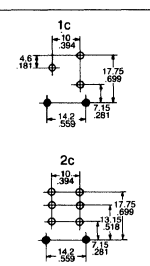
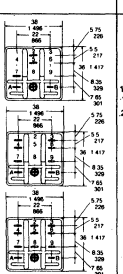
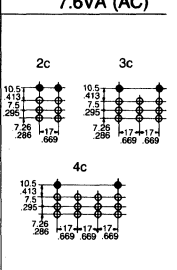
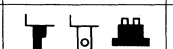
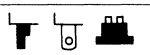
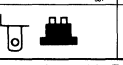
Aromat Relay Selector Chart

	Subminiature	4-pole sequence type	Miniature Power	Compact Power	10 Amp Power	20 Amp Power
	HA-RELAY	HQ-RELAY	HC-RELAY	HL-RELAY	HP-RELAY	HG-RELAY
• Type of relay						
• Features	• Compact size	• High contact reliability • Long life • Operation display Provided	• Wide applications • Versatile range • Foot print compatible with competitive types	• Large capacity • Compact size • Foot print compatible with competitive types	• Long life • Foot print compatible with competitive types	• Large capacity 20A
• Sealed types available	●		●			
• Flux-proof types available		●				
• Contact material	Silver nickel	Gold-clad silver nickel	Gold-flashed silver alloy	Silver alloy	Silver alloy	Silver-cadmium-oxide
• Contact rating (reference value) Maximum [cos φ = 1]	3 A 250 V AC, 30 V DC	3 A max. 250 V AC, 125 V DC	10 A 250 V AC; 7 A 250 V AC; 5 A 250 V AC	15 A max. 125 V AC; 10 A max. 250 V AC	10 A max. 250 V AC	20 A max. 250 V AC
Minimum	10 mA 1 V	1 mA 1 V	1 mA 0.1 V (1c, 2c, 3c, 4c)	1 mA 1 V	10 mA 1 V	10 mA 10 V
• Contact arrangement	1C	4C	1C 2C 3C 4C	1C 2C	1C, 2C, 3C	2C, 3C, 4C
• Life expectancy Mechanical	10^5	5×10^6	2×10^5	5×10^7	2×10^5	2×10^5
Electrical	10^7	10^8	(DC) 10^8 (AC) 5×10^7	(DC) 10^8 (AC) 5×10^7	10^7	(DC) 10^6 (AC) 10^7
• Breakdown voltage Between coil and contacts	750Vrms	700Vrms	700Vrms	1000Vrms	(HP31,32)1000Vrms (HP33) 2000Vrms	2000Vrms
Between contacts of same polarity	—	700Vrms	700Vrms	1500Vrms	2000Vrms	2000Vrms
Between contacts of different polarity	1500Vrms	1500Vrms	1500Vrms	1500Vrms	2000Vrms	2000Vrms
Between contact sets	—	—	1500Vrms	—	—	—
• Surge withstand voltage						
• Coil voltage	(DC) 5, 6, 9, 12, 24, 48V (AC) 6, 12, 24, 48, 115V	(DC) 6, 12, 24, 48, 100V (AC) 6, 12, 24, 48, 110, 115, 220, 240V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V	(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V		(DC) 6, 12, 24, 48, 110V (AC) 6, 12, 24, 48, 115, 220, 240V
• Nominal operating power	(DC) 360mW (AC) 0.9VA	(Single) (AC) 1.4VA (DC) 0.9W (−L2) DC 1.4W	(DC) 0.9W (AC) 1.2VA	(DC) 0.9 to 1.0W (AC) 1.2 to 1.3VA	(DC) 1.5W (AC) 2.0VA	(2C) 1.4W (DC) 3.6VA (AC) (3C) 1.6W (DC) 5.2VA (AC) (4C) 2.0W (DC) 7.6VA (AC)
• Terminal layout (Bottom View) •: coil terminal (.100 inch grid) mm inch						
• Mounting method						

Note: Meaning of symbol marks : PC board terminal; : Plug-in; : Top-mounting; : Top-mounting with PC board terminals

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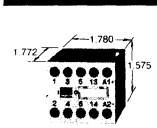
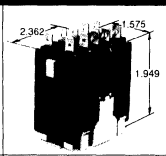
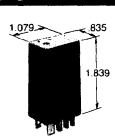
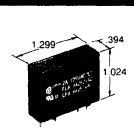
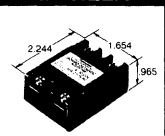
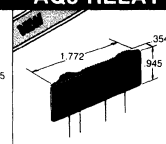
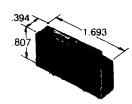
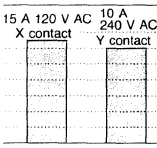
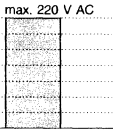
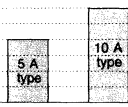
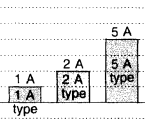
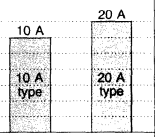
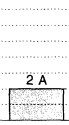
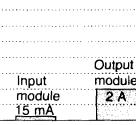
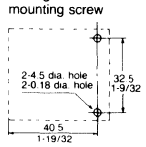
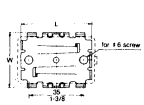
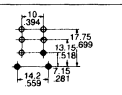
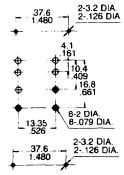
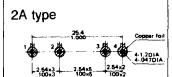
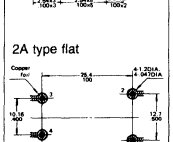
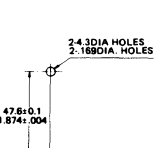
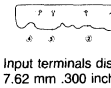
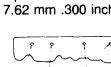
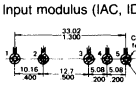
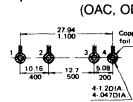
PC-5 RELAY	**VC-RELAY**	**H-OP RELAY**	**AQ1-RELAY**	**AQ2-RELAY**	**AQ8-RELAY**	**I/O-RELAY**
						
• Direct motor drive by IC output • Surge suppression circuit incorporated • Screw terminal	• Large capacity with Form X contacts	• No heat sink required • Long life • Latching types available	• Both slim and flat package • Zero-voltage turn ON and zero-current turn OFF • No chattering or bouncing	• 2 types of isolation zero-cross reed relay • Triac use for load control	• Slim type • Snubber circuit integrated • Zero-cross and nonzero-cross	• Input and output modules for interfacing between cpu and load • 4 types: IAC, OAC, IDC, ODC
		●				
Silver alloy	Silver-cadmium-oxide	Gold flash silver alloy				
						
4X, 3X1Y, 2X2Y	1X, 2X, 3X, 4X, 1X1Y, 2X1Y, 2X2Y, 3X1Y	1a	1 pole	1 pole	1 pole	Input module Output module
25×10^4	2.5×10^5	10^7	—	—	—	—
10^7	10^6	10^7	—	—	—	—
2,500Vrms	2500Vrms	—	—	—	—	—
—	2500Vrms	—	—	—	—	—
—	2500Vrms	3,000Vrms (HOP5A) 3,750Vrms (HOP10A)	3000Vrms for input-output	1500Vrms for input-output	3000Vrms for input-output	4,000Vrms for input-output
—	—	—	—	—	—	—
		6,000V surge (HOP10A)				
(DC) 12, 24V	(AC) 24, 120, 240V	(DC) 3, 5, 12, 24V	(Input) 3–28VDC	(Input) AQ10A1: 19.2–28.8VDC AQ10A2, AQ20A2: 4–30VDC	(Input) 5, 12, 24 V DC	(Input module) AC: 5mA 80–140VAC DC: 20mA, 3–32VDC
500mW	5.0 to 6.6VA	HOP5A (Single) (−L2) 300–360mW (−L) 150mW HOP10A (Single) (−L2) 240–280mW (−L) 120mW	—	—	—	—
Drilling dimensions for mounting screw 	 Mounting bracket Bracket A 45 1.772 35 1.378 Bracket B 50 1.969 45 1.772	HOP 5 A  HOP 10 A 	2A type  2A type flat 	 Mounting hole	Input terminals distance 5.08 mm .200 inch  Input terminals distance 7.62 mm .300 inch 	Input modulus (IAC, IDC)  Output modules (OAC, ODC) 

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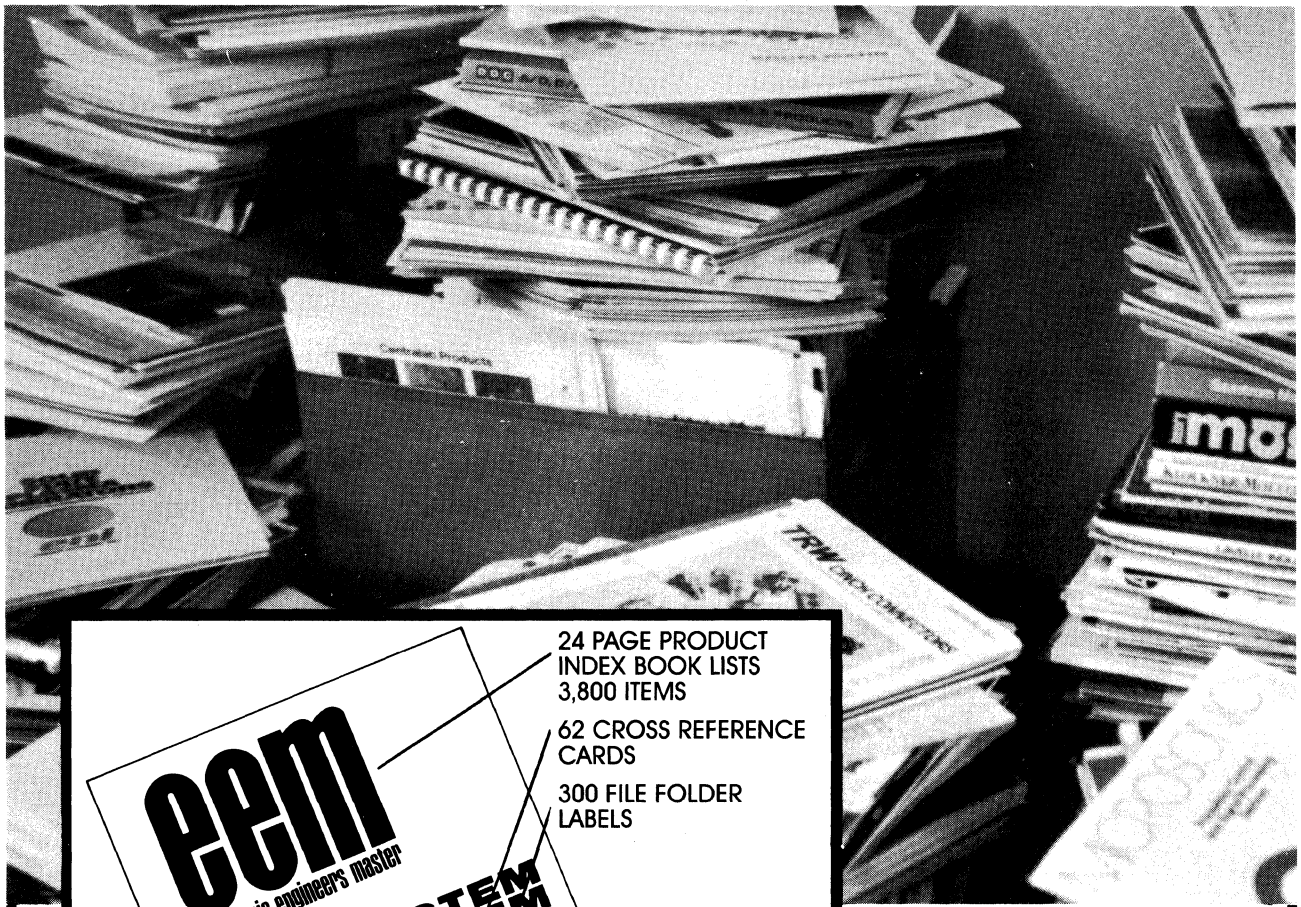

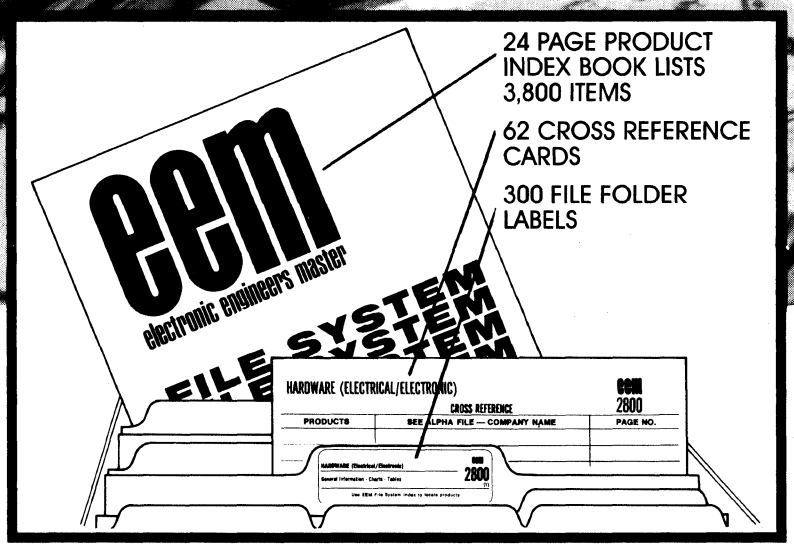

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AT&T

ANALOG
High-Voltage Solid State Relays

Description

AT&T's multi-purpose, solid-state relays (MSR) are low-cost bi-directional switches that can replace mechanical relays in many applications. These relays are rated at 1500 Vrms of input/output isolation and are available in a variety of package configurations. Maximum output ratings to 350 volts per pole with maximum current loads to 200 mA are standard features of these devices. Typical applications are telephone switchhook, high-voltage testers, industrial controls, triac drivers, and isolation switching. The MSRs use GaAlAs LEDs to optically couple the control signal to a dielectrically isolated, high-voltage integrated circuit. The LH1056AT/AAB/CT and LH1061AB/AAC are UL approved. UL approval for the LH1085AT is pending.

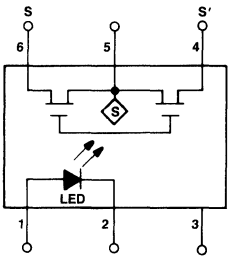
Features

- Low ON-Resistance
- Clean, bounce-free switching
- High solid-state reliability
- Low power consumption
- Noise-free operation
- High-surge capability
- dv/dt typically better than 500 V/μs
- No electromagnetic interference

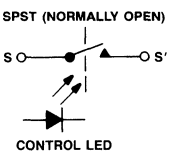
Typical Electrical Characteristics T_A = 25°C

	SPST			DPDT
Parameter	**LH1056AT/AAB**	**LH1056CT**	**LH1085AT**	**LH1061AB/AAC**
Turn-On Time LED Current 5 mA I_{LOAD} = 37 mA	1.0 ms	1.0 ms	1.0 ms	2.0 ms
Turn-Off Time LED Current 5 mA I_{LOAD} = 37 mA	0.5 ms	0.5 ms	0.5 ms	1.0 ms
LED On Voltage 10 mA	1.30 V	1.30 V	1.30 V	1.30 V
ON Resistance 25 mA	30 Ω	27 Ω	30 Ω	12 Ω
Voltage Breakdown 50 μA	380 V	380 V	380 V	230 V
Feedthrough Capacitance	24 pF	24 pF	30 pF	35 pF
LED Forward Current Turn-On 25°C 70°C	 1.5 mA 2.5 mA	 1.5 mA 2.5 mA	 1.5 mA 2.5 mA	 1.5 mA 2.5 mA

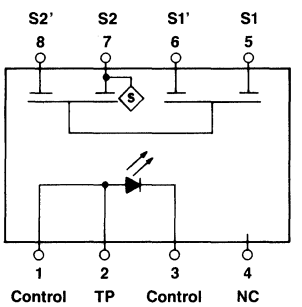
LH1056A-Type/LH1085AT Functional Diagram



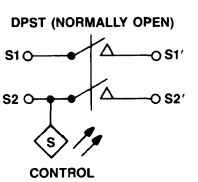
LH1056A-Type/LH1085AT Equivalent Relay Diagram



LH1061AB/AAC Functional Diagram



LH1061AB/AAC Equivalent Relay Diagram



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Clare Division Products

GENERAL INSTRUMENT

Clare·ification Chart-Relays

Product Name	Breakdown Contact to Coil (VDC)	Breakdown Across Contacts (VDC)	FCC 68	Approvals (UL, CSA, BSI, Etc.)	S= Sealed U=Unsealed S-U=Sealed Standard (Can Be Supplied Unsealed)	Packaged Type	
CLARE RELAYS FORM A, B							
MRBS	1400	210	YES	BSI, PTB	S	METAL	SPECIAL APPLICATION RELAYS
MRBT	1400	250	YES		U	METAL	SPECIAL APPLICATION RELAYS
PRMA	1400	250	YES	UL, VDE	S	MOLDED	14 PIN DIP RELAYS
DSS3	1000	250	NO		S	PLASTIC	SPECIAL APPLICATION RELAYS
DSS4	1400	250	YES		S	MOLDED	SINGLE IN LINE (SIP) RELAY
CUP V	2800	350	YES	BSI, PTB	S-U	PLASTIC	STAGGERED PIN LAYOUT
CUP 1	2800	350	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
PRME	1000	250	YES		S	MOLDED	14 PIN DIP RELAY
MRB	1400	250	YES	UL	U	METAL	1.0 X .01 INCH GRID
951	1400	250	NO		S	MOLDED	OTHER CLARE RELAYS
926	1400	250	YES		U	PLASTIC	OTHER CLARE RELAYS
MSS2	1400	1400	YES	VDE	S	MOLDED	14 PIN DIP RELAY
MSS4	1400	1400	YES		S	MOLDED	SINGLE IN LINE (SIP) RELAY
MSS6	1000	1400	YES		S-U	PLASTIC	16 PIN DIP RELAY
CUP 6	2800	1400	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
CUP 5	2800	1400	YES		S-U	PLASTIC	STAGGERED PIN LAYOUT
MMRB	1400	1400	YES		U	METAL	1.0 X .01 INCH GRID
HRM	700	1400	YES		S	METAL	SPECIAL APPLICATION RELAYS
HRB	1400	1400	YES		U	METAL	1.0 X .01 INCH GRID
851	1400	1400	YES		S	MOLDED	OTHER CLARE RELAYS
CLARE RELAYS FORM C							
PRMA	1400	175	NO		S	MOLDED	14 PIN DIP RELAY
922	1400	175	NO		U	METAL	1.0 X 0.1 INCH GRID
HGZM	1000	1400	YES		S-U	PLASTIC	16 PIN DIP RELAY
LX	2100	1400	YES	UL, CSA	S-U	PLASTIC	16 PIN DIP RELAY
LM44	2100	1400	YES	UL, CSA	S-U	PLASTIC	16 PIN DIP RELAY
LA	700	700	YES		U	PLASTIC	MULTI POLE RELAY
LB/LBP	700	700	YES		U	PLASTIC	MULTI POLE RELAY
LC	700	700	YES		U	PLASTIC	MULTI POLE RELAY
MHC	1400	1400	YES		S	PLASTIC	1.0 X 0.1 INCH GRID
HGJM	1400	1400	YES	UL	S	METAL	OTHER MERCURY WETTED
HGWM	1400	1400	YES		S	METAL	OTHER MERCURY WETTED
HGRM	1400	1400	YES	UL	S	METAL	OTHER CLARE RELAYS
HGSM	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HGSR	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HGM	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
HG	1400	1400	YES		S	METAL	OTHER CLARE RELAYS
CLARE REED SWITCHES							
FR 1		350			S	GLASS	RUTHENIUM DRY REED SWITCH
FR 2		350			S	GLASS	BIFURCATED RUTHENIUM DRY REED SWITCH
MA 1		1400			S	GLASS	ALL POSITION MERCURY WETTED REED SWITCH
MH 1		1400			S	GLASS	STANDARD FORM A WETTED REED SWITCH
MH 2		1400			S	GLASS	SMALL DIAMETER WETTED REED SWITCH
MH C		1400			S	GLASS	MINIATURE MERCURY WETTED REED SWITCH
HG W		1400			S	GLASS	FASTEST MERCURY WETTED REED SWITCH
HG 1		1400			S	GLASS	POWER MERCURY WETTED REED SWITCH

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NEW

TO-5 RELAY

SIZE:

- Diameter
  - Enclosure (max) — .335 inches (8.51)
  - Base (max) — .370 inches (9.40)
- Height (max): .280 (7.11)

CONTACT RATING/ ARRANGEMENT:

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

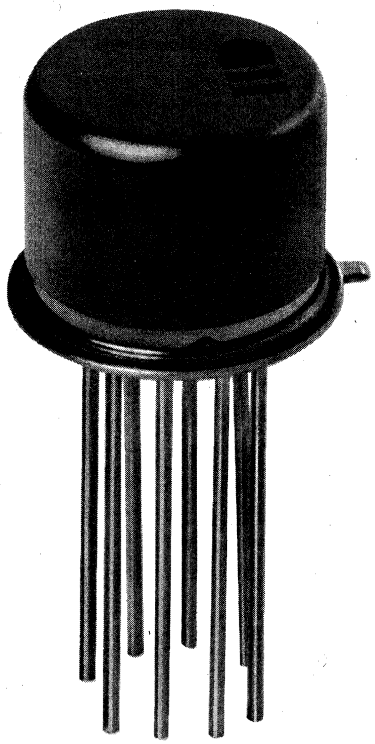
COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	50
6.0	98
9.0	220
12.0	390
18.0	880
26.5	1560
30.0	2500

FEATURES:

- Built in accordance with MIL-R-39016/9: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

TM SERIES*



QPL PENDING

*Consult CII for other TO-5 versions

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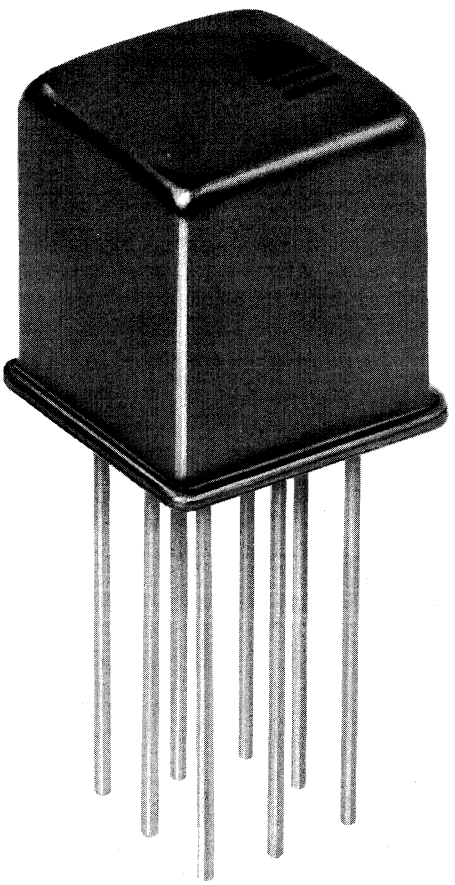
0.100 GRID RELAY

NEW

TC SERIES*



Q.P.L. PENDING

*Consult CII for other 0.100 grid versions

SIZE:

- Width & Depth:
  - Enclosure (sq. max) — .335 inches (8.51)
  - Base (sq. max) — .370 inches (9.40)
- Height (max): .275 (6.99)

CONTACT RATING/ ARRANGEMENT:

- DC Rating:
  - Resistive — low level to 1 amp / 28 VDC
- Contact Resistance:
  - 0.1 ohm max before life
  - 0.2 ohm max after life
- Contact Arrangement:
  - 2 Form C (DPDT)

COIL VOLTAGES:

Coil Voltages (Nominal VDC)	Coil Resistance (ohms +/- 10% at 25°C)
5.0	50
6.0	98
9.0	220
12.0	390
18.0	880
26.5	1560

FEATURES:

- Built in accordance with MIL-R-39016/17: other QPL versions pending
- All welded construction, hermetically sealed
- State-of-the-art cleaning techniques and precious metal contact material with gold plating

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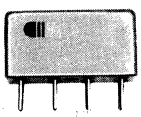
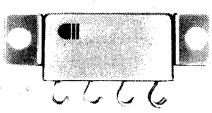
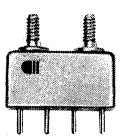
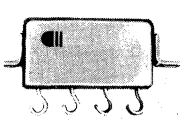
Military Grade/Half Size Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **HFW** (Standard Sensitivity)	H- .410 (10.41)* D- .410 (10.41) W- .810 (20.57)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/6 level L, M & P (Request Brochure HFW 87)
 **HFW4A** (4 Amp Rating)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57)	• Low Level to 4.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Excellent RF switching • Ambient temp rating −65°C to + 85°C • Designed to MIL-R-39016 (Request Brochure HFW 87)
 **HMS** (Sensitive Series)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	5 to 36.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Energy-saving 100/125 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/44 level L, M & P (Request Brochure HFW 87)
 **HMB** (Bifilar Coil)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57) *mm	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Bifilar transient suppression • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/22 level L, M & P (Request Brochure HFW 87)

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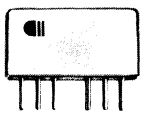
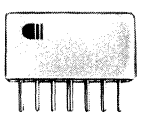
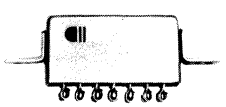
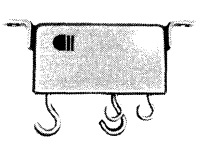
Military Grade/Half Size Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **LS** (Latching Series)	H- .410 (10.41)* D- .410 (10.41) W- .810 (20.57)	• Low Level to 2.0 Amps • 2 Form C, (DPDT)	5 to 48.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Single or dual latch version • Excellent RF switching • Qualified to MIL-R-39016/45 level L, M (Request Brochure HFW 87)
 **SR** (4 Pole Version)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57)	• Low Level to 2.0 Amps • 4 Form C (4PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Four pole design • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/40 level L, M (Request Brochure HFW 87)
 **SS** (6 Pole Version)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57)	• Low Level to 2.0 Amps • 6 Form C, (6PDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Six pole hi-density design • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 87)
 **C-10 AMP** (10 Amp Series)	H- .410 (10.41) D- .410 (10.41) W- .810 (20.57) *mm	• Low Level to 10 Amps • 1 Form C, (SPDT)	6 to 26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Unique hi-current design package • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-39016 (Request Brochure HFW 87)

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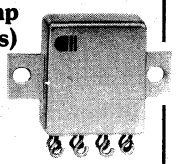
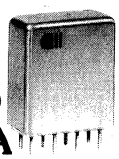
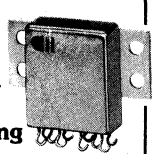
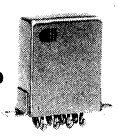
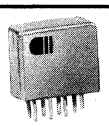
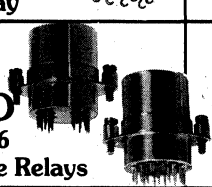
Military Grade/Full Size Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
(3 Amp Series) FW 	H- .875 (22.23)* D- .400 (10.16) W- .800 (20.32)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Sensitive version available • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-5757/10 (Request Data Sheet FW-85)
(5 Amp Version) FW5A 	H- .875 (22.23) D- .400 (10.16) W- .800 (20.32)	• Low Level to 5.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 5.0 Amp version of FW • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-5757 (Request Data Sheet FW-85)
LFW (Latching Series) 	H- .900 (22.86) D- .400 (10.16) W- .800 (20.32)	• Low Level to 3.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.3 to 110.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • One and two coil operation • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-5757

Military Grade/Other Relays

153/95 Coaxial Relays	H- .875 (22.23) D- .400 (10.16) W- .800 (20.32)	• RF Contacts— up to 75 Watts • 1 Form C, 2 Form C	12.0 to 26.5 VDC	• Hermetically sealed enclosures • RF switch to 1000 MHz • Meets applicable portions of MIL-R-5757 and MIL-S-3928 • Terminates with coax cable or LEPRA/CON connectors (Request Data Sheet 153/95-85)
PF 10 Amp Power Relay 	H- 1.300 (33.02) D- .515 (13.08) W- 1.075 (27.31)	• Low Level to 10.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	6.0 to 115.0 VDC	• Welded, hermetically sealed enclosures • Very low contact resistance • Package volume .72 cubic inch • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-5757/23 & 28 (Request Data Sheet PF-85)
MFW ⅙th Size Relay 	H- .410 (10.41) D- .230 (5.84) W- .500 (12.70)	• Low Level to 1.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	3.5 to 53.0 VDC	• Hermetically sealed enclosures • Low contact resistance • Total volume only .046 cubic inch • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-39016/34, L & M level (Request Data Sheet MF-84)
SF 40 MW Sensitive Relay	H- 1.281 (32.54) D- .400 (10.16) W- .800 (20.32)	• Low Level to 2.0 Amps • 1 Form C, 2 Form C 2 Form B, 2 Form A	1.8 to 40.0 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • 40 milliwatt sensitivity • Excellent RF switching • Ambient temp rating −65°C to + 125°C • Designed to MIL-R-5757/13 (Request Data Sheet SF-85)
RD 4&6 Pole Relays 	H- 1.34 (34.04) D- 1.14 (28.96) W- 1.06 (26.92)	• Low Level to 2.0 Amps • 4 Form C, 6 Form C *mm	26.5 VDC	• Welded, hermetically sealed enclosures • Low contact resistance • Optional all-welded construction • 100 G Shock • Ambient temp rating −65°C to + 125°C • Qualified to MIL-R-5757/1 & 7 (Request Data Sheet RD-83)

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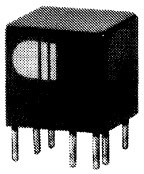
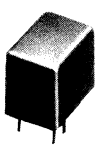
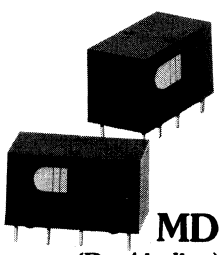
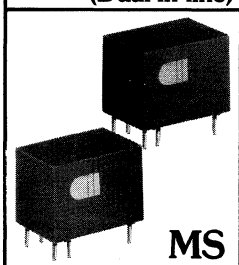
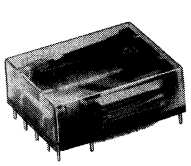
Commercial PCB Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
 **MM** **(2 Amp Series)**	H- .410 (10.41)* D- .394 (10.0) W- .394 (10.0)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT) 1 Form C (SPDT) 1 Form A (SPNO) 2 Form A (DPNO)	3 VDC 5 VDC 6 VDC 12 VDC 24 VDC 48 VDC	• Bifurcated contacts gold clad silver-palladium. • Rated for low level to 2.0 Amp switching. • Mount six relays per square inch. • Long Life—Mechanical 100 million ops. • High shock/high vibration resistance. • .1 inch (2.54 mm) footprint. • Fast operate and release time. • Low contact resistance. • UL recognized. File #E90612 • Completely sealed (Request Data Sheet MM-87)
 **MN** **(Single PoleVersion)**	H- .390 (9.9) D- .287 (7.3) W- .406 (10.3)	• Low Level (microwatts) up to 1.0 Amps 24 VDC • 1 Form C (SPDT)	3 VDC 5 VDC 6 VDC 9 VDC 12 VDC 24 VDC	• Single Cross Bar Ag Pd Gold Cap • Completely Sealed • Contact Rating Low Level to 1.0 Amp @ 28 VDC • Meets FCC Part 68 1500 V on Request (Request Data Sheet MN-87)
 **MD** **(Dual in-line)**	H- .460 (11.7) D- .381 (9.7) W- .787 (20.0)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 2 Form C (DPDT)	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Two form C bifurcated contacts gold clad silver-palladium. • Standard and high sensitivity models. • Completely sealed. • Contact rating from low level to 2.0 Amps switching—3.0 Amps carry. • Super clean construction—inert gas filled. • Designed for low contact resistance and contact resistance stability during life. • UL recognized. File #E90612 • Conforms to FCC Part 68, 1500V peak • CSA approved #LR65354-1. (Request Data Sheet MD-85)
 **MS** **(Single Pole Series)**	H- .413 (10.5) D- .413 (10.5) W- .606 (15.4)	• Low Level (microwatts) up to 2.0 Amps 24 VDC • 1 Form C (SPDT)	3 VDC 5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• High reliability switching at low cost. • Standard and high sensitivity models. • Gold clad silver-palladium contacts. • Low contact resistance. • High shock and high vibration resistance. • Super clean construction—inert gas filled. • Low level to 2.0 Amps contact switching—3.0 Amps carry. • UL recognized. File #E90612 • CSA approved #LR65354-1. (Request Data Sheet MS-85)
 **MP4** **(4 Pole Flat Pack)**	H- .45 (11.5) D- 1.20 (30.5) W- .96 (24.5) *mm	• Low Level (microwatts) up to 2.0 Amps 24 VDC •4 Form C(4PDT) 4 Form D(4PDT)** [2 Form C(DPDT) [2 Form D(DPDT)** **make before break	5 VDC 6 VDC 9 VDC 12 VDC 24 VDC 48 VDC	• Low profile. • Stands only .45 inches (11.5 mm) high. • Long life: 100,000,000 mechanical operations. 1,000,000 operations at 1.0 Amps. • Environment sealed. • Designed for low contact resistance and contact stability during life. • Contact rating: From low level to 2.0 Amps switching—3.0 Amps carry. • UL recognized. File #E90612. • Conforms to FCC Part 68, 1500V peak • CSA approved #LR65354-1. (Request Data Sheet MP-4-86)

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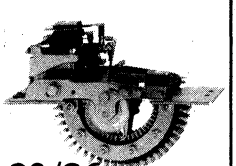
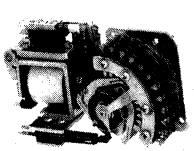
Telephone Relays

RELAY	SIZE (Case Size)	CONTACT RATING/ CONFIGURATION	COIL VOLTAGES	FEATURES
MA (4 Pole)	H-1.070 L-1.200 W-0.750	• Low Level (microwatts) to 2.0 Amps 28 VDC • MA-4 pole MB-6 pole MC-12 pole	6 VDC 12 VDC 24 VDC 48 VDC 60 VDC	• 4, 6 & 12 poles available • Bifurcated contacts • Low cost • PCB or plug-in mounting (Request Data Sheet MA/MB-85)
MB (6 Pole)	H-1.070 L-1.200 W-1.000			
MC (12 Pole)	H-1.230 L-1.200 W-1.000			
C	Variable	• Low Level to 10.0 Amps • Contact Arrangements: Long frame: up to 8 Form C Medium frame: up to 8 Form C Short frame: up to 4 Form C	6 to 250 VDC	• Optional hermetic sealing • AC or DC operation • Fast operate and fast release times • Variety of accessories • Ambient temp rating −55°C to + 85°C • Custom designs available (Request Catalog 502)
J	Variable			
R	Variable			

Stepping Switches

 **20/26**	Variable	• Point variations: 10 to 52 point operation • Contact rating: 0.1 Amp @ 115 VAC or 30 VDC resistive Carry: 3.0 Amps	6 to 110 VDC	• Optional sealing • Insulation resistance 10^9 Ω at 500 VDC • Fast operate and fast release times • Variety of switch mounting accessories • Operating temperature −0°C to + 85°C • Custom designs available (Request Catalog 601)
 **210/211**	Variable			

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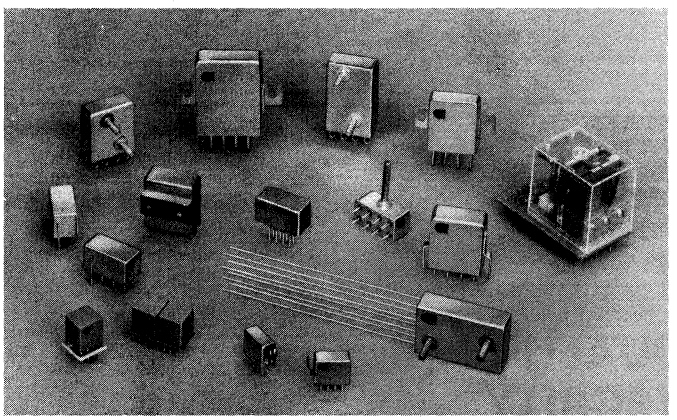
Custom Built Relays

- Build to Print
- Custom Made
- Unique Applications
- Replacement/Alternative Design
- Specialized Testing
- RF Switching
- Industrial/Commercial/Military
- High Shock
- High Vibration
- Extreme Temperatures



Application Engineering

Communications Instruments Application Engineering Department can provide technical and design assistance in the selection of the ideal relay for your application. This includes design modification, prototypes or special mounting configurations. Our technical staff is ready to help you get the most for your investment in Communications Instruments broad line of relays.

Relays Qualified to MIL-SPEC

CII relays are qualified to the following Military Specifications for electromechanical relays.

MILR39016/6	Half size, DPDT, low level to 2 Amps
MILR39016/22	Half size, DPDT, low level to 2 Amps, bifilar coil
MILR39016/34	One sixth size, DPDT, low level to 1 Amp
MILR39016/40	Half size, 4PDT, low level to 2 Amps
MILR39016/44	Half size, DPDT, low level to 2 Amps, 100/125 MW
MILR39016/45	Half size, DPDT, low level to 2 Amps, latching
MILR5757/1-026	Full size, 6PDT, low level to 2 Amps
MILR5757/7-003	Full size, 4PDT, low level to 2 Amps
MILR5757/10	Full size, DPDT, low level to 2 Amps

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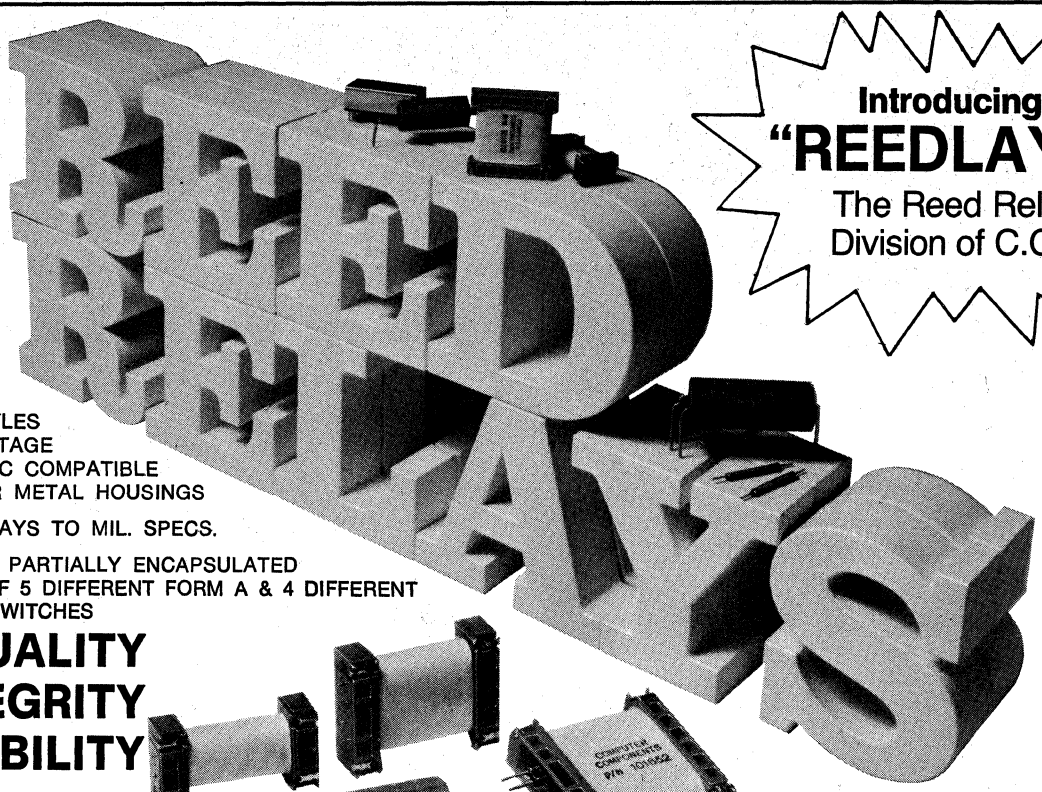

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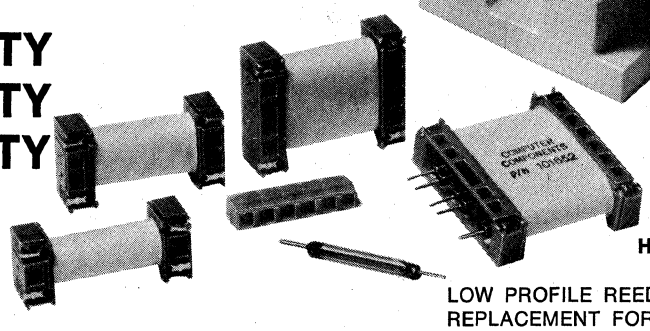

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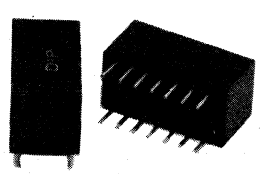

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Dimensions (in. LxWxH)		.810x.210x .225	1.400x.250x .280	.750x.400x .280	.960x.400x .350	.815x.415x 475	1.200x.660x 460	.925nom.x .500x.375	1.190x.500x .375	.760x.200x .300	.750x.240x .245
Series		2200 2900 Microminiature	2400 Miniature	2600 DIP	2700 Hg-wetted DIP	2800 Miniature	3200, 3400, 3500 Low-thermal EMF	4000 4200 Low cost	7000 Miniature	9000 SIP	9200 SMD
Applications		ATE, 50 Ω Transmission line, Large matrices	ATE, Telephone switching, Modems	ATE, High reliability DIP	ATE, Laser trimming systems, Motor control	High performance replacement for Thermosen DM2C, D2C	Low thermal EMF, data acquisition, Thermocouple, RTD, transducer inputs	Modems, Telephone switching, ATE, Security systems, General-purpose	ATE, Electrical test equipment, Medical Instrumentation, Telephone applications, General-purpose	50 Ω transmission line, ATE, Large matrices, Telephone switching, Modems	ATE, Modem applications, Process control, 50 Ω transmission line, Surface mountable
Contact Configuration		1A, 1C dry 1A Hg-wetted	1A, 1C dry 1A Hg-wetted	1A, 1B, 1C, 2A dry	1A, 1C Mercury wetted	2C, dry	1A, 2A, 3A, 1B High voltage Dry contacts	1A, 1C, 2A, 2C, 1B Dry 1 A Hg-wetted	1A to 4A dry, high voltage, and Hg-wetted 1C to 3C, dry 1A latch, dry	1 A dry – Low-level to power loads	1 A dry
Contact dielectric Strength		Up to 400 V peak	Up to 1500 V peak	Up to 400 V peak	1000 V peak	250 V peak	Up to 1000 V peak	Up to 1200 V peak	Up to 1200 V peak	250 V peak	250 V peak
Typical Life	Low Level	1A dry; $5x10^8$ typical	1A dry; $5x10^8$ typical	1A dry; $5x10^8$ typical	10^9	10^7	2A dry; $5x10^8$ typical	1A dry; $1x10^8$ typical	1A dry; $5x10^8$ typical	$5x10^8$ typical	$5x10^8$ typical
	Rated Load	10^7 typical	10^7 typical	10^7 typical	10^8 typical	10^6	10^7 typical	10^7	10^7 typical	10^7 typical	10^7 typical
Coil Voltage		5, 12	5, 12	5, 12	5, 12, 24	5, 12, 24	5, 12	5, 6, 12, 24	5, 12, 24	5, 12	5, 12
Features		Small size, 50 Ω transmission line switching. Ultra-fast switching time (500 μsec typ.). Low power (150mW). Electrostatic coaxial shields available.	High voltage & power available. Telephone switching. Electrostatic shielding. Low power.	Full magnetic shielding with DIP footprint. 500 μsec switching time. Low power. Electrostatic shielding. Diode option.	Form C, Form A mercury-wetted in DIP footprint. Diode option. 1 Amp switching.	Reed Relay with electromechanical footprint. Hermetically-sealed contacts. Electrostatic shield.	Low thermal EMF capabilities 200 nV-5 μV. High isolation 10^{12} Ω typ. High common-mode rejection.	Electrostatic & magnetic shields. Flame retardant case. Fully sealed. Low power. Low cost.	Electrostatic shield available. Diode available. 1.0"x0.1" grid.	Automated assembly methods. Diode available. Thermoset epoxy on lead-frame construction. 0.200" NARROW. Electrostatic / coaxial shield.	50Ω transmission line switching. Electrostatic / coaxial shield. Automated SMT construction. Thermoset epoxy on lead-frame construction. "J", gull wing, axial and radial terminals available.

Common features: Fully encapsulated, full magnetic shielding except for 9000, 9200, wave solderable, pc mountable, impervious to both aqueous and chemical cleaning.

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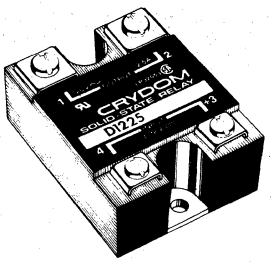
CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



2.5 TO 90 AMP, 120, 240 AND 480 VAC SCR AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS

These Crydom SSRs make it possible to switch AC power loads up to 47 kw. Output circuit consists of inverse-parallel (back-to-back) dual SCRs to meet the most demanding requirements. Features include zero voltage switching, phase control and normally closed models available.

AC Control Models—SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
A1202	24-140	2.5	22.5
A1210	24-140	10	120
A1225	24-140	25	250
A1240	24-140	40	625
A2402	48-280	2.5	22.5
A2410	48-280	10	120
A2425	48-280	25	250
A2440	48-280	40	625
A2450	48-280	50	625
A2475	48-280	75	1000
A4808	80-530	8	72
A4812	80-530	12	140
A4825	80-530	25	250
A4840	80-530	40	400
A4875	80-530	75	1000
A4890	80-530	90	1200

General Specifications
Isolation Voltage: 4000 VAC Std. (Input to Output)
Operating Temperature Range: – 30°C to 80°C. UL and CSA

DC Input Control Models
Control Signal Range . . . . . .3-32 VDC
Must Operate Voltage . . . . . .3 VDC Max
Must Release Voltage . . . . . .1 VDC Min
Input Current . . . . . .4 mA max @ 5 VDC

AC Input Control Models
Control Signal Range . . . . . .90-280 VAC
Must Operate Voltage . . . . . .90 VAC Max
Must Release Voltage . . . . . .10 VAC Min
Input Current . . . . . .2 mA max @ 120 VAC

DC Control Models—SCR Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
D1202	24-140	2.5	22.5
D1210	24-140	10	120
D1225	24-140	25	250
D1240	24-140	40	625
D2402	48-280	2.5	22.5
D2410	48-280	10	120
D2425	48-280	25	250
D2440	48-280	40	625
D2450	48-280	50	625
D2475	48-280	75	1000
D4808	80-530	8	72
D4812	80-530	12	140
D4825	80-530	25	250
D4840	80-530	40	400
D4850	80-530	50	625
D4875	80-530	75	1000
D4890	80-530	90	1200

ADDITIONAL DC INPUT MODELS AVAILABLE:
"NORMALLY CLOSED" . . . . . —B SUFFIX
"NON-ZERO SWITCH" . . . . . —10 SUFFIX
"400 Hz" . . . . . —4 SUFFIX

8 TO 90 AMP, 48-530 AND 48-660 VAC AC OUTPUT SOLID-STATE RELAYS 1000-1200V BLOCKING

The highest power rated SSRs, up to 59 kw, 4000V of isolation with the highest available blocking voltages (1.2 KV) below which the SSRs will not mistrigger. The wide margin between operating and blocking voltages permits the proper use of transient suppression (MOV) devices on the 480V line. Features include high dv/dt and zero voltage switching.

General Specifications
Control Signal Range "C", "WD" 4 to 32 VDC
"CD" . . . . .4 to 8 VDC
"CA" . . .90 to 140 VAC
Input Current @ 5 VDC . . . . . .15 mA max.
Isolation Voltage 50/60 Hz . . . .4000 VRMS
Operating Temperature Range. 0°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current Amps (RMS)	One Cycle Surge Amps (pk)
D4808C	48-530	8	72
D4812C	48-530	12	140
D4825C	48-530	25	250
D4850C	48-530	50	625
D4875C	48-530	75	1000
D4890C	48-530	90	1200
H10CD4850	48-660	50	625
H10CD4890	48-660	90	1200
H10CA4850	48-660	50	625
H10CA4890	48-660	90	1200
H12CD4850	48-660	50	625
H12CD4890	48-660	90	1200
H12CA4850	48-660	50	625
H12CA4890	48-660	90	1200
H10WD4850	48-660	50	625
H10WD4890	48-660	90	1200
H12WD4850	48-660	50	625
H12WD4890	48-660	90	1200

7.0 TO 40 AMP, 100 TO 500 VDC CMOS DC INPUT SOLID STATE RELAYS

This new Crydom series of DC power SSRs incorporates a power MOSFET as the output device in the classic Crydom package. The input can be driven from most logic circuits, requiring less than 1.6 mA at 5 VDC.

General Specifications
Control Signal Range . . . . . .3.5 to 32 VDC
Input Current @ 5 VDC . . . . . .1.6 mA max.
Isolation Voltage 50/60 Hz . . . .2500 VRMS
Operating Temperature Range. 0°C to 80°C

Crydom Model No.	Line VDC	Max. Load Current @ 40°C Amps	One-Cycle Surge Amps (PK)
D1D07	0-100	7.0	15
D1D12	0-100	12	28
D1D20	0-100	20	42
D1D40	0-100	40	106
D2D07	0-200	7.0	22
D2D12	0-200	12	27
D4D07	0-400	7.0	17
D4D12	0-400	12	36
D5D07	0-500	7.0	19
D5D10	0-500	10	29

10 TO 75 AMP, 120-240V DC CONTROLLED, AC OUTPUT SSRs FEATURE IC FIRING CIRCUITS TO BOOST RELIABILITY AND PERFORMANCE

Combining integrated circuit technology and the proven Crydom series 1 high power dissipation output system results in superior SSRs. The reduction of control circuit components from 22 to 3 greatly increases life and reliability.

SCR OUTPUT

Crydom Model No.	Input Control Voltage	Output Load Current	Ratings Volts (RMS)
CSD2410	3.5-15 VDC	10A	120/240
CSD2425	3.5-15 VDC	25A	120/240
CSD2440	3.5-15 VDC	40A	120/240
CSD2450	3.5-15 VDC	50A	120/240
CSD2475	3.5-15 VDC	75A	120/240
CSE2410	15-32 VDC	10A	120/240
CSE2425	15-32 VDC	25A	120/240
CSE2450	15-32 VDC	50A	120/240

TRIAC OUTPUT

CTD2410	3.5-15 VDC	10A	120/240
CTD2425	3.5-15 VDC	25A	120/240

SERIES 1—HEATSINK SELECTION GUIDE

Maximum Operating Current (SSR Rating)	Crydom Heatsink Type	Maximum Ambient Temperature (@ Max. Current)
10A	HS-1	25°C
10A	HS-2	40°C
25A	HS-2	25°C
50A	HE-54	40°C

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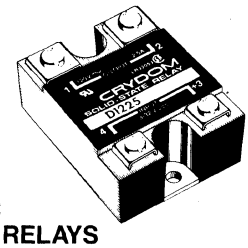
CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 1



5 THRU 25 AMP/120 AND 240 VAC TRIAC AC OUTPUT SOLID-STATE RELAYS

Crydom Triac SSRs are quality-made devices designed for general purpose switching applications where performance requirements are less demanding than those offered by SCR output types.

General Specifications	DC Input	AC Input
Control Signal Range . .	3 to 32 VDC	90 to 280 VAC
Input Current	4 mA @ 5 VDC	2 mA @ 120 VAC
Isolation Voltage	4000 VRMS	4000 VRMS
Oper. Temp. Range	– 30°C to 80°C	– 30°C to 80°C

DC Control Models—Traic Output

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current, Amps (RMS)	One-Cycle Surge, Amps (PK)
TD1210	24-140	10	100
TD1225*	24-140	25	250
TD2410*	48-280	10	100
TD2425	48-280	25	250
TD4825	80-530	25	250

AC Control Models—Triac Output

TA1210	24-140	10	100
TA1225	24-140	25	250
TA2410	48-280	10	100
TA2425	48-280	25	250
TA4825	80-530	25	250

TIME DELAY RELAYS 48 TO 280 VAC, 10, 25 OR 50 AMP 2 TIMING RANGES

Standard series 1 relay with built-in Time Delay. (External resistor for 0 to 10 Megohm.)

General Specifications

Control Voltage Range . . . . . .3.5 to 15 VDC
Timing Range "DSD" . . . . . .0.1 to 83 sec
Timing Range "DLD" . . . . . .1.6 to 1330 sec

Crydom Model No.	Max Load Current, Amps (pk)	One-Cycle Surge Amps (pk)
DSD2410	10	120
DSD2425	25	250
DSD2450	50	625
DLD2410	10	120
DLD2425	25	250
DLD2450	50	625

SOFT-START POWER MODULES/RELAYS 90-140 AND 180-280 VAC 10 TO 75 AMPS

A control module is used in combination with a Crydom phase control relay to provide gradual applicaton of power to the load.

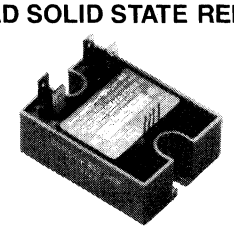
General Specifications: All models.

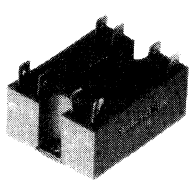
Input Operate Voltage Range . . . . . .3.5 to 10 VDC
Minimum Release Voltage . . . . . .1 VDC
Input Current @ 5 VDC . . . . . .1.6 mA

Crydom Model No.	Output Voltage Range VAC	Max Load Current Amps
10SST120	90-140	10
25SST120	90-140	25
40SST120	90-140	40
10SST240	180-280	10
25SST240	180-280	25
40SST240	180-280	40
75SST240	180-280	75

DUAL & QUAD SOLID STATE RELAYS 24-280 VAC

NEW





These space saving and cost saving "dual" and "quad" series provide two (2) or four (4) totally independent AC output solid state relays in a single Series 1 package. The "dual" types employ inverse parallel SCR outputs and are available in 25 AMP and 40 AMP models. The "quad" types have triac outputs. Protection is provided by an internal dv/dt snubber network across the output switch which restricts the rate of rise of most voltage transients to within acceptable limits. Features include 2500VRMS optical isolation, zero voltage turn-on and zero current turn-off of the load. Random voltage turn-on units (– 10 suffix) are also available for phase control applications.

These series are ideal when multiple SSR's are required for interfacing between the logic output of TTL, HTL, MOS or microprocessor circuits and AC loads such as motors, heaters, lamps, solenoids and transformers.

25, 40 AMP Dual-SCR Output 20 AMP Quad-Triac Output

General Specifications

Isolation Voltage: . . . . . .2500 VAC
Temperature Range:
Storage . . . . . – 40°C to 120°C
Operating: . . . . . – 30°C to 80°C
Weight: . . . . . .3.5 oz. (98G) Max.
Control Signal Range . . . . . .4-15 VDC
Must Operate Voltage . . . . . .4 VDC Max.
Must Release Voltage . . . . . .1 VDC Min.
Input Current . . . . . .34 mADC Max.
Off-State dv/dt . . . . . .200V/usec Min.

DUAL—SCR OUTPUT **UL Recognized, CSA Certified**

Crydom Model No.	Line VAC (47-70 Hz)	Max. Load Current Amps (RMS) (Per Section)	One-Cycle Surge Amps (PK) (Per Section)	Switching Mode
D2425D	24-280	25	350	Zero
D2425D-10	24-280	25	350	Non-Zero
D2440D	24-280	40	500	Zero
D2440D-10	24-280	40	500	Non-Zero

QUAD—TRIAC OUTPUT **UL Recognized, CSA Pending**

TD2420Q	24-280	20	250	Zero
TD2420Q-10	24-280	20	250	Non-Zero

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CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

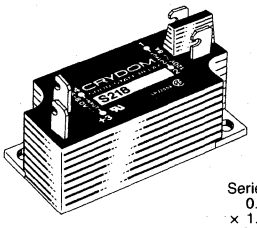
SERIES 2

8 AMPS, 120 AND 240 VAC AC OUTPUT, PANEL MOUNT SOLID-STATE RELAYS

The Crydom Series 2 solid-state relays combine small size, zero voltage switching and high current rating in a package designed for heat sink or panel mounting. Standard 0.187" push-on terminals allow quick connection and are positioned to provide maximum isolation between control and power circuits.

General Specifications

Control Signal Range. . . . . .3.5 to 8 VDC
Control Signal Range"221C" 3.5 to 7 VDC
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min



Series 2
0.85" (21.59 mm)
× 1.75" (44.5 mm)
× 0.83" (21.08mm)

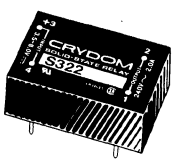
Must Operate Current . . . . . .12 mA max
Isolation Voltage . . . . . .2500 VAC
Operating Temperature Range . . . . . – 30°C to 80°C
Snubber . . . . . .Internal

Crydom Model No.	Line VAC (47-63 Hz)	Max. Load Current @ 40°C Amps (RMS)	One-Cycle Surge Amps (PK)
S218	20-140	8	120
S228	40-280	8	120
S221C	5-280	1.25	30
S228C	24-280	8	120

SERIES 3

AC OUTPUT, PC BOARD MOUNT SOLID-STATE RELAYS 0.3 TO 3 AMPS 120 AND 240 VAC

Case Style 30A



Case Style 3

Designed for PCB applications. Units require only 1 sq. in. space on boards. Overall height of 0.45" on case 3 allows spacing on 0.5" centers. High current rating. Zero voltage switching.

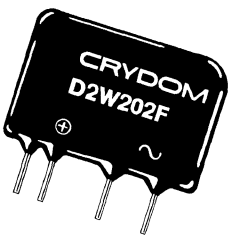
General Specifications

Control Signal Range. . . . . .3.5 to 8 VDC
(Models S3013A/S3023A . . .3.5 to 18 VDC)
Must Operate Voltage . . . . . .3.5 VDC max
Must Release Voltage . . . . . .1 VDC min.
Isolation Voltage . . . . . .2500 VAC
(Models S3013A/S3023A. . . . . .4000 VAC)
Operating Temperature Range. . . – 30°C to 80°C

Crydom Model No.	Line VAC (47-63 Hz)	Max. I @ 40°C A (RMS)	One-Cycle Surge Amps (PK)	Internal Snubbers	Case Style
S310	20-140	0.3	2	No	3
S3010A	20-140	0.3	2	Yes	30A
S320	40-280	0.3	2	No	3
S3020A	40-280	0.3	2	Yes	30A
S312	20-140	2	55	No	3
S3012A	20-140	2	55	Yes	30A
S3013A	24-140	3	55	Yes	30A
S322	40-280	2	55	No	3
S3022A	40-280	2	55	Yes	30A
S3023A	48-280	3	55	Yes	30A

SERIES D2W

LOW COST AC OUTPUT 60 TO 280 VAC, 2 AMPS SOLID-STATE RELAYS



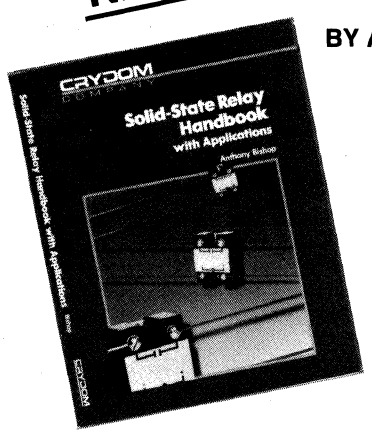
The D2W202F is designed to achieve optimum performance at a record low cost by means of completely automated assembly using labor saving robotics. The package has a hard, skin-tight epoxy coating which provides excellent environmental protection and a pinout that matches the Series 6.

General Specifications

Control Signal Range . . . . . .3 to 28 VDC
Must Operate Voltage, max. . . . . .3 VDC
Must Release Voltage, min. . . . . .1 VDC
Input Current @ 5 VDC max. . . . . .4 mA
Input Impedance, min. . . . . .1500 OHMS
Dielectric Strength: 50/60 Hz . .2500 VRMS
Operating Temperature Range. . . – 20°C to 80°C

Crydom Model No.	Control Voltage Range	Output Ratings	Surge One Cycle
D2W202F	3-32 VDC	2A @ 60-280 VAC	28A pk
D2W203F	3-32 VDC	3A @ 60-280 VAC	—
D2W203F-11	3-32 VDC	3A @ 60-280 VAC	80A pk

NEW



SOLID-STATE RELAY HANDBOOK

WITH APPLICATIONS

BY ANTHONY BISHOP

This comprehensive 223 page reference to the use and applications of Solid-State Relays (SSRs) incorporates a detailed tutorial on what SSRs are and why they are used in various industrial applications. In its pages you will find:

- A thorough introduction to solid-state relays
- Descriptions of various coupling methods
- SSR operation and parameters
- Coverage of different drive methods
- Thermal considerations
- Applications of SSRs in microprocessor-based equipment for industrial machine control
- A cross reference of types and manufacturers
- A handy glossary of terms

ORDER: HDBK-899

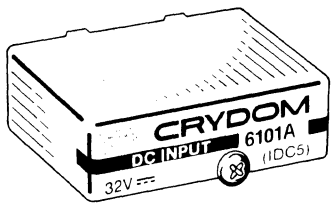
CRYDOM COMPANY: 17215 Studebaker Rd., Cerritos, CA 90701 • Phone: (213) 865-3536 • Fax: (213) 865-3318

CRYDOM COMPANY

SOLID-STATE RELAYS AND INPUT/OUTPUT SWITCHES

SERIES 6

AC AND DC MICROPROCESSOR INPUT/OUTPUT MODULES



For electrically clean, photo-isolated, noise-free interfacing between logic level programmable controllers, microprocessors and computerized machine controls and power level loads.
Input modules accept power level signals and convert them to logic level signals. Output modules accept logic level signals to switch AC or DC loads to 3.5 Amps.

General Specifications—All Models
Dielectric (Input/Output) . . . . . .4000 VRMS
Isolation Resistance (Input/Output @ 500 V) . . . .10^{10} Ohms
Capacitance (Input/Output) . . . . . .8.0 pF
Operating Temperature Range. . . . . – 40°C to 80°C

3.5 AMPS, 60 VDC, 120 and 240 VAC
Standard Input/Output Modules (and Equivalents)
*IN COMPLIANCE WITH NEMA 2-230 (NOISE IMMUNITY)

5 Volt Models		15 Volt Models					
P-N	Equivalent	P-N	Equivalent	Type	Input Current vs. Voltage	Maximum Load Voltage	Maximum Load Current
6101/6101A*	IDC5	6131	IDC15	DC/IN	7 mA @ 32 VDC	30 VDC	25 mA @ 80°C
6201A*	IAC5	6231	IAC15	AC/IN	6 mA @ 120 VAC	30 VDC	25 mA @ 80°C
6202A*	IAC5-A	6232	IAC15-A	AC/IN	6 mA @ 240 VAC	30 VDC	25 mA @ 80°C
6301A*	ODC5			DC/OUT	15 mA @ 5 VDC	60 VDC	3 ADC @ 45°C
6401A*	OAC5			AC/OUT	15 mA @ 5 VDC	140 VAC	3A RMS @ 45°C
6402A*	OAC5-A			AC/OUT	15 mA @ 5 VDC	280 VAC	3A RMS @ 45°C
6102	—	—	—	DC/IN	6 mA @ 180 VDC	30 VDC	25 mA @ 80°C
6200	—	—	—	AC/IN	6 mA @ 24 VAC	30 VDC	25 mA @ 80°C
6302	ODC5-A	—	—	DC/OUT	12 mA @ 5 VDC	200 VDC	1.5A @ 45°C

Buffered Output Modules
*SINK CURRENT (NON-INVERTING) **SOURCE CURRENT (INVERTING)

Crydom Part No.						
5V Models	15V Models	Type	Input Current vs. Voltage 5 Volt Models	Input Current vs. Voltage 15 Volt Models	Maximum Load Voltage	Maximum Load Current
6311	6341	DC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	60 VDC	3.5 ADC @ 45°C
6321	6351	DC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	60 VDC	3.5 ADC @ 45°C
6411	6441	AC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	140 VAC	3.5A RMS @ 45°C
6412	6442	AC/OUT	75 μA @ 0.8 VDC*	175 μA @ 2.0 VDC*	280 VAC	3.5A RMS @ 45°C
6421	6451	AC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	140 VDC	3.5A RMS @ 45°C
6422	6452	AC/OUT	75 μA @ 2.4 VDC**	75 μA @ 8.0 VDC**	280 VAC	3.5A RMS @ 45°C

SERIES DMP

AC AND DC INPUT/OUTPUT MODULES
3 AMPS, 30, 60 VDC AND 280 VAC

Electrically identical to Series 6 models. Packaged in a hard, skin-tight epoxy conformal coating for excellent environment protection and fast heat-transfer. Pin-out matches Series 6.

Crydom Model Number	Module Type	Input Current vs. Voltage	Max. Load Voltage
DMP6101A	DC/IN	32 mA @ 32 VDC	30 VDC
DMP6201A	AC/IN	6 mA @ 120 VAC	30 VDC
DMP6202A	AC/IN	6 mA @ 240 VAC	30 VDC
DMP6301A	DC/OUT	15 mA @ 5 VDC	60 VDC
DMP6402A	AC/OUT	15 mA @ 5 VDC	280 VDC

DELTROL RELAYS

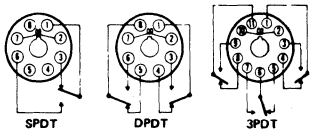
MADE IN U.S.A.

SEE SECTION 4550 FOR SOLENOIDS

105 Series

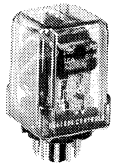
L = 1-3/8
W = 1-3/8
H = 2

General purpose plug-in relay for continuous duty operation. Plastic cover. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



BASE DIAGRAMS FOR 105 SERIES

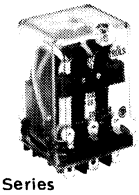
B-3 HOLD DOWN SPRING S/N 20171-00



105A Series

L = 1-3/8
W = 1-3/8
H = 2

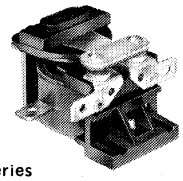
General purpose plug-in relay with a lamp connected across relay coil; indicates voltage applied to coil. Recognized under the components Program of Underwriters Laboratories, Inc. (File No. E37066).



165/166 Series

L = 1-13/32
W = 1-1/2
H = 2-3/16

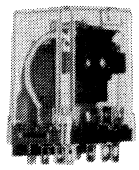
Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA Recognized.



170 Series

L = 1-7/8
W = 1-5/8
H = 1-1/4

High current relays for industrial control applications. Molded nylon encapsulated coil is resistant to fungus and moisture. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).



268 Series

W = 1-1/2
D = 1-7/16
H = 2-1/2

Plastic covered general purpose plug-in relay. Molded nylon coil. Continuous duty operation. .187 quick connect terminals. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). Also CSA recognized.

105 SERIES

Stock No.	Series	Contacts Arrang.	Contacts Rating (Amps)	Coil Input Voltages	Coil Resistance (Ohms)	Coil Nominal Power
20106-82	105	SPDT	10A	24VAC	82	2.0VA
20106-84	105	SPDT	10A	120VAC	2,250	2.0VA
20107-84	105	DPDT	5A	120VAC	1,800	2.2VA
20108-81	105	DPDT	10A	12VAC	19	2.0VA
20108-82	105	DPDT	10A	24VAC	74	2.0VA
20108-84	105	DPDT	10A	120VAC	1,800	2.0VA
20108-85	105	DPDT	10A	240VAC	6,800	2.0VA
20110-82	105	3PDT	10A	24VAC	74	2.2VA
20110-84	105	3PDT	10A	120VAC	1,800	2.2VA
20110-85	105	3PDT	10A	240VAC	6,800	2.2VA
20114-80	105	DPDT	10A	6VDC	30	1.2W
20114-81	105	DPDT	10A	12VDC	120	1.2W
20114-82	105	DPDT	10A	24VDC	472	1.2W
20114-83	105	DPDT	10A	48VDC	1,800	1.2W
20114-84	105	DPDT	10A	110VDC	10,000	1.2W
20116-81	105	3PDT	10A	12VDC	120	1.2W
20116-82	105	3PDT	10A	24VDC	472	1.2W

105A SERIES (w/Indicator Lamp)

Stock No.	Series	Contacts Arrang.	Contacts Rating (Amps)	Coil Input Voltages	Coil Resistance (Ohms)	Coil Nominal Power
20117-82	105A	DPDT	10A	24VAC	74	2.2VA
20117-84	105A	DPDT	10A	120VAC	1,800	2.2VA
20117-85	105A	DPDT	10A	240VAC	6,800	2.2VA
20118-84	105A	3PDT	10A	120VAC	1,800	2.2VA

165/166 SERIES

Flange-Mount Versions are Also Available.

Stock No.	Series	Contacts Arrang.	Contacts Rating (Amps)	Coil Input Voltages	Coil Resistance (Ohms)	Coil Nominal Power
20307-82	166	DPDT	10A	24VAC	74	2.2VA
20307-84	166	DPDT	10A	120VAC	1,800	2.2VA
20307-85	166	DPDT	10A	240VAC	6,800	2.2VA
20308-82	166	3PDT	10A	24VAC	74	2.2VA
20308-84	166	3PDT	10A	120VAC	1,800	2.2VA
20308-85	166	3PDT	10A	240VAC	6,800	2.2VA
20310-80	166	DPDT	10A	6VDC	30	1.2W
20310-81	166	DPDT	10A	12VDC	120	1.2W
20310-82	166	DPDT	10A	24VDC	472	1.2W
20325-84	165	3PDT	5A	120VAC	1,800	2.2VA
20311-81	166	3PDT	10A	12VDC	120	1.2W
20311-82	166	3PDT	10A	24VDC	472	1.2W
20311-84	166	3PDT	10A	110VDC	9,500	1.2W
20381-82	166A	3PDT	10A	24VAC	74	2.2VA
20381-83	166A	3PDT	10A	120VAC	1,800	2.2VA

170 SERIES

Stock No.	Series	Contacts Arrang.	Contacts Rating (Amps)	Coil Input Voltages	Coil Resistance (Ohms)	Coil Nominal Power
20392-82	170	SPST-NO-DM	30A	24VAC	44	4.7VA
20392-83	170	SPST-NO-DM	30A	120VAC	1,100	4.7VA
20394-81	170	SPST-NO-DM	30A	12VDC	72	2W
20394-82	170	SPST-NO-DM	30A	24VDC	288	2W

268 SERIES

Stock No.	Series	Contacts Arrang.	Contacts Rating (Amps)	Coil Input Voltages	Coil Resistance (Ohms)	Coil Nominal Power
20684-82	268	DPDT	15A	24VAC	74	2.2VA
20684-84	268	DPDT	15A	120VAC	1,800	2.2VA
20686-82	268	DPDT	15A	24VDC	472	1.2W

DELTROL RELAYS MADE IN U.S.A.

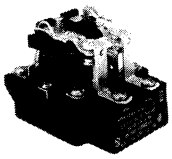
SEE SECTION 4550 FOR SOLENOIDS

General purpose relays with plastic dust cover with flange mounting, barrier-type .250" quick-connect terminals and molded-nylon coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA Recognized.

275F SERIES

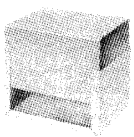
		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20844-82	275F	DPDT	25A	24VAC	55	2.4VA
20844-84	275F	DPDT	25A	120VAC	1,500	2.4VA
20848-82	275F	SPST-NO-DM	35A	24VDC	320	1.8W
20852-82	275F	DPDT	25A	24VDC	320	1.8W

Single Pole
L = 2-1/2
W = 2-1/2
H = 2-3/16



Double Pole
L = 3-11/32
W = 2-1/2
H = 2-3/8

Heavy duty power relay for industrial control applications. Particularly suited for motor controls, heater loads, welder loads, and other power switching applications. Molded nylon coil resists fungus and moisture. Long life, rugged construction. Rating: 30 amps, 1-1/2 hp, 120/240 VAC. Heavy duty screw-type terminals. Mounting: two 3/16" holes on 1-7/8" centers. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA listed (File No. 20690).



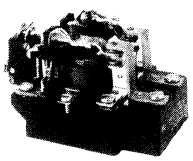
B-5 DUST COVER
L = 5
W = 4
H = 3
S/N 20257-80

Sealed knock-out holes for standard conduit fittings. Relay mounts on pre-drilled base. Constructed of Aluminum. Snap action cover release. Accommodates relay series 900.

900 SERIES

Auxiliary Switch Models are Also Available.

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20237-82	900	SPST-NO	30A	24VAC	12	9.5VA
20237-83	900	SPST-NO	30A	120VAC	290	9.5VA
20238-82	900	SPST	30A	24VAC	12	9.5VA
20238-83	900	NO-DM	30A	120VAC	290	9.5VA
20239-82	900	SPDT	30A	24VAC	12	9.5VA
20239-83	900	SPDT	30A	120VAC	290	9.5VA
20240-82	900	DPST-NO	30A	24VAC	12	9.5VA
20240-83	900	DPST-NO	30A	120VAC	290	9.5VA
20240-84	900	DPST-NO	30A	240VAC	1,200	9.5VA
20241-82	900	DPDT	30A	24VAC	12	9.5VA
20241-83	900	DPDT	30A	120VAC	290	9.5VA
20241-84	900	DPDT	30A	240VAC	1,200	9.5VA
20243-81	900	SPDT	30A	12VDC	72	2W
20243-82	900	SPDT	30A	24VDC	290	2W
20244-81	900	DPST-NO	30A	12VDC	72	2W
20244-82	900	DPST-NO	30A	24VDC	290	2W
20245-81	900	DPDT	30A	12VDC	72	2W
20245-82	900	DPDT	30A	24VDC	290	2W
20245-84	900	DPDT	30A	110VDC	6,050	2W



L = 4-1/4
W = 2-1/2
H = 2-3/8

900 Series heavy duty power relay with snap-action, 10 amp, 1/4" hp, SPDT auxiliary switch. Molded nylon coil resists fungus and moisture. Listed under the Components Program of Underwriters Laboratories, Inc. (File No. E37066). CSA File No. 20690.

900-1C SERIES

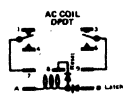
		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20246-83	900-1C	DPDT	30A	120VAC	290	9.5VA
20249-82	900-1C	DPST-NO	30A	24VDC	290	2W

L = 1-13/32
W = 1-1/2
H = 2-3/16

Latching relays especially suited for AC power supplies. Units have moisture and fungus-resistant nylon encapsulated coil. Recognized under the Components Program of Underwriters Laboratories, Inc. (File No. E37066).

166ML SERIES

		Contacts		Coil		
Stock No.	Series	Arrang.	Rating (Amps)	Input Voltages	Resistance (Ohms)	Nominal Power
20525-84	166ML	DPDT	10A	120VAC	1,800	4VA



WIRING DIAGRAMS FOR 166ML SERIES

Diodes are Externally Wired and Supplied by customer. Type IN4005 or equivalent recommended. 3PDT ONLY

All Dimensions are Nominal.

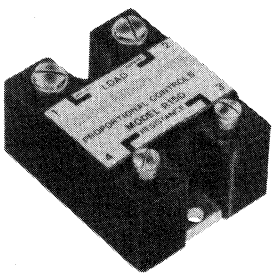
DELTROL controls / DIVISION OF DELTROL CORP
2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

DOUGLAS RANDALL
Division of Kidde Industries, Inc.
KIDDE
6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

RELAYS & COIL PRODUCTS

RELAYS

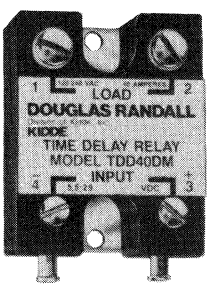
PROPORTIONAL CONTROL



- R series for variable AC control with variable resistor input
- An additional module to provide variable AC control with 0-10 VDC input
- RD series for variable AC control with 0-10 VDC input in one module

See EEM page **B•1409**

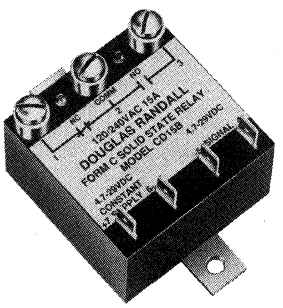
TIME DELAY



- Up to 40 amp operation
- Total solid state unit
- Timing set by external resistor from 300 ms to 23 min. duration on standard units
- Full opto-isolation, zero crossover, integral heat sink features

See EEM page **B•1407**

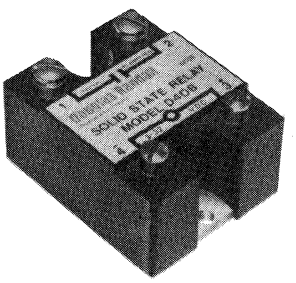
FORM C RELAY



- True Form C Function
- Full Solid State Design Incorporates Opto Isolation, 0-Voltage Switching, Integral Heat Sink
- LED Indicators of Switching Status
- Models Available for Both AC and DC Loads

See EEM page **B•1406**

SOLID STATE RELAY



- Full line of standard AC output relays UL recognized
- DC output relays to 8 amp and 500V
- Opto isolation, zero voltage switching

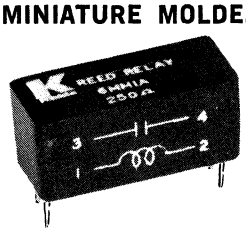
See EEM page **B•1408**

REED RELAY and COIL PRODUCTS

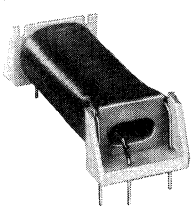
REED RELAYS

- One week turnaround on special samples

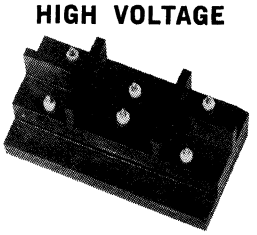
MINIATURE MOLDED



OPEN TYPES

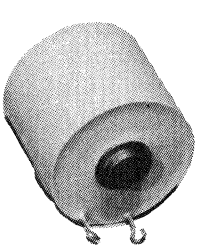


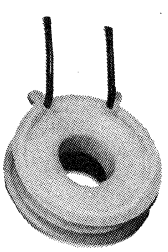
HIGH VOLTAGE

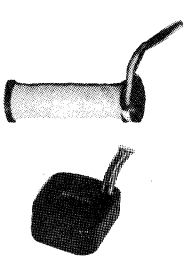


COILS

Tape wound
Bobbin wound
Molded
Interleave
Interweave
Encapsulated







TRANSFORMERS

- Up to 500 VA split bobbin types available
- Specialty transformers of all types

DOUGLAS RANDALL

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KIDDE
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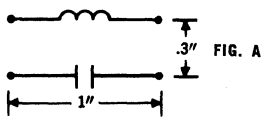
REED RELAYS

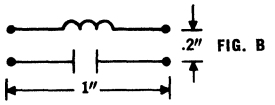
new

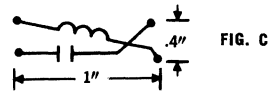
Form 1C (SPDT) and Form 2C (DPDT) UL RECOGNIZED REED RELAYS

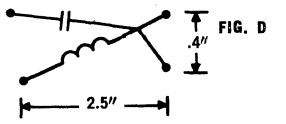
FILE NO. E/54552; C.C. NRNT2

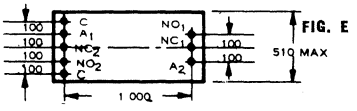
Fig.	Part No.	Nom. Volt.	DCR Ohms ±10%	Contact Rating
1 & A	377885 377455 377886	6 12-19 24	250 1200 4000	10W, .5A or 200VDC 120VAC @ .275 Amp Use for gating triacs @120VAC
1 & B	377472 375388 377471	6 12-19 24	250 1200 4000	
1 & C	377327 377806 377807	5 12 24	250 1000 4000	240VAC @ .040 Amp. Use for gating triacs @ 240VAC
2 & D	377307 (SE) 377410 377201	6 12 24	175 700 2880	3A @ 17VDC 1A @ 100VDC .3A @ 300VDC For inductive AC loads up to the ratings shown.
	CSA Certified — File LR 34149			
3	377808 377809 377810 373350	6 12 24 48	250 1000 2150 2150	20W, .5A or 500VDC 240VAC @ .040 Amp. Use for triac gating ± 240VAC
4 & B	378510 378511 378512	6 12 24	170 675 2700	10W, .5A or 200VDC 120VAC @ .275A Used for gating triacs @ 120VAC
4 & B	378513 378514 378515	6 12 24	170 675 2700	As above, supplied with dust cover
1 & E	378193 378194 378195	6 12 24	170 675 2700	Form 2C .05A @ 20VAC or VDC
5 & F	378196 378197 378198	6 12 24	250 1000 4000	Form 1C .05A @ 20VAC or VDC

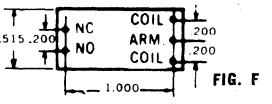


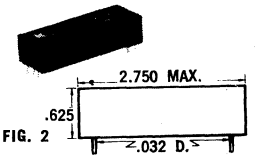


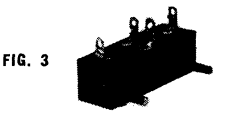


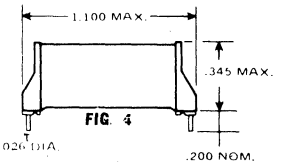


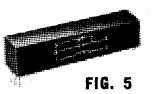










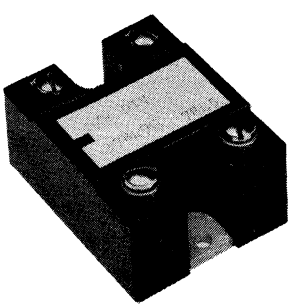


SPECIAL DESIGNS

Douglas Randall makes custom designed relays to solve difficult problems. A few models are shown below to illustrate the variety available.

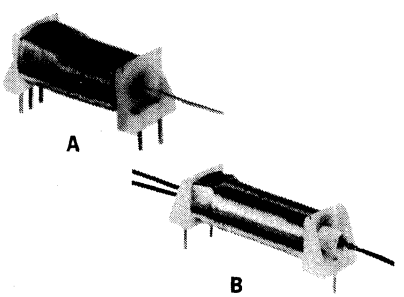
Douglas Randall will gladly review your applications and offer rapid engineering and prototype service.

CURRENT SENSING RELAYS



Douglas Randall offers a line of DC current sensing relays with coils capable of handling 25 Amperes DC. Contact arrangements can be Form 1A, Form 1B, or Form 1C.

HIGH INSULATION RESISTANCE RELAYS



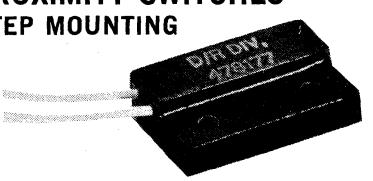
Two typical designs are shown above:

A — A miniature reed relay with a floating lead to maintain high IR.

B — This is a relay using Form A and Form B switches timed to provide a Form C (break before make) function with flying leads to maintain 10^{13} ohms. Up to 5 Form A contacts are available @ 10^{13} ohms.

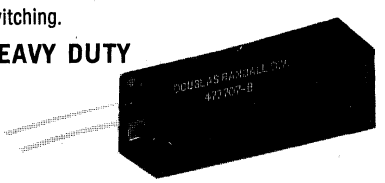
PROXIMITY SWITCHES

STEP MOUNTING



This encapsulated switch is available with Form 1A, Form 1B, Form 1C or Form 2A contacts. It can be supplied with dry reed, mercury wet, high voltage (to 1,000VDC) or high power (to 100VA) contacts. The one shown was designed for low contact resistance and low level switching.

HEAVY DUTY



The proximity switch shown above has heavy duty contacts rated at 100VA. This switch and matching magnet are epoxy encapsulated for heavy duty use on outdoor machinery.

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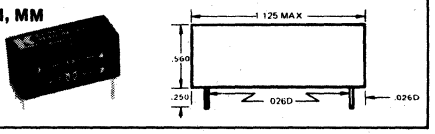
REED RELAYS

MINIATURE REED RELAYS

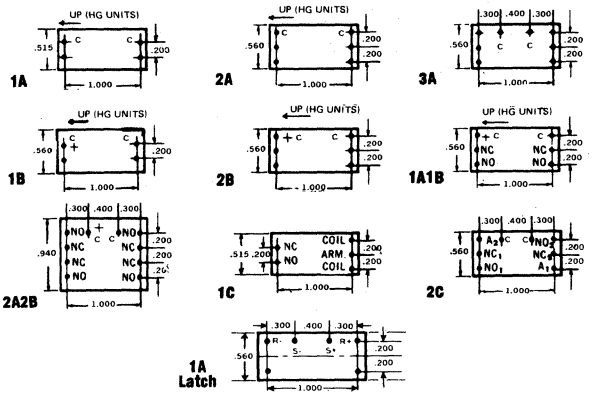
Molded — Series MM Dry, HgM Mercury Wet*
Open — Series MG Dry Reed, HgMG Mercury Wet*

Form	Nominal Voltage	DCR Ohms ±10%	MM Series Part Number	MG Series Part Number
1A	6 12 24	250 1000 4000	6MM1A 12MM1A 24MM1A	6MG1A 12MG1A 24MG1A
2A	6 12 24	170 675 2700	6MM2A 12MM2A 24MM2A	6MG2A 12MG2A 24MG2A
3A	6 12 24	110 450 1800	6MM3A 12MM3A 24MM3A	6MG3A 12MG3A 24MG3A
4A	6 12 24	60 250 1000	— — —	6MG4A 12MG4A 24MG4A
5A	6 12 24	50 200 800	— — —	6MG5A 12MG5A 24MG5A
6A	6 12 24	50 200 800	— — —	6MG6A 12MG6A 24MG6A
1B	6 12 24	170 675 2700	6MM1B 12MM1B 24MM1B	6MG1B 12MG1B 24MG1B
2B	6 12 24	110 450 1800	6MM2B 12MM2B 24MM2B	6MG2B 12MG2B 24MG2B
1A1B	6 12 24	110 450 1800	6MM1A1B 12MM1A1B 24MM1A1B	6MG1A1B 12MG1A1B 24MG1A1B
2A2B	6 12 24	50 200 800	6MM2A2B 12MM2A2B 24MM2A2B	6MG2A2B 12MG2A2B 24MG2A2B
1C	6 12 24	250 1000 4000	6MM1C 12MM1C 24MM1C	6MG1C 12MG1C 24MG1C
2C	6 12 24	170 675 2700	6MM2C 12MM2C 24MM2C	6MG2C 12MG2C 24MG2C
3C	6 12 24	60 250 1000	— — —	6MG3C 12MG3C 24MG3C
4C	6 12 24	50 200 800	— — —	6MG4C 12MG4C 24MG4C
1A Latch	6 12 24	85/85 340/340 1350/1350	6MML1A 12MML1A 24MML1A	6MGL1A 12MGL1A 24MGL1A

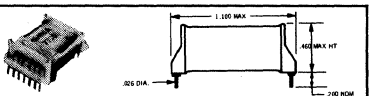
Miniature Molded, MM



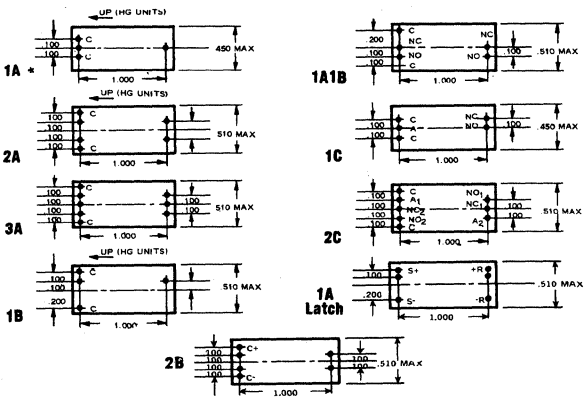
Terminal Layout Series MM (Bottom View)



Miniature Open, MG



Terminal Layout Series MG (Bottom View)



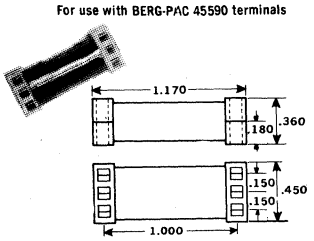
Contact Data — Series MM, SI, MG, XMG and Hg Versions

Contact Type	Contact Rating Form A	Form B	Form C
Dry	10W 12VA .5A 250VDC .15Ω*	10W 12VA .5A 250VDC .15Ω*	3W 3VA .25A 100VDC .2Ω*
Hg Wet	28W — 1A 1000VDC .05Ω*	28W — 1A 1000VDC .05Ω*	14W 14VA .5A 1000VDC .05Ω*
All Position Hg Wet	3W 2.5VA .25A 1000VDC .05Ω*	— — — — —	— — — — —

* Initial Resistance

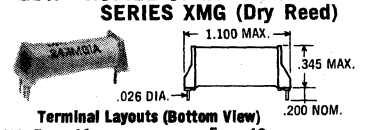
SNAP-IN RELAYS SERIES SI

For use with BERG-PAC 45590 terminals

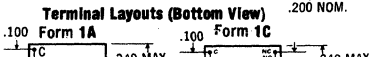


Form	Nominal Voltage	Part Number	DCR Ohms ±10%
1A	6 12 24	6SI1A 12SI1A 24SI1A	250 1000 4000

LOW PROFILE OPEN RELAYS SERIES XMG (Dry Reed)



Terminal Layouts (Bottom View)



Form	Nominal Voltage	Part Number	DCR Ohms ±10%
1A*	6 12 24	6XMG1A 12XMG1A 24XMG1A	168 675 2700
1C*	6 12 24	6XMG1C 12XMG1C 24XMG1C	168 675 2700

Note: Nylon Cover Available.
* Hg wet switches available.

NOTES

1. E/M shields std. all Series MM and all Form B and Form L.
2. E/S shields optional.
3. 1000VDC switches available all Form A and B relays.
4. Premium run-in switches available all models.
5. Ultra sensitive relays available.
6. Series MML/1A, have internal diodes.

* Hg Wet, Form C, & Non-Position Sensitive available

OPERATING DATA — All Series

Must Operate — 70% Nominal
Must Release — 10% Nominal
Maximum Voltage —
Form A and C — 200% Nominal
Form B and Latching — 130% Nominal
Environmental Data: −20°C to +65°C; vibration 35g to 2000cps: shock, 30g.

DOUGLAS RANDALL

Division of Kidde Industries, Inc.

KIDDE

6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

REED RELAYS

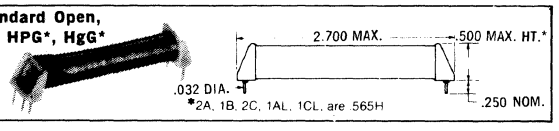
STANDARD SIZE REED RELAYS

Molded — Series SM, HP*, Hg*
Open — Series SG, HPG*, HgG*

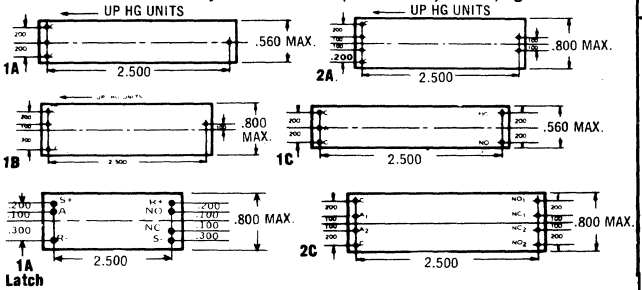
		SM Series	Molded	SG Series	Open
Form	Nominal Voltage	Part Number	DCR Ohms ±10%	Part Number	DCR Ohms ±10%
1A	6	6SM1A	180	6SG1A	180
	12	12SM1A	725	12SG1A	720
	24	24SM1A	2900	24SG1A	2880
2A	6	6SM2A	175	6SG2A	110
	12	12SM2A	700	12SG2A	440
	24	24SM2A	2750	24SG2A	1760
1B	6	6SM1B	175	6SG1B	110
	12	12SM1B	700	12SG1B	440
	24	24SM1B	2750	24SG1B	1760
2B	6	6SM2B	140		
	12	12SM2B	550		
	24	24SM2B	2200		
1C	6	6SM1C	180	6SG1C	180
	12	12SM1C	725	12SG1C	720
	24	24SM1C	2900	24SG1C	2880
2C	6	6SM2C	175	6SG2C	110
	12	12SM2C	700	12SG2C	440
	24	24SM2C	2750	24SG2C	1760
1A Latch	6	6SML1A	85/85	6SGL1A	85/85
	12	12SML1A	340/340	12SGL1A	340/340
	24	24SML1A	1350/1350	24SGL1A	1350/1350

*For part numbers and DCR values contact factory. See specification table for contact ratings.

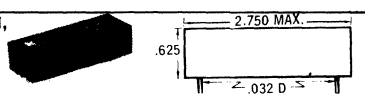
Standard Open, SG, HPG*, HgG*



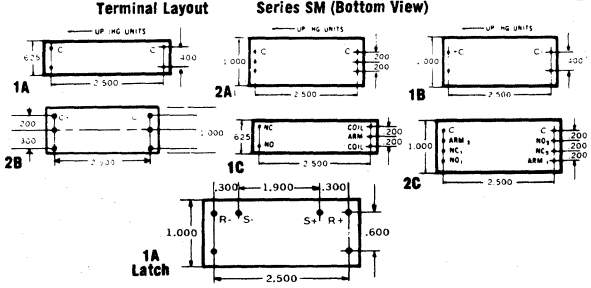
Terminal Layout **Series SG (Bottom View) — HPG, HgG**



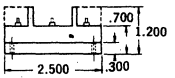
Standard Molded, SM, HP*, HG



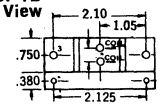
Terminal Layout **Series SM (Bottom View)**



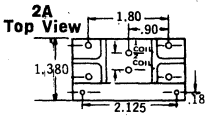
HIGH VOLTAGE RELAYS — HV SERIES



1A or 1B Top View



2A Top View



Form	Nom. Volt.	Part Number	DCR Ohms ±10%
1A (1B*)	6	6HV1A	25
	12	12HV1A	100
	24	24HV1A	400
2A	6	6HV2A	20
	12	12HV2A	80
	24	24HV2A	320

OPTION:
* Relays available in Form B up to 7,500V.

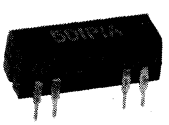
Note: To order, specify as follows: 6HV1A 35 is a 6HV1A relay with 3,500VDC switch.

CONTACT DATA

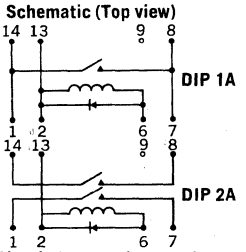
Series	Maximum Resistive Rating			Breakdown Voltage (min.)	Initial Resistance
35	3,500VDC	3.0A	50W	5,000VDC	.100 Ohms
75	7,500VDC	3.0A	50W	10,000VDC	.100 Ohms
100	10,000VDC	3.0A	50W	12,500VDC	.100 Ohms

SERIES DIP RELAYS

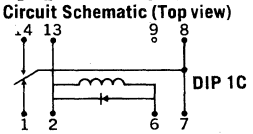
Fit all standard DIP sockets.
Compatible with logic inputs.
Packaged for Automatic Insertion.



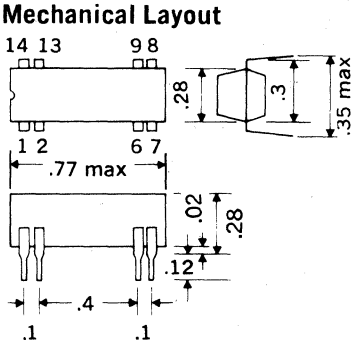
Schematic (Top view)



Circuit Schematic (Top view)



Mechanical Layout



SERIES DIP RELAYS

Contact Form	Nominal Voltage	DCR Ω±10%	*Part Number
1A	5 VDC	500	5 DIP 1A
	12 VDC	800	12 DIP 1A
	24 VDC	2000	24 DIP 1A
2A	5 VDC	140	5 DIP 2A
	12 VDC	400	12 DIP 2A
	24 VDC	1300	24 DIP 2A
1C	5 VDC	200	5 DIP 1C
	12 VDC	500	12 DIP 1C
	24 VDC	1500	24 DIP 1C

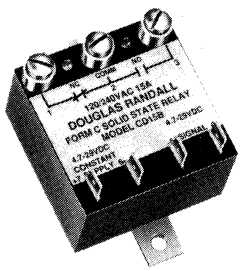
*Clamp Diode Available, add D to Part Number e.g. 5 DIP 1AD.

Contact Rating — 1A & 2A 10 VA @ .3A or 100 VDC
1C 3 VA @ .2A or 30 VDC
Initial Control Resistance — 1A & 2A .150Ω
1C .150Ω
Must Operate — 75% Nominal
Must Release — 10% Nominal

DOUGLAS RANDALL
Division of Kidde Industries, Inc.
KIDDE
6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

FORM C RELAYS

FORM C AC SWITCHING RELAYS



FEATURES

- True Form C Function
- Full Solid State Design Incorporates Opto Isolation, O-Voltage Switching, Integral Heat Sink
- LED Indicators of Switching Status
- Models Available for Both AC and DC Loads

The Douglas Randall Form C Solid State relay is a true break-before-make device. LEDs indicate the conducting side of the relay. Opto isolation, zero crossover and integral heat sink are standard. Units are available with either DC or AC input.

MODEL	CONSTANT SUPPLY	INPUT SIGNAL	OUTPUT
CD15B	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp 120-240 VAC
CD40B	4.7-29 VDC Continuous	4.7-29 VDC	40 Amp 120-240 VAC
CA15B	90-140 VAC Continuous	Dry Switch	15 Amp 120-240 VAC
CA40B	90-140 VAC Continuous	Dry Switch	40 Amp 120-240 VAC

OPERATION

DC INPUT

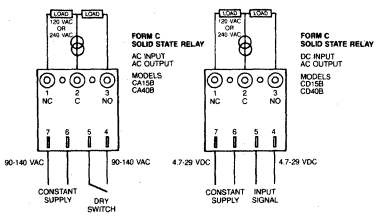
The relay requires a constant supply of DC voltage independent of the switching signal or output load functions. In order for the relay to operate, both DC constant supply and AC load must be connected to the appropriate terminals (see schematic). At this point, the NC load will conduct while the NO load will remain open. In order to switch the relay, the signal terminals are activated by a DC signal of 4.7-29 VDC. At this time the normally closed contacts will open and the normally open contacts will close. LED on indication shows the conducting side at all times. Removal of the DC signal voltage switches the relay to its initial conducting position. If the constant supply is not applied, both sides will be open and both LEDs will be off. Constant supply can be used as an on-off switch on the normally closed side.

AC INPUT

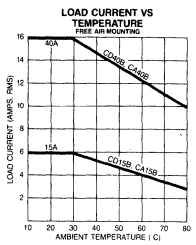
The Form C relay with AC input requires a 90-140 VAC constant supply and a dry closure for the switch signal. The operation of the relay and indication of the LEDs are the same as for the DC input models.

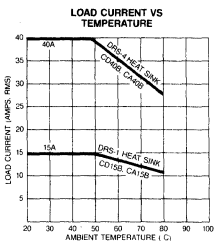
O-CROSSING AND TRANSFER TIME

The Form C relay incorporates a O-crossing feature to minimize switching transients. To assure break-before-make between output terminals, a 10ms. minimum transfer time is designed into the unit. Due to O-crossing variations, the maximum transfer time could be as much as 18ms.



The relay is a seven terminal device. Terminals 1, 2, and 3 are output terminals. Terminals 4 and 5 are signal terminals, and 6 and 7 are constant supply terminals.





INPUT DATA-AC LOAD RELAYS

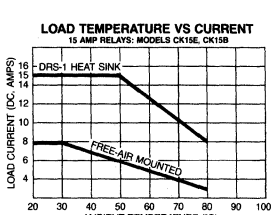
	DC SIGNAL	CONSTANT SUPPLY	AC SIGNAL	CONSTANT SUPPLY
Range	4.7-29 VDC	4.7-29 VDC	Dry Closure	90-140 VAC
Must Operate	4.7 VDC	4.7-29 VDC		90 VAC
Must Release	1.0 VDC	1.0 VDC		10 VAC
Input Impedance	2.7K	2.7K		5.5K
Isolation Signal to Load Signal to Base	 4000 V 2500 V	 4000 V 2500 V	 4000 V 2500 V	 4000 V 2500 V
Temperature Range	−20 + 80C		−20 + 80C	

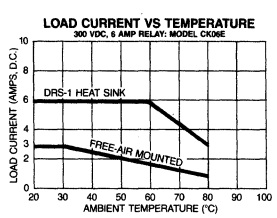
AC OUTPUT DATA

	CD15B	CA15B	CD40B	CA40B
AC Line Voltage	90-300 VAC	90-300 VAC	90-300 VAC	90-300 VAC
AC Load Current	15A	15A	40A	40A
Frequency	47-63Hz	47-63Hz	47-63Hz	47-63Hz
Voltage Drop at Rated Current	1.6	1.6	1.6	1.6
Minimum Holding Current	100MA	100MA	200MA	200MA
Typ. Turn On Voltage	6V	6V	6V	6V
Off-State Leakage Current	5MA	5MA	10MA	10MA
Isolation Output to Base	2500V	2500V	2500V	2500V

NOTES
1. Snubbers are included. For highly inductive applications, consult factory for additional assistance.
2. Specials available. Consult factory with requirements.
3. If the relay is connected properly, one LED will be on. If both LEDs are off, the relay will not operate. Be sure power is applied to output load terminals and constant supply terminals.

FORM C DC SWITCHING RELAYS





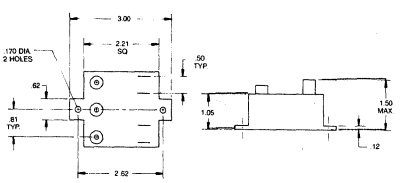
The Douglas Randall Form C DC solid state relay is a true break-before-make device. LEDs indicate the conducting side of the relay. Opto isolation and integral heat sink are standard in a fully epoxy encapsulated unit.

MODEL	CONSTANT SUPPLY	DC SIGNAL	OUTPUT
CK06E	4.7-29 VDC Continuous	4.7-29 VDC	6 Amp-300 VDC
CK15E	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp-300 VDC
CK15B	4.7-29 VDC Continuous	4.7-29 VDC	15 Amp-80 VDC

DC OUTPUT DATA

	CK06E	CK15B	CK15E
DC Line Voltage	2-300 VDC	2-80 VDC	2-300 VDC
Continuous Current	6ADC	15ADC	15ADC
Off State Leakage	2MA	5MA	5MA
Voltage Drop At Rated Current	1.5VDC	1.5VDC	1.5VDC
Isolation Load to Base Signal Load	 2500V 4000V	 2500V 4000V	 2500V 4000V
Minimum Holding Current	30MA	50MA	50MA

MECHANICAL ARRANGEMENT—ALL MODELS



NOTES
1. Specials available. Consult factory.
2. A transfer time of 10ms is designed into the unit. Other transfer times are available on request.
3. Weight 6 oz. Max.
4. 8-32 screws for load terminals and female connectors for constant supply and signal terminals included with relay.
5. All dimensions in inches.

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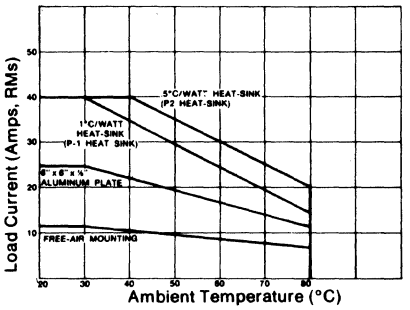
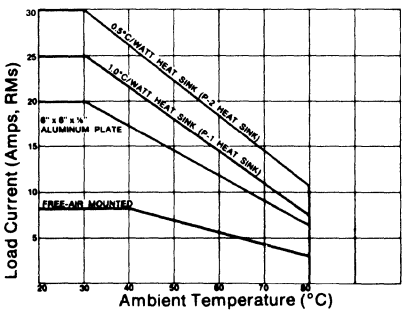
SOLID-STATE TIME DELAY RELAYS SERIES TD

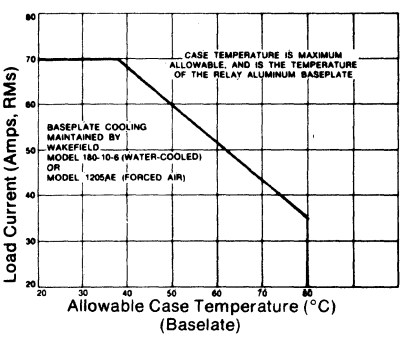
LOAD CURRENT VS. TEMPERATURE 40 AMP RELAYS:



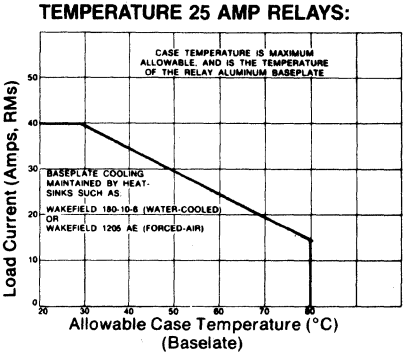
LOAD CURRENT VS. TEMPERATURE 25 AMP RELAYS:



CURRENT VS. BASE PLATE TEMPERATURE 40 AMP RELAYS:

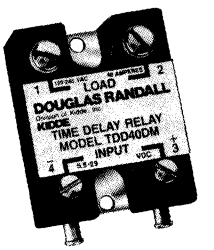


CURRENT VS. BASE PLATE TEMPERATURE 25 AMP RELAYS:



TIME DELAY RELAY SWITCHING

Series TD relays are available in delayed make or delayed break models, with DC or AC input, and switching capability up to 40 amps at 120/240 VAC. They incorporate leading edge R/C micro circuit technology and retain the desirable characteristics of our standard solid-state relays, such as opto-isolation, zero crossover, and integral heat sink. Time delay is set by applying an external resistor to the terminals provided.

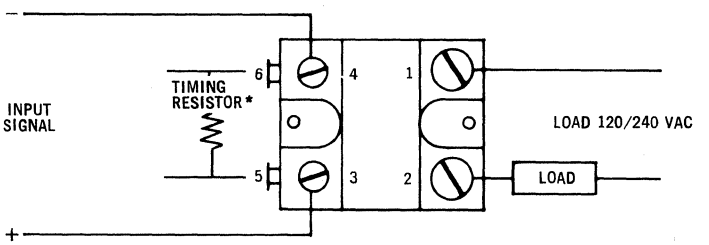


MODEL*	INPUT	OUTPUT AC	MODEL*	INPUT	OUTPUT AC
TDD25DM	5.5-29 VDC	120/240-25A	5TDD25DB	5.0 VDC**	120/240-25A
TDD40DM	5.5-29 VDC	120/240-40A	5TDD40DB	5.0 VDC**	120/240-40A
TDD25DB	5.5-29 VDC	120/240-25A	TDA25DM	90/140 VAC	120/240-25A
TDD40DB	5.5-29 VDC	120/240-40A	TDA40DM	90/140 VAC	120/240-40A
5TDD25DM	5.0 VDC**	120/240-25A	TDA25DB	90/140 VAC	120/240-25A
5TDD40DM	5.0 VDC**	120/240-40A	TDA40DB	90/140 VAC	120/240-40A

* DM—Delayed Make
DB—Delayed Break

** +10%, −5%

SCHEMATIC DIAGRAM



* Time is set by connecting the proper resistor to the terminals on the front of the unit (5 and 6). The value of the resistor corresponds to 15K ohms per second; i.e. 60K ohms will give a delay of 4 seconds. Standard units will accept up to 22 megohms, which corresponds to approximately 23 minutes. Special units may be ordered for extended time delays.

ACCURACY:

±1% from −20°C to +60°C with a common composition timing resistor. Accuracy can be improved by using special resistors or by keeping the resistor in a temperature controlled environment. Contact the factory for additional details.

SIZE:

2¼" long by 1¾" wide by 1⅛" high maximum.

WEIGHT:

4 oz. maximum.

Specifications are subject to change without notice.

GENERAL SPECIFICATIONS —ALL UNITS

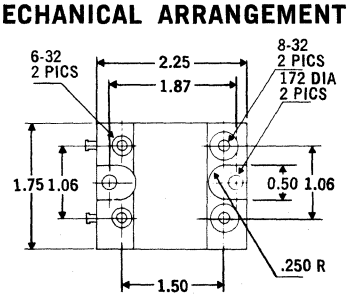
- Zero crossover switching
- 7500V opto-isolation
- Back-to-back SCR operation
- Timing: 15K ohm/second nominal; 22 megohms maximum.
- Minimum operation with resistor terminal shorted: 300 milliseconds nominal.
- All units have snubbers

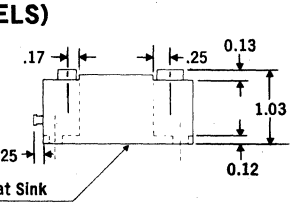
MECHANICAL OPTIONS

Available in OEM quantities. Contact Douglas Randall for details.

1. Model TD relays are available with lead wires or with spade terminals.
2. Changes in mounting hole dimensions are available as options.
3. Tapped mounting holes are available.

MECHANICAL ARRANGEMENT (ALL MODELS)





SIZE: 2¼ L x 1¾ W x 1⅛ maximum.
WEIGHT: 4 ounces maximum.

Special models can be provided with lead wires or other types of termination. Consult Douglas Randall for details.

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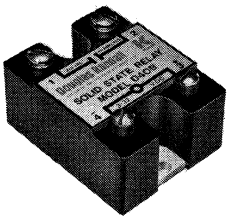
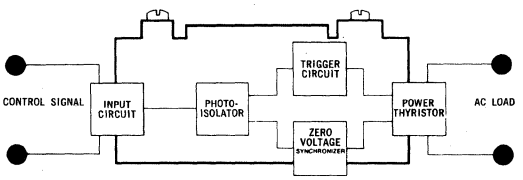
SOLID STATE COMPONENTS
STOCKED FOR IMMEDIATE DELIVERY

SOLID STATE RELAYS RATINGS TO 40 AMPS

AC OUTPUT / DC OR AC CONTROL UL RECOGNIZED / FILE NO. E60556 / C.C. NMFT2 CSA CERTIFIED FILE LR34149





Douglas Randall's line of solid state AC output relays are UL recognized for resistive, lamp and motor loads. Featuring opto-isolation and zero-voltage switching models are available to handle up to 40 Amp. DC or AC control signals can be specified and Form A or B output.

INPUT SIGNAL DATA (AC OR DC)

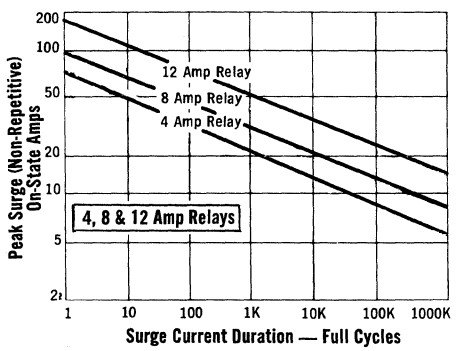
	DC	AC
Range	3-32V[5]	90-240VAC (80-140VDC)
Must Operate	3VDC	90VAC (80VDC)
Must Release	1VDC	10VAC (10VDC)
Input Impedance	1000Ω Min., 40KΩ Min.	
Isolation		
Signal to Load	1500V, 10^{10}Ω DC	
Signal to Base	1500V, 10^{10}Ω DC	
Capacitance	15 pF Signal to Load	
Temperature Range	−30°C to +80°C	

MODEL NUMBERS (NOTE 4)

Output Rating	Current	DC Signal	AC Signal
90-140VAC	4A	D04A	A04A
	8A	D08A	A08A
	12A	D12A	A12A
	25A	D25A	A25A
	40A	D40A	A40A
200-280VAC	4A	D04B	A04B
	8A	D08B	A08B
	12A	D12B	A12B
	25A	D25B	A25B
	40A	D40B	A40B
400-480VAC*	12A	D12D	A12D
	25A	**D25D**	**A25D**
	40A	**D40D**	**A40D**

* Not U/L Recognized
No Internal Snubber
Not CSA Certified

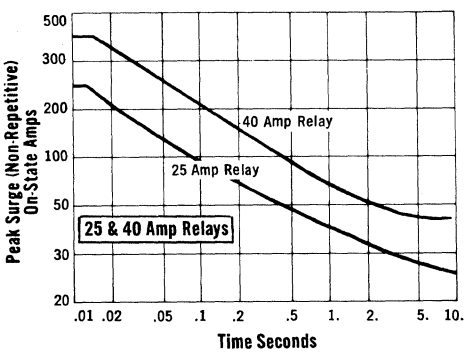
SURGE CURRENT VS TIME



OUTPUT DATA (AC OUTPUT)

Maximum Current	4A	8A	12A	25A	40A
One Cycle Surge Current	75A	100A	150A	250A	400A
Overload (1 sec., RMS)	20A	30A	50A	40A	75A
Minimum Holding Current	50mA Typ.	50mA Typ.	50mA Typ.	50mA Typ.	50mA Typ.

SURGE CURRENT VS TIME

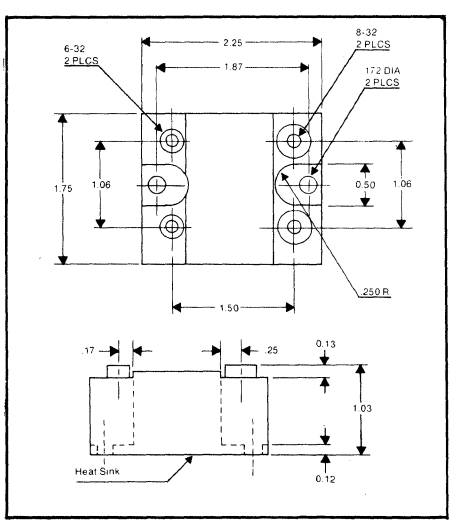


AC Line Voltage: 90/140V or 200/280V[1] @ 47-63 Hz[2]
Voltage Drop @ Rated Current: 1.6V Max.
Typical Turn-on Voltage: 5V
Response Time (DC Signal): ½ Cycle Max.
dv/dt[6] Off State: 100V/μsec.
Commutating: 5V/μsec.

Off State Leakage Current:
90/140VAC — 4.5mA Typ.
200/280VAC — 5.5mA Typ.
400/480VAC — 1.5mA Typ.
Isolation Output to Base: 1500V, 10^{10}Ω DC[3]
Contact Form: SPST (NO)[4]

NOTES AND OPTIONS

1. Special wide range models can be made which will switch loads from 18V to 140V. These relays can handle either 24VAC or 120VAC loads.
2. 2500VAC isolation between input and output.
3. Form A (SPST-NO) relays are standard. Form B (SPST-NC) switching is optional. Models incorporating this feature are designated by NC. e.g. A40B-NC.
4. All DC models are TTL compatible over the full operating temperature range.
5. All relays except 480VAC Models incorporate an RC snubber network which prevents false operation from transients up to the dv/dt level shown. More severe transients may require additional external protection. We will review your application and recommend the additional protection needed.



MECHANICAL SPECIFICATIONS

Size: 2¼"L x 1¾"W x 1⅛" maximum.

Weight: 4 ounces maximum.

Termination: Standard Models — Control Signal: 6-32 screws. Output: 8-32 screws.
Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory for details.

SPECIAL DESIGNS

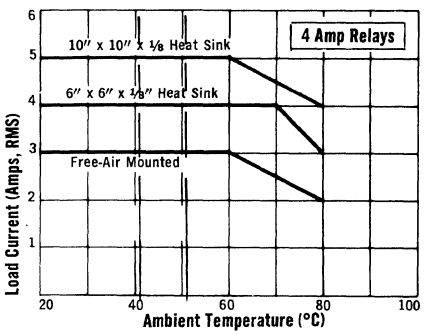
Douglas Randall has designed many special solid state relays, such as a polarized, latching, SPDT unit which will switch 12A at 28VDC. We also have the capability of making special package sizes and terminal arrangements for our solid state relays at moderate tool cost. Your inquiries will be reviewed promptly.

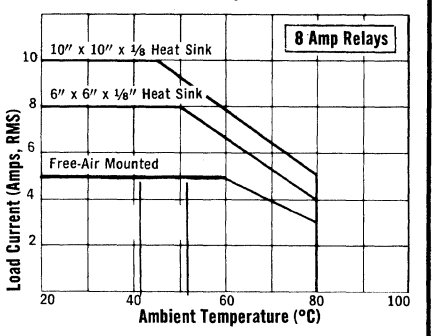
DOUGLAS RANDALL SOLID STATE COMPONENTS

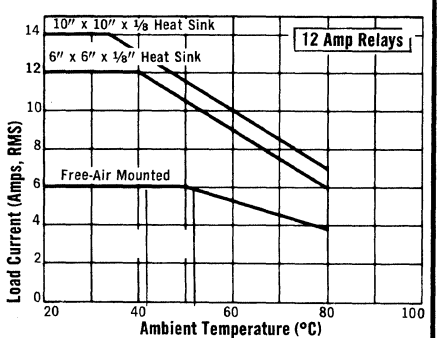
Division of Kidde Industries, Inc.
KIDDE
STOCKED FOR IMMEDIATE DELIVERY
6 Pawcatuck Avenue, P.O. Box 506, Pawcatuck, CT 06379 (203) 599-2075, FAX (203) 599-1754

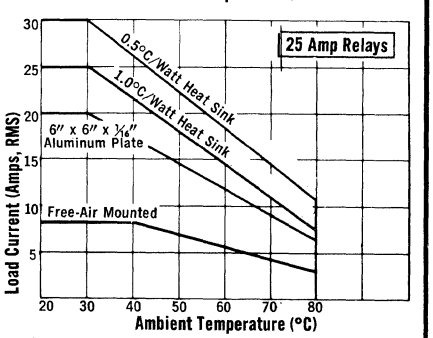
AC OUTPUT (Cont'd)

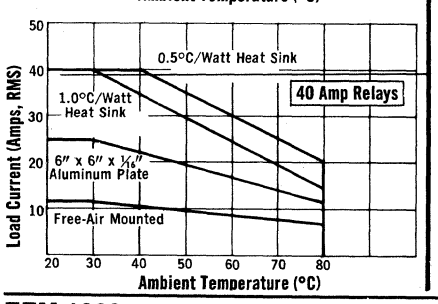
LOAD CURRENT VS TEMPERATURE











PROPOSITIONAL CONTROLS

40 AMP @ 480 VAC

Douglas Randall Proportional Control vary loads up to 40 Amp @ 480 VAC from 0 to 99%.

Mechanical Specifications on page 7

SERIES R — RESISTOR CONTROLS

These controls operate by connecting a variable resistor to the input terminals. See Figs. 1 & 2.

INPUT*
Variable Resistor (150,000Ω, 1 watt) — For 120VAC
Variable Resistor (1 Megohm, ½ watt) — For 240VAC, 277VAC or 480VAC

Output Voltage		CURRENT 5A	10A	15A	25A	40A
90-130 VAC	Models	R05A	R10A	R15A	R25A	R40A
200-240 VAC	Models	R05B	R10B	R15B	R25B	R40B
400-480 VAC	Models*	R05D	R10D	R15D	R25D	R40D

OUTPUT DATA

Maximum Current	5A	10A	15A	25A	40A
One Cycle Surge Current	75A	100A	150A	225A	400A
Overload (1 Sec., RMS)	20A	30A	50A	70A	150A
Minimum Holding Current	.05A	.05A	.07A	.08A	.09A
AC Line: 90/130 VAC, 200/240 VAC, 250/300 VAC or 400/480 VAC					
Typical Leakage: 90/130 VAC — 10 mA; 200-240 VAC — 7 mA; 250-300 VAC — 6 mA; 400-480 VAC — 3 mA*					

* Models R05D, R10D, R15D, R25D and R40D have no snubbers.

SERIES RD / LOGIC INPUT CONTROL

Series RD provide full control from 0% to 99% when energized by 0-10 VDC or 0-15m ADC signals.

MODEL RD04A AND MODEL RD04B UL Listed File Number E103645

INPUT SIGNAL	0-10 VDC or 0-15 ma DC[2]	
OUTPUT DATA	RD04A	RD04B
Maximum Current	4A	4A
One Cycle Surge Current	100A	100A
One Second Overload Current	40A	40A
Minimum Holding Current	.05A	.05A
AC Line Voltage	90-130 VAC @ 47-63 Hz	200-240 VAC
Off State Leakage	.01A (typical)	.01A (typical)
Response Time	150 m sec @ 10 VDC (typical)	300 m sec @ 10 VDC
Isolation (Input to Output)	500 VRMS	500 VRMS

Notes: 1. All data is measured at 25°C.
2. The input is not polarity sensitive, but **must be protected against voltages above 10 VDC.**

INPUT MODULES RDA, RDB & RDD

These modules accept 0-10 VDC signals. Their output is connected to the input terminals of Series R — Resistor Modules, which in turn controls loads up to 40 Amp @ 480 VAC. See Fig. 3.

NOMINAL PERCENTAGES OUTPUT VS INPUT RESISTANCE @ 25°C

Models R05 to R40A

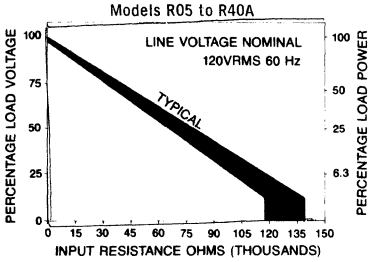


Fig. 1

Models R05 to R40B, R05 to R40D

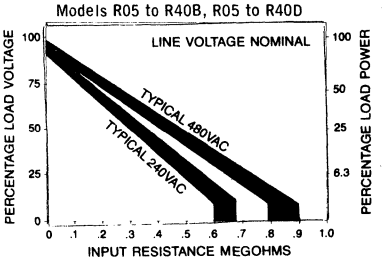


Fig. 2

PERCENT OUTPUT VOLTAGE VS INPUT VOLTAGE

Models RDA, RDB, RDD, RD04A, RD04B

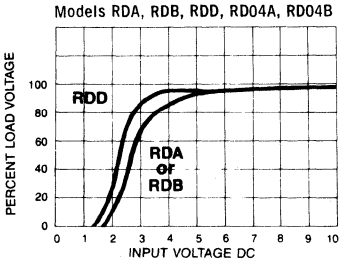


Fig. 3

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SOLID STATE RELAYS SERIES K
DC OUTPUT / DC CONTROL SIGNAL

NEW Output to 250 VDC

Douglas Randall Series K are SPST (NO) or (NC) relays which will switch loads of 4, 8 or 12 Amps to 250 VDC. They provide rapid switching and opto-isolation between input and output. The sensitive inputs are compatible with DTL or TTL logic. Arc-free switching makes these relays suitable for hazardous atmospheres.

MODEL NUMBERS

Output Voltage	Current	Model
2-32VDC	4 Amp	K04A
	8 Amp	K08A
	12 Amp	K12A
2-55VDC	4 Amp	K04B
	8 Amp	K08B
	12 Amp	K12B
2-250 VDC	6 Amp	K06D

*Inductive loads must be diode suppressed.
† Normally closed add — (NC) K04A-NC.

INPUT SIGNAL DATA

Range	3-32VDC
Must Operate	3VDC
Must Release	1VDC
Input Impedance	1000Ω Min.
Isolation	
Signal to Load	1500V
Signal to Base	1500V
Temperature	−30°C to +80°C

MECHANICAL ARRANGEMENT

See AC output relays on page B•1348

OUTPUT DATA

Continuous Current	4A, 8A, or 12A
DC Line Voltage	2-32VDC or 2-55VDC
Off State Leakage	2mA DC
Turn On Time	50 Micro Sec.
Turn Off Time	500 Micro Sec.
Voltage Drop @ Rate Current	1.5VDC Max.
Isolation Load to Base	1500V

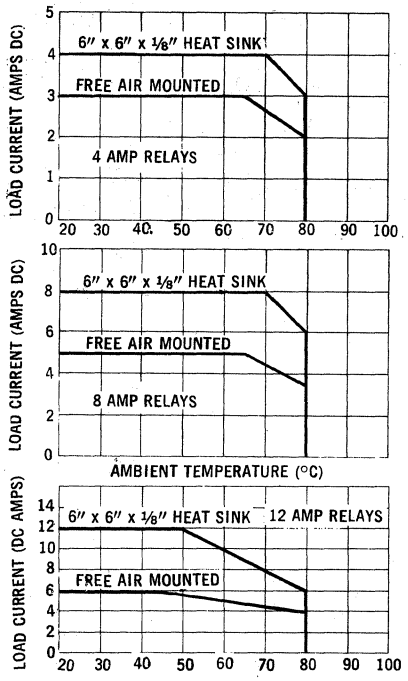
SIZE:
2¼L x 1¾W x 1⅛H Max.

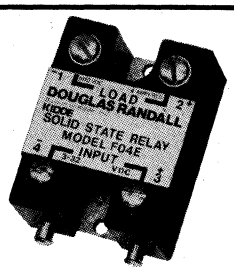
WEIGHT:
4 Ounces Max.

TERMINATION:
Standard Models —
Control Signal:
6-32 Screws
Output:
8-32 Screws

Special Models can be provided with lead wires or other types of termination in OEM quantities. Consult the factory & see pg. B•1348 for mechanical details.

LOAD CURRENT VS TEMPERATURE





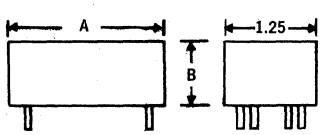
500 VDC SWITCHING

Series F Relays are available SPST (NO) or SPST (NC). They provide rapid switching of loads up to 8 amperes DC. Inputs are opto-isolated and compatible with DTL or TTL logic signals. Arc-free switching makes them suitable for hazardous atmospheres as well as machine tool process control equipment.

MODEL	CURRENT	OUTPUT VOLTAGE	SURGE CURRENT (MAX.) 100μs @ 2% DUTY CYCLE
F04E	4 Amp	25-500 VDC	30 Amp
F08E	8 Amp	25-500 VDC	60 Amp

Note: To designate normally closed relays, add suffix "NC"; e.g., F04E-NC.

SOLID STATE RELAYS — SERIES CV
PC MOUNTED —



INPUT DATA			OUTPUT DATA	
	CV1	CV2		CV1 & CV2
Nominal Voltage	5.5VDC	28VDC	Current	3A RMS
Voltage Range	4-10VDC	10-32VDC	Surge Current	80A Peak
Must Operate	4VDC	10VDC	Minimum Current	50mA
Must Release	.4VDC	.4VDC	Off State Leakage	8mA
Impedance	1000Ω	4000Ω	Voltage	24 to 240VAC
Isolation (Input to Output)	1500V	1500V		@ 47 to 63 Hz
	15pF	15pF	Voltage Drop	2.0VAC
			Offstate dv/dt	100V/μsec.
			Turn On Time	8.3msec.
			Turn Off Time	16 msec.

INPUT DATA			OUTPUT DATA	
	CV3	CV6		CV3 & CV6
Nominal Voltage	5.5VDC	28VDC	Maximum Current	3A DC
Voltage Range	4-10VDC	10-32VDC	Voltage Range	4-55VDC
Must Operate	4VDC	10VDC	Voltage Drop	1.6VDC
Must Release	.4VDC	.4VDC	Off State Leakage	10mA DC
Impedance	1000Ω	4000Ω	Turn On Time	500μsec.
			Turn Off Time	1.5msec.

INPUT DATA			OUTPUT DATA	
	CV4	CV5		CV4 & CV5
Voltage Range	10-55VDC	90-130VAC	Voltage	30VDC
Current	10mA	10mA	Current	16mA Max.
Must Not Operate	3mADC	.8mA RMS	Leakage	100μA
Isolation	1500V	1500V	Voltage Drop	.4VDC
Capacitance	10pF	10pF	Logic Supply Volt.	4-5-6VDC
Impedance	—	40KΩ	Logic Supply Cur.	10mA @ 6VDC

MODELS CV-1 & CV-2

3 Amp output @ 120/240 VAC
Zero crossover, Opto-isolation
Dim. A — 2.00" Max, B — .650" Max.

MODELS CV-3 & CV-6

3 Amp output @ 4 to 55 Volts DC
Opto-isolation
Dim. A — 2.00", B — .75"

MODELS CV-4 & CV-5

Convert 10-55 VDC (CV-4)
Convert 90-130 VAC (CV-5)
to Logic Level outputs
Opto-isolation
Dim A — 1.25", B — .50"

AC Output CV-1 & CV-2 U/L Recognized, File E60556, C.C.NMFT2
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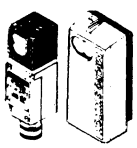
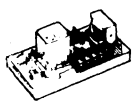
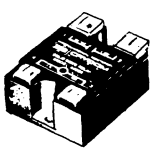

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS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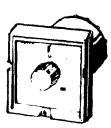
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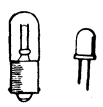
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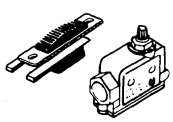
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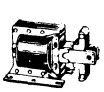
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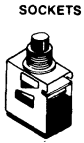
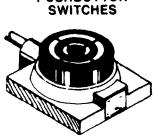

PUSHBUTTON SWITCHES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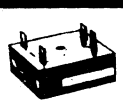
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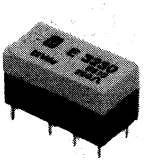
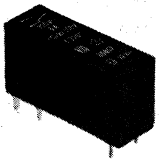
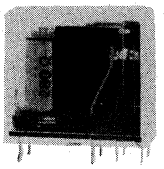
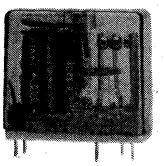
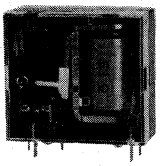
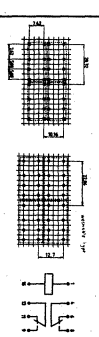
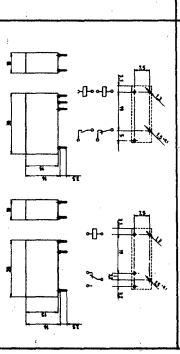
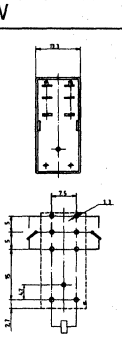
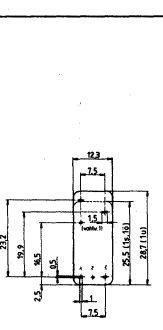
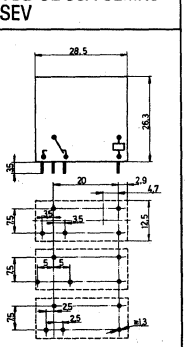
GENERAL PURPOSE PC BOARD RELAYS POWER RELAYS AND CONTACTORS						
		E3230	**E3207**	**E3208**	**E3201**	**E3206S**
FEATURES		DIP-construction, flux resistant, Ag-Pd-contacts, Au-plated washable types available	Large capacity—high sensitivity—small size/wide insulation distance—air and creepage distance >8 mm slim line type	Large capacity, compact size, wide insulation distance—flux resistant, washable, air and creepage distance >8 mm Latching types available slim line type	Porcelain base, low/high temperature peaks, large capacity, flux resistant	Large capacity, compact size, wide insulation distance, air and creepage distance >8 mm Latching types available washable types available slim line type
DIMENSIONS (inch)		.8(W)×.45(H)×.39(D)	1.1(W)×.63(H)×.4(D)	1.13(W)×1.04(H)×.52(D)	1.13(W)×1.0(H)×.48(D)	1.12(W)×1.04(H)×.5(D)
(mm)		20.32(W)×11.4(H)×9.8(D)	28(W)×16(H)×10(D)	28.8(W)×26.5(H)×13.3(D)	28.7(W)×25.5(H)×12.3(D)	28.5(W)×26.3(H)×12.7(D)
CONTACT ARRANGEMENT		2C	1A, 1B, 1C(1C:W=30mm)	2A, 2B, 2C	1A, 1B, 1C	1A, 1B, 1C
CONTACT RATING RESISTIVE		1.25A 125V AC	8A 220V AC	8A 220V AC	8A 240V AC 10A 120V AC 7A 30V DC	10A 220V AC
CONTACT MATERIAL		AgPd 40/60-Au (10μ)	AgCd O	AgCd O AgCuAu-plated	AgCd O, AgCu AgCuAu-plated	AgCd O AgCuAu-plated
LIFE	mechanical operations electrical at load	15×10^6 5×10^6	10^7 2×10^5(1A);10^5(1B,1C) 8A 220V AC	10^7 1.5×10^5 8A 220V AC	3×10^7 3×10^5 6A 220V AC	10^7 2×10^5 10A 220V AC
BREAKDOWN VOLTAGE BETWEEN COIL DATA	open contacts contacts and coil		1000V 4000V	1000V 4000V	1000V 2500V	1000V 4000V
	voltage (V)	6 12 24 48 5	6 9 12 24 48	6 12 24 48 60	5 6 12 24 48 60	6 12 24 48 60
	resistance (Ω)	66 280 1050 4000 36	160 360 660 2200 8000	53 280 1100 3500 6000	53 75 280 1100 3500 6000	75 280 1100 3500 6000
	power (W) pull-in voltage drop-out voltage	0.5 75% 10%	0.25 75% 10%	0.5 75% 10%	0.5 75% 10%	0.5 75% 10%
SPECS.	release time operate time	10 ms 10 ms	12 ms 18 ms	5 ms 11 ms	6 ms 14 ms	4 ms 10 ms (1B:14 ms)
	dielectric Str insulation res.	500V AC 1000 MΩ/500 V	2500V AC >50 MΩ/500V	2500V AC >50 MΩ/500V	2500V AC 100MΩ/500V	2500V AC 50MΩ/500V
TEMPERATURE RANGE		−25°C to +65°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C	−40°C to +70°C
APPROVALS *PENDING			UL*-CSA*-VDE	VDE-UL-CSA-SEMKO-SEV	UL-CSA	VDE-UL-CSA-SEMKO-SEV
BOTTOM VIEW (mm)						

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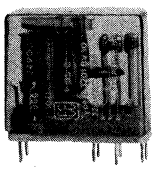
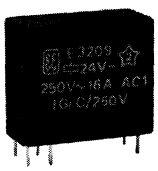
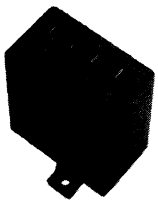
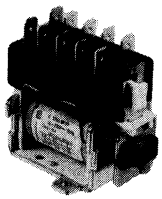
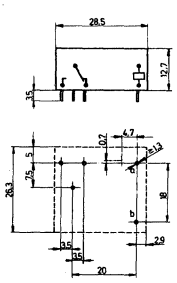
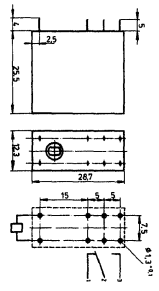
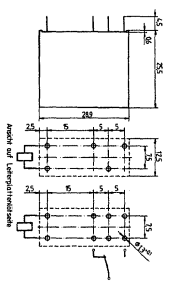
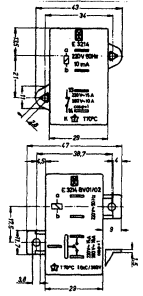
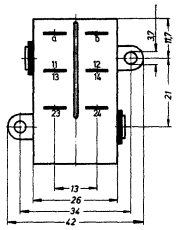
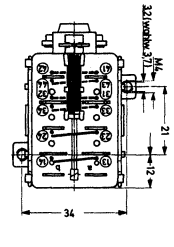
Precise performance within product specifications.
Complete engineering capability for application assistance.

					
E3206L	**E3201 BV30**	**E3209**	**E3214**	**E3252**	**E3250**
Large capacity— compact size, wide insulation distance, air and creepage distance >8 mm latching types available low profile type	Porcelain base, low/high temperature peaks, large capacity, flux resistant slim line type	Low/high temperature peaks, large capacity, flux resistant, washable, high inrush current capability	Fastons High switching capacity Universal mount	Fastons High switching capacity Universal mount	VDE 0660 Miniature Contactor, fastons High switching capacity Universal mount
1.12(W)×.5(H)×1.04(D)	1.13(W)×1.0(H)×.48(D)	1.13(W)×1.00(H)×.49(D)	1.75(W)×1.87(H)×1.02(D)	1.9(W)×1.97(H)×1.14(D)	2.13(W)×2.05(H)×1.61(D)
28.5(W)×12.7(H)×26.3(D)	28.7(W)×25.5(H)×12.3(D)	28.9(W)×25.5(H)×12.5(D)	44.5(W)×47.5(H)×26(D)	48(W)×50(H)×29(D)	54(W)×52(H)×41(D)
1A, 1B, 1C	1A, 1B, 1C	1A, 1B, 1C	1A, 1B, 1C	2A/1A, 1B/1A	4A/3A, 1B/2A-2B/3A 4A/3A, 1B/2A-2B/1B
10A 220V AC	16A	20A	10A 380V AC 15A 220V AC	16A 380V AC	16A 380V AC
AgCd O AgCuAu-plated	AgCd O	AgCd O	AgCd O	AgCd O	AgCd O
10^7 2×10^5 10A 220V AC	2×10^7 1.5×10^5 16A 220V AC	3×10^7 1.5×10^5 16A 220V AC	10^5 16A 220V AC	10^5 16A 250V AC	10^5 16A 220V AC
1000V 4000V	1000V 2500V	1000V 4000V	1500V 2000V	1000V 2500V	1000V 2000V
6 12 24 48 60	5 6 12 24 48 60	6 12 24 48 60	220V AC, 120V AC	380/220V AC, 120V AC	220/380V AC, 120V AC
75 280 1100 3500 6000	53 75 205 740 3500 6000	75 280 1100 3500 6000	2.2VA	3VA(1W)	6VA(3.6W)
0.5 75% 10%	0.5 75% 10%	0.35 75% 10%	80% 10%	80% 10%	80% 10%
4 ms 10 ms (1B:14 ms)	6 ms 14 ms	3 ms 7 ms	15 ms 25 ms	15 ms 25 ms	35 ms 50 ms
2500V AC 50MΩ/500V	2500V AC 100MΩ/500V	2500V AC 100MΩ/500V	2000V	2500V	2000V
−40°C to +70°C	−40°C to +70°C	−30°C to +70°C	−40°C to +70°C	−40°C to +70°C	−30°C to +60°C
VDE-UL-CSA-SEMKO-SEV	UL-CSA (1A)	UL-CSA-VDE	VDE-DEMKO-SEMKO-SEV-UL-CSA	VDE-SEV-SEMKO-UL-CSA	ÖVE-SEV-DEMKO-KEMA-SEMKO-UL*
					

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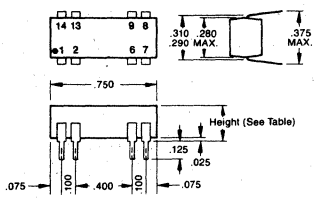
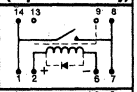
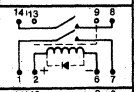
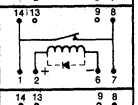
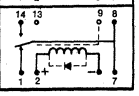
ELECTROL REED RELAYS

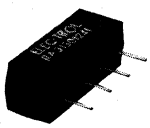
DIP

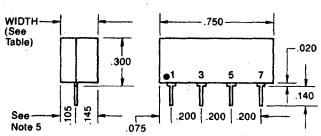


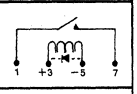
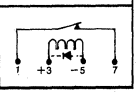
Contact Form	Contact Rating Max. Load (Resistive)	Part Number No Diode	Part Number With Diode	Coil V.D.C.	Coil Res. (ohms) @20°C ±10%	Max. Pick-Up V.D.C. @20°C	Min. Drop-Out V.D.C. @20°C	Physical Height	Physical No. Term.	E.S. Option *	Circuit Diagram (Top View of Relay)
1A SPST-NO	10W .5A 200V	RA30451051	RA30461051	5	500	3.8	1.0	.275"	8 Pin DIP	Yes	
		RA30451061	RA30461061	6	500	4.0	0.5				
		RA30451121	RA30461121	12	500	8.0	1.0				
		RA30451241	RA30461241	24	2150	16.0	2.0				
2A DPST-NO	10W .5A 200V	RA30982051	RA31232051	5	200	3.8	1.0	.275"	8 Pin DIP	Yes	
		RA30982061	RA31232061	6	200	4.0	1.0				
		RA30982121	RA31232121	12	500	8.0	2.0				
		RA30982241	RA31232241	24	2150	16.0	4.0				
1B SPST-NC	10W .5A 200V	RA30511051	RA30521051	5	500	3.8	1.0	.275"	8 Pin DIP	No	
		RA30511061	RA30521061	6	500	4.0	0.5				
		RA30511121	RA30521121	12	500	8.0	1.0				
		RA30511241	RA30521241	24	2150	16.0	2.0				
1C SPDT	3W .25A 100V	RA30421051	RA30441051	5	200	4.0	0.5	.275"	8 Pin DIP	Yes	
		RA30421061	RA30441061	6	80	4.0	0.5				
		RA30421121	RA30441121	12	500	8.0	1.0				
		RA30421241	RA30441241	24	2000	16.0	2.0				

* For electrostatic shielding add —02 to P/N

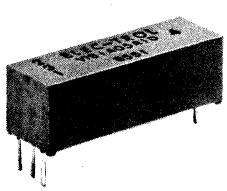
SIP

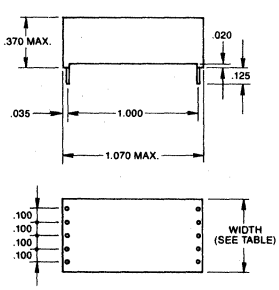


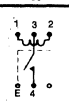
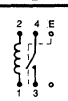


Contact Form	Contact Rating Max. Load (Resistive)	Part Number No Diode	Part Number With Diode	Coil V.D.C.	Coil Res. (ohms) @20°C ±10%	Max. Pick-Up V.D.C. @20°C	Min. Drop-Out V.D.C. @20°C	Physical Width	Physical No. Term.	E.S. Option *	Circuit Diagram (Top View of Relay)
1A SPST-NO	10W .5A 200V	RA31301051	RA31311051	5	500	3.8	1.0	.250"	4 Pin SIP	No	
		RA31301061	RA31311061	6	500	4.0	0.5				
		RA31301121	RA31311121	12	500	8.0	1.0				
		RA31301241	RA31311241	24	2150	16.0	2.0				
1B SPST-NC		RA31321051	RA31331051	5	500	3.8	1.0	.250"	4 Pin SIP	No	
		RA31321061	RA31331061	6	500	4.0	0.5				
		RA31321121	RA31331121	12	500	8.0	1.0				
		RA31321241	RA31331241	24	2150	16.0	2.0				

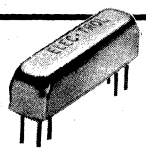
VISTA





Contact Form	Contact Rating (Resistive)	Part Number	Coil V.D.C.	Res. (ohms) @20°C ±10% Coil	Max. Pick-V.D.C. @20°C Up	Min. Drop-V.D.C. @20°C Out	Max. Width	Circuit Diagram (Top View of Relay) Replace "XX" in Part No. A	Circuit Diagram (Top View of Relay) Replace "XX" in Part No. B
1A	10W .5A 200V	VIS1A05X10	5	500	3.8	0.5	.350		
		VIS1A06X10	6	125	4.0	0.5			
		VIS1A12X10	12	500	8.0	1.0			
		VIS1A24X10	24	2000	16.0	2.0			
		VIS1A48X10	48	8000	32.0	4.0			
2A		VIS2A05X10	5	200	3.8	0.5	.450		
		VIS2A06X10	6	110	4.0	0.5			
		VIS2A12X10	12	440	8.0	1.0			
		VIS2A24X10	24	1750	16.0	2.0			
		VS2A48X10	48	7000	32.0	4.0			
1B	10W .5A 200V	VIS1B05X10	5	200	3.8	0.5	.450		
		VIS1B06X10	6	110	4.0	0.5			
		VIS1B12X10	12	440	8.0	1.0			
		VIS1B24X10	24	1750	16.0	2.0			
		VIS1B48X10	48	7000	32.0	4.0			
1C	3W .25A 100V	VIS1C05X10	5	500	3.8	0.5	.350		
		VIS1C06X10	6	125	4.0	0.5			
		VIS1C12X10	12	500	8.0	1.0			
		VIS1C24X10	24	2000	16.0	2.0			
		VIS1C48X10	48	8000	32.0	4.0			

MICRO MINIATURE



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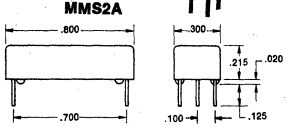
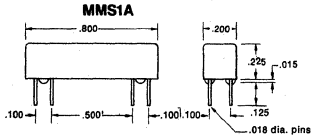
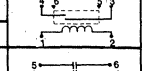
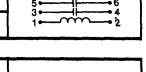


MMS1A



Contact Form	Contact Rating Max. Load	Part Number X Designates Contact Symbol	Coil V.D.C.	Coil Res. (ohms) @20°C	Max. Pick-Up V.D.C. @20°C	Min. Drop-Out V.D.C. @20°C	Circuit Diagram Bottom View
1A	See Table Below	MMS1A05AX3	5/6	150	3.7	0.4	
		MMS1A12AX3	12	900	9.0	1.0	
2A	See Table Below	MMS2A05AX3	5/6	200	3.7	0.4	
		MMS2A12AX3	12	800	9.0	1.0	

Form A Contact Symbol Numbers	Ratings (Res. Load) Watts D.C.	Ratings (Res. Load) Max. Amps	Ratings (Res. Load) Max. Volts	LIFE (x 10^4 Operations) Rated Load	LIFE (x 10^4 Operations) Low Levels	Max. Initial Contact Res. (ohms)	Min. Breakdown V.D.C.	Recommended Application
1	10	0.5	100	5	20	.2	200	Standard
2	5	0.5	100	1	50	.2	300	Dry/Low Level
3	5	0.5	100	5	20	.2	200	RF Loads

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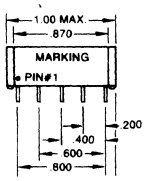
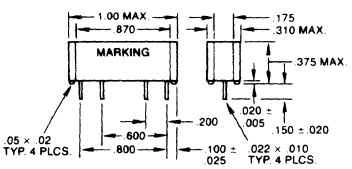
ELECTROL REED RELAYS/SOLID STATE RELAYS

BLUE BOY

BBS1C

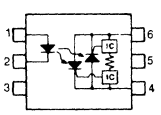


BBS1A & BBS1B

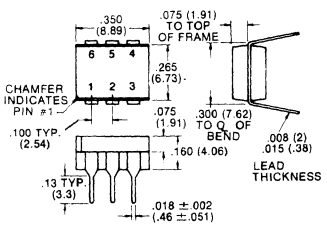


Part Number	Coil V.D.C.	Coil Res. Ohms @20°C ±10%	Max. Operate V.D.C. @20°C	Min. Release V.D.C. @20°C	Operate/ Bounce (Nominal Timing Milliseconds)	Supp. lease/ Re-Bounce (Nominal Timing Milliseconds)	Max. Coil V.D.C.	Minimum V.D.C. Breakdown: Open Contacts	Minimum V.D.C. Breakdown: Insulated Terminals	Maximum D.C. Resistive Contact Rating: Watts	Maximum D.C. Resistive Contact Rating: Amps	Maximum D.C. Resistive Contact Rating: Volts	Circuit Diagram (Top View)
BBS1A Series													
BBS1A05A10	5-6	500	3.8	0.5	0.4/0.3	0.1/—	8.0	300	1500	10	0.5	200	
BBS1A06A10	5-6	125	3.8	0.5	0.4/0.3	0.1/—	8.0	300	1500	10	0.5	200	
BBS1A12A10	12	500	8.0	1.0	0.4/0.3	0.1/—	16.0	300	1500	10	0.5	200	
BBS1A24A10	24	2000	16.0	2.0	0.4/0.3	0.1/—	32.0	300	1500	10	0.5	200	
BBS1A48A10	48	8000	32.0	4.0	0.4/0.3	0.1/—	64.0	300	1500	10	0.5	200	
BBS1C Series													
BBS1C05A10	5-6	200	4.0	0.5	0.6/0.4	0.5/1.2	8.0	100	1500	3.0	0.25	200	
BBS1C06A10	5-6	125	4.0	0.5	0.6/0.4	0.5/1.2	8.0	100	1500	3.0	0.25	200	
BBS1C12A10	12	500	8.0	1.0	0.6/0.4	0.5/1.2	16.0	100	1500	3.0	0.25	200	
BBS1C24A10	24	2000	16.0	2.0	0.6/0.4	0.5/1.2	32.0	100	1500	3.0	0.25	200	
BBS1B Series													
BBS1B05A10	5-6	500	3.8	0.5	0.5	0.4/0.3	8.0	300	1500	10	0.5	200	
BBS1B06A10	5-6	125	3.8	0.5	0.5	0.4/0.3	8.0	300	1500	10	0.5	200	
BBS1B12A10	12	500	8.0	1.0	0.5	0.4/0.3	16.0	300	1500	10	0.5	200	
BBS1B24A10	24	2000	16.0	2.0	0.5	0.4/0.3	32.0	300	1500	10	0.5	200	
BBS1B48A10	48	8000	32.0	4.0	0.5	0.4/0.3	64.0	300	1500	10	0.5	200	

SC6 SERIES
(SOLID STATE RELAYS)

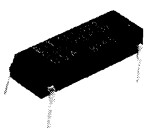


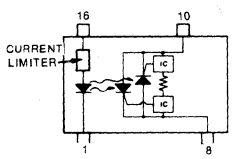
CIRCUIT DIAGRAM
(Top View)



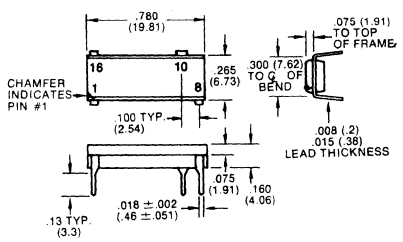
Part No.	Input: Operate Current	Output: Rated Voltage	Output: Rated Current
SC610 SC612	15mA 5mA	140Vrms	0.5 Amp
SC620 SC622	15mA 5mA	280Vrms	0.5 Amp
SC630 SC632	15mA 5mA	280Vrms	0.5 Amp

SB SERIES
(SOLID STATE RELAYS)





CIRCUIT DIAGRAM



Part No.	Input: Current Limiter	Input: Operate Range	Output: Rated Voltage	Output: Rated Current
SB5421 SB5421V*	Constant Current	3.8-32VDC	12-140Vrms	.010 to 1.0A**
SB5422 SB5422V*	Constant Current	3.8-32VDC	12-280Vrms	.010 to 1.0A**
SB2369*	None	5-30mA	12-280Vrms	.010 to 1.0A**
SB2369-01*	270 Ohm Res.	3.5-7.0VDC	12-280Vrms	.010 to 1.0A**

* Designed to meet VDE requirements.

In addition to the reed relays shown, ELEC-TROL offers **TELEPHONE LINE SENSING RELAYS, LOW THERMAL RELAYS, RF SWITCHING RELAYS** and **PROXIMITY DEVICES.** The new **VISTA REED RELAYS** shown here are also available with up to 6 form A contacts, up to 4 form C contacts, 1 or 2 mercury wetted contacts, and a 1 form A magnetic latching contact.

The DIP, SIP, and **BLUE BOY RELAYS** also are available in other configurations.

ELEC-TROL manufactures its own **REED SWITCHES** in an ultra modern plating facility and class 100 laminar flow clean rooms. Special **REED SWITCHES** can be made to suit your special application.

STANDARD HERMETIC SEALED RELAYS

SERIES	General Information	Contact Form	Contact Rating	D × W × H Size	Sensitivity	Coil Voltage	Coil Resistance ±10%	Max. Pick Up/Latch Voltage/ Current @ +25°C	Min. Drop Out Voltage/ Current @ +25°C
30	Digital time delay relay. Operate or release delay. Note: 4DPT available in delay on operate only.	1PDT 2PDT 3PDT 4PDT	2 Amp 28 VDC or 10 Amp 28 VDC	Various	N/A	28 VDC Nominal	N/A	N/A	N/A
40	Especially designed for lower power input, with dry circuit to 3 amps switching capability.	1PDT or 2PDT	Dry Circuit to 3 Amp 28 VDC Resistive	.970 × .970 × 1.781	20 mw 1PDT 40 mw 2PDT	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14 MADC 6.3 MADC 2.8 MADC	5 MADC 2.3 MADC 1.0 MADC
50	Qualified to M39016/6.	2PDT	D/C to 2A 28 VDC Resistive	.4 × .800 × .41	250 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	40 Ohms 150 Ohms 700 Ohms	3.0 VDC 6.0 VDC 13.0 VDC	0.6 VDC 1.2 VDC 2.3 VDC
55	½ size sensitive latching relay qualified to MIL-R-39016/45.	2PDT	D/C to 2A 28 VDC Resistive	.4 × .800 × .41	90 mw Latch/Reset	6.0 VDC 12.0 VDC 26.5 VDC	100 Ohms 500 Ohms 1800 Ohms	3.0 VDC 6.7 VDC 12.7 VDC	N/A
68	Crystal can "Lazy S" header.	2PDT	D/C to 2A 28 VDC Resistive	.359 × .797 × .875	300 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	35 Ohms 140 Ohms 552 Ohms	3.2 VDC 6.5 VDC 13.0 VDC	0.5 VDC 1.1 VDC 2.3 VDC
71	Sensitive crystal can relay.	2PDT	D/C to 2A 28 VDC Resistive	4 × .8 × 1.280	40 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14.2 MADC 6.3 MADC 2.8 MADC	1.42 MADC 0.63 MADC 0.28 MADC
77	Crystal can. Sensitive latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	4 × .8 × .875	90 mw Latch/Reset	6.0 VDC 12.0 VDC 26.5 VDC	100 Ohms 500 Ohms 1800 Ohms	3.0 VDC 6.7 VDC 12.7 VDC	N/A

SERIES	30	30	40	50	55	68	71	77
SHOCK	2 Amp 30 G's 11 msec	10 Amp	50 G's 11 ±1.0 ms	100 G's 10 ms ±2.0 ms	100 G's 10 ms ±2.0 ms	100 G's 10 ±2 Amps	50 G's 10 ±2 ms	100 G's
VIBRATION NOTE: SPECIAL ADJUSTMENTS	10 G's 10-2000 Hz		10 G's 40 to 500 Hz	30 G's 56 to 3000 Hz	30 G's 56 to 3000 Hz	20 G's 56 to 3000 Hz	15 G's 10-2000 Hz	20 G's 10-2000 Hz
OPERATE TIME MAX.	Time delay range		35 ms	4 ms	5 ms	5 ms	15 ms	5 ms
RELEASE TIME MAX.	.2-300 sec fixed		15 ms	4 ms	N/A	5 ms	10 ms	N/A

Electronic Specialty Corporation

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STANDARD HERMETIC SEALED RELAYS

SERIES	General Information	Contact Form	Contact Rating	D × W × H Size	Sensitivity	Coil Voltage	Coil Resistance ±10%	Max. Pick Up/Latch Voltage/ Current @ +25°C	Min. Drop Out Voltage/ Current @ +25°C
79	Crystal can. Non-latching relay.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.4 × .8 × .875	250 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	35 Ohms 140 Ohms 600 Ohms	3.0 VDC 5.9 VDC 12.5 VDC	0.3 VDC 0.6 VDC 1.5 VDC
80	Sensitive. Coils are in hermetically sealed compartments, separate from contact chamber.	2PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.41 × .915 × 1.281	40 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 5000 Ohms	14.2 MADC 6.3 MADC 2.8 MADC	1.42 MADC 0.63 MADC 0.28 MADC
90 **92**	Sensitive—non-latching. Sensitive—Latching.	4PDT	Dry Circuit to 3 Amps 28 VDC Resistive	.601 × 1.032 × 1.278	80 mw Pick Up 80 mw Latch/Reset	12.0 VDC 26.5 VDC 12.0 VDC 26.5 VDC	500 Ohms 2000 Ohms 500 Ohms 2000 Ohms	12.6 MADC 6.3 MADC 6.3 VDC 12.6 VDC	1.26 MADC 0.63 MADC N/A
93 **94**	Non-latching Welded or solder sealed. Latching. Welded or solder sealed.	2PDT	10 Amps 28 VDC Resistive	.515 × 1.032 × 1.300	500 mw Pick Up 150 mw Latch/Reset	12.0 VDC 26.5 VDC 12.0 VDC 26.5 VDC	65 Ohms 300 Ohms 240 Ohms 1000 Ohms	5.8 VDC 12.5 VDC 6.0 VDC 12.3 VDC	1.1 VDC 2.3 VDC N/A
99	High current. Low profile.	2PDT	10 Amps 28 VDC Resistive	.515 × 1.032 × .885	1000 mw Pick Up	6.0 VDC 12.0 VDC 26.5 VDC	8.4 Ohms 35 Ohms 170 Ohms	2.9 VDC 5.9 VDC 13 VDC	.55 VDC 1.1 VDC 2.3 VDC
100 **102**	Sensitive—non-latching. Sensitive—Latching.	6DPT	Dry Circuit to 3 Amps 28 VDC Resistive	.852 × 1.032 × 1.278	150 mw Pick Up 150 mw Latch/Reset	12.0 VDC 26.5 VDC 12.0 VDC 26.5 VDC	200 Ohms 1000 Ohms 250 Ohms 1000 Ohms	27.4 MADC 12.2 MADC 6.1 VDC 12.3 VDC	2.74 MADC 1.22 MADC N/A
103 **104**	Non-latching. Latching.	4PDT	10 Amps 28 VDC Resistive	.852 × 1.032 × 1.3	100 mw Pick Up 300 mw Latch/Reset	12.0 VDC 26.5 VDC 12.0 VDC 26.5 VDC	32 Ohms 150 Ohms 125 Ohms 500 Ohms	5.8 VDC 12.5 VDC 6.1 VDC 12.3 VDC	1.1 VDC 2.3 VDC N/A
F **H** **T**	Full or Half size crystal can coaxial relays with 8″ min. RG 178 B/U cables attached. T Series sensitive. Welded sealing.	1 PDT with Auxiliary Contacts or 2 PDT Coax	RF to 1.5 Amps 50 Watt Max.	Frequency Range to 500 MHz VSWR—1:1.1 Typical. Characteristic Impedance—50 Ohm Typical. Cross Talk—50 dB Typical.		12.0 VDC 26.5 VDC 12.0 VDC 26.5 VDC 26.5 VDC	140 Ohms 600 Ohms 150 Ohms 700 Ohms 1000 Ohms	5.9 VDC 12.5 VDC 6.0 VDC 13.0 VDC 6.3 MADC	1.0 VDC 2.3 VDC 1.2 VDC 2.3 VDC .63 MADC

SERIES	79	80	90	92	93	94	99	100	102	103	104	F/H/T
SHOCK	100 G's 11 ±2 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	50 G's 11 ±1 ms	N/A
VIBRATION	20 G's 10-2000 Hz	15 G's 56-2000 Hz	15 G's 56-2000 Hz	15 G's 56-2000 Hz	20 G's 10-2000 Hz	20 G's 56-2000 Hz	20 G's to 2000 Hz	15 G's 56-2000 Hz	15 G's 56-2000 Hz	15 G's 56-2000 Hz	15 G's 56-2000 Hz	N/A
OPERATE TIME MAX.	5 ms	15 ms	20 ms	9 ms	7 ms	10 ms	7 ms	18 ms	8 ms	8 ms	9 ms	5 ms T 15 ms
RELEASE TIME MAX.	5 ms	10 ms	5 ms	N/A	3 ms	N/A	3 ms	5 ms	N/A	5 ms	N/A	5 ms T 10 ms

Electronic Specialty Corporation

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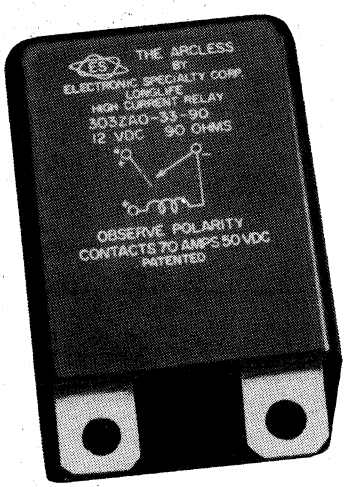
New From ES Electronic Specialty Corporation

70 AMP ARCLESS™ RELAYS



OVER 10,000,000 OPERATIONS IN OUR 185°F CHAMBER . . . AND STILL RUNNING!

If your company's products can use lightweight, more compact 70 amp relays that go and go and go, call us.

The ultimate in high current DC load switching. The load is switched with power semiconductors short term, and carried by the relay hard contacts long term, preventing the semiconductors from overheating.

The Arcless™ uses a SPST heavy duty mechanical relay. In addition to switching 70 AMP loads, the Arcless will withstand a 180 AMP inrush current from motor or lamp load.

Applications for arcless relays should include all high current DC switching where reliability and long life are important design criteria.

No arc between contact points — **No** electro-magnetic interference. This non-arcing feature is useful for switching where EMI or RFI might cause damage to equipment, software, or quality of radio signals.

Reliability, smaller size, no EMI or RFI and much longer lasting. A price of under $20, in quantity, makes reliability affordable.

OUTSTANDING CHARACTERISTICS

Life — Over 10 million operations at full load.

Low Cost — Effective cost versus performance characteristics.

High Current — 70 AMP loads at 50 VDC: Resistive Motor Lamp

Fast Switching — 1 Millisecond maximum turn on time.

Low Contact Resistance — 1.5 Milliohms maximum.

PHYSICAL

Case: Metal can or molded plastic.

Weight: 250 grams

Load Connections: 2 flat terminals.

Coil Connection: 1 flat terminal.

Sealing: Encapsulated in heat conductive epoxy compound.

ELECTRICAL

Contact Configuration: 1 Form-A SPST ground side switching only. (See block diagram)

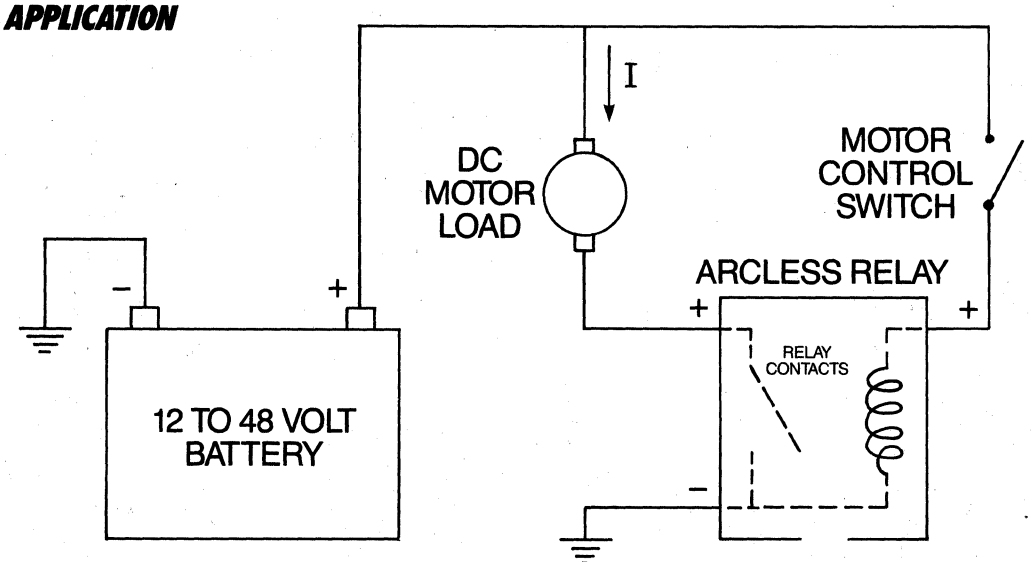
Contact/Mechanical Life: More than 10,000,000 operations at full rated electrical load and temperature.

Contact Overload: Four times rated contact load for 50 operations at 200 millisecond maximum pulse duration.

Static Contact Resistance: 1.5 milliohms maximum at rated current.

Dynamic Contact Resistance: 6 milliohms maximum at 70 AMPS from 12 to 50 VDC.

TYPICAL APPLICATION



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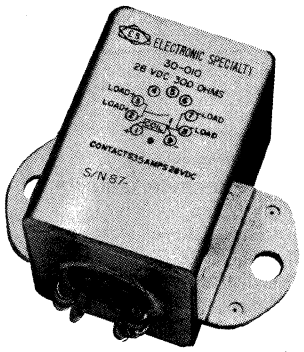
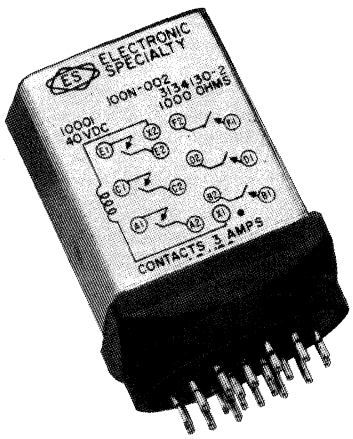
NEW! FROM ELECTRONIC SPECIALTY CORP.



ARCLESS RELAY 30 AMPERE DC SERIES 300

1. Over 1,000,000 Operations. Limited only by mechanical life of the relay.
2. No Bounce—Fast on time.
3. Low Contact Resistance—.004 ohms max.
4. Meets EMI Mil-Std-461B, REO2.
5. Vibration and Shock: Mil-R-6106 characteristic C.
6. Ambient Temperature: −55°C to +85°C.



SQUARE TO ROUND

Square peg in round hole? If you use a round can circular pin configuration we have a relay that is compatible electronically, environmentally, and mechanically—it fits into the same envelope.

Available in 4PDT 3-10 Amps rated and 6PDT 3 Amp rated.

This eliminates the need for expensive redesign and gives you:

- A solution to sole source problems
- Competitive prices
- Prompt delivers
- A quality component

Special bracket design available.

TIME DELAY

These new relays can be configured for many different applications: Pickup and dropout in same relay; sensing power interrupt, which results in a recycle or a timing decision; switching after power removed.

Combined functions can include both pickup and dropout in the same relay. Pickups range from milliseconds to hours, using internal or external timing resistors. A separate dropout function can hold the relay energized for up to 30 seconds after power is removed.

Another possible combination is a delay with a power interrupt. This stretches the time out to three times the actual power interrupt, but not more than the delay period. After time out, a power interrupt will result in a 1.5 second dropout delay before the three times power-off function becomes the controlling factor.

For engineering information and available options, contact

Electronic Specialty Corporation

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FIFTH DIMENSION INC.

Mercury Relays That Operate in any Position

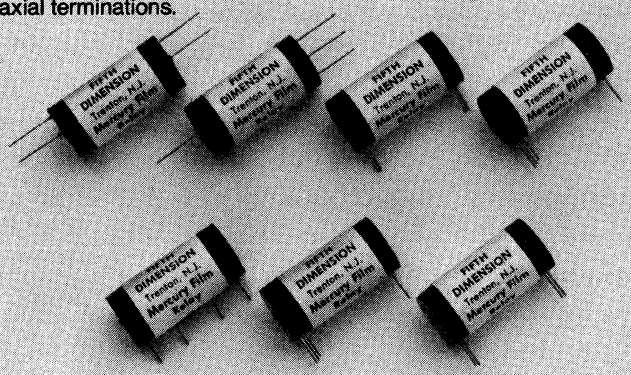
- **No Contact Bounce** — Produce clean square-wave pulses
- **Position Insensitive** — No pool of mercury
- **Self-Healing Contacts** — Always wetted with fresh mercury
- **Rugged Construction** — Welded steel switching capsule
- **Sealed Package** — High density polyethylene (WK Series)

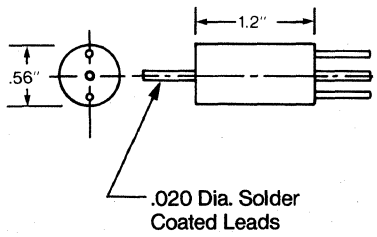
Specifications

Meet Lightning Surge Standards — 2500 volts coil-to-contact breakdown meets FCC standards (WK Series only)
Contact Type: Form A (SPST) mercury film
Contact Bounce: None at 80% of rated voltage or higher
Load Current to 52 VDC: 0.24 amps
Load Current to 200 VDC: 0.10 amps
Contact Resistance: 150 milliohms (max.)
Contact Resistance Stability: ±15 milliohms
Contact Breakdown Voltage: 800 volts DC or AC (rms)
Coil-to-Contact Breakdown: 2500 VAC
Operate Time: 4.0 milliseconds (max.)
Release Time: 4.0 milliseconds (max.)

Molded Case Series WK. Relay can be submerged in appropriate cleaning solvents during board assembly.

Series WK Mercury Relays are available in a wide variety of footprints including 0.1, 0.15 and 0.2-inch PCB spacing as well as with in-line and axial terminations.

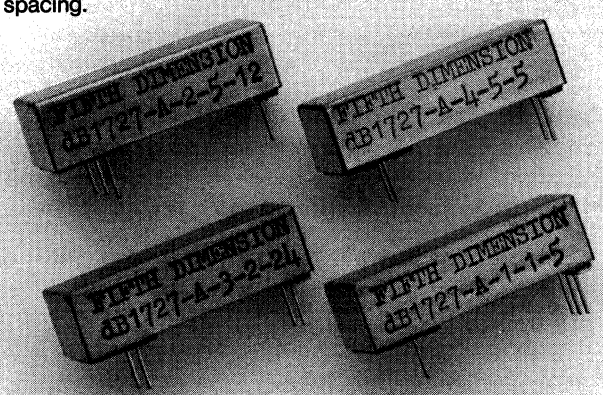


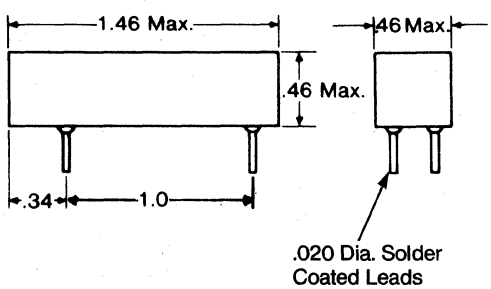


Nominal Coil Volts	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	250 MW	375 MW	500 MW		
5	100	67	50	4.0	0.5
12	575	384	288	9.6	1.2
24	2300	1536	1150	19.2	2.4

Shielded Series dB. Open-frame magnetically shielded.

Series dB Mercury Relays are available with 0.1, 0.15 or 0.2-inch PCB spacing.





Nominal Coil Voltage	Coil Resistance (± 10%) Ohms			Must Operate Volts	Must Release Volts
	125 MW	250 MW	500 MW		
5	200	100	50	4.0	0.5
12	1150	575	288	9.6	1.2
24	4608	2300	1150	19.2	2.4

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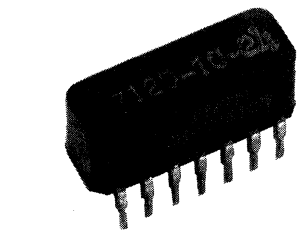
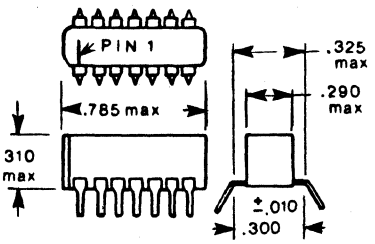
FIFTH DIMENSION INC.

Mercury Relays That Operate in any Position

DIP Relays

- Position-insensitive, bounce-free LCI sealed capsule
- 100% run-in @ 10 VDC-100 mA for 2.5 x 10^6 operations
- 5, 12 and 24 VDC-700 Mw coil drives
- Life expectancy over 50 x 10^6 operations
- Latching or non-latching operation
- Molded diallyl phthalate case





- Operate Time (max.) — 2.5 ms
- Release Time (max.) — 3.0 ms
- Contact Resistance — 75 milliohms

7000 Series (DC to 10 MHz)

- Rated Contact Load — 1.0 amp 4 VDC to 0.3 amp @ 200 VDC

2000 Series (DC to 100 MHz)

(Specifications at 100 MHz)

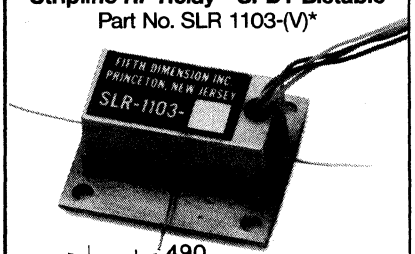
- Rated Contact Load — 10 watts CW
- Insertion Loss (Typical) — 0.2 dB
- Isolation (Typical) — 40 dB
- VSWR (Typical) — 1.5

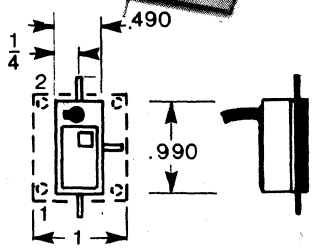
Bistable (Latching Relays)			Monostable (Non-Latching Relays)		
Part No.	Form	Diode Protection	Part No.	Form	Diode Protection
7120-1A-V*	A	No	7210-1A-V*	A	No
7120-1C-V	C	No	7210-1C-V	C	No
7121-1A-V	A	Yes	7211-1A-V	A	Yes
7121-1C-V	C	Yes	7211-1C-V	C	Yes
2122-1A-V	A	No	2212-1A-V	A	No
2122-1C-V	C	No	2212-1C-V	C	No

*Specify Coil Voltage

50 Ohm Stripline and Coaxial Relays

Stripline RF Relay • SPDT Bistable
Part No. SLR 1103-(V)*



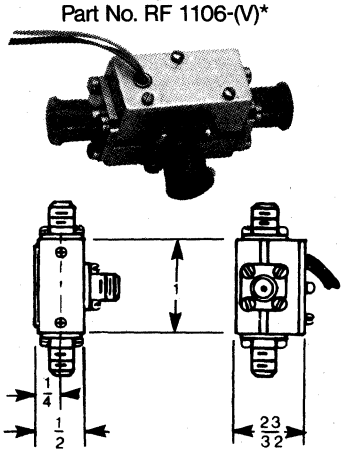


- Position-insensitive, bounce-free LCI sealed capsule
- Bistable operation
- 5, 12 and 24 VDC-700 Mw coil drives
- Operate Time (max.) — 4.0 ms
- Cycling rate — to 40 Hz
- Frequency Range — DC to 1 GHz
- Dielectric strength — 300 VDC
- Rated Load — 10 watts CW

	100 MHz	1.0 GHz
Typ. Insertion Loss (dB)	.07	.30
Typ. Isolation (dB)	56	36
Typ. VSWR	1.03	1.20

*Specify Coil Voltage

Coaxial RF Relay • SPDT Bistable
Part No. RF 1106-(V)*



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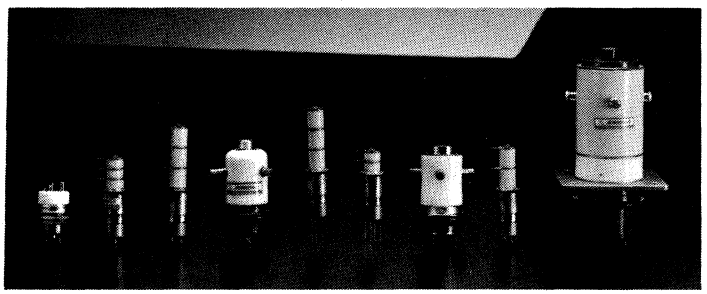
JENNINGS VACUUM/GAS RELAYS

Relay Testing

Jennings operates test facilities to provide all environmental, high voltage, and radio frequency (RF) test parameters. All relays are individually tested prior to shipment for pull-in voltage, timing characteristics, contact resistance, and dielectric strength.

Vibration, shock, humidity, salt spray, temperature effects, current load and reliability tests are regularly performed on a sampling basis.

Mechanical life reliability tests are performed on a sample basis with equipment that only passes relays which cycle with proper sequences of contact operation. Some relay types have been checked to more than 10^8 operations.



Peak Test Voltage (kV)	Model Number	Peak Working Voltage (kV) DC/60 Hz	Continuous Current Amps (RMS) DC/60 Hz	Maximum Capacitance Between Open Contacts or Contacts to Ground	Contact Configuration	Contact Resistance (ohms)	Operate Time (ms, Max)	Release Time (ms, Max)	Coil Resistance*	Expected Mech Life × 10⁶	Connector Type	Weight Ozs. (Nom.)
SPST/VACUUM												
4	RF40(1)	3.6	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
4	RF41, RF42	3.6	12	1.6	N/C	.020	10	10	290	1	Sol.	1
4	RF44	3.6	12	1.6	Latch	.012	4	N/A	80	1	Sol.	1
8	RF5A	7.5	12	1.6	N/C	.050	12	12	920	1	Sol.	1
8	RF6A	7.5	12	1.6	N/O	.050	12	12	920	1	Sol.	1
9	RF43(1)	7.0	12	1.6	Latch	.020	10	N/A	47	1		
10	RF47	8.0	35	1.6	Latch	.004	4	N/A	80	1	Sol.	1
10	RF4A, RF4B(1)	8.0	30	4.0	N/C	.015	18	18	156	1	Sol.	2
12	RF50, RF51	10.0	12	1.6	N/C	.020	15	15	290	1	Sol.	1
12	RJ5	12.0	15	1.0	N/C	.030	10	10	180	1	S, N300, N400	3
15	RD5A, RF5B	12.0	15	1.0	N/O	.010	18	8	265	1	N300, N400	3
15	RD6A, RD6B	12.0	15	1.0	N/C	.010	18	8	265	1	N300, N400	3
30	RS8, RS10	28.0	75	1.5	N/O	.003	30	10	120	1	T	7
33	RJ8A	28.0	110	1.3	N/O	.003	18	8	120	2	T	10
33	RJ10	28.0	110	1.3	N/C	.003	18	8	120	2	T	10
SPDT/VACUUM												
4	RF1D, RF1E	2.0	8	2.0	SPDT	.050	10	10	920	2	Sol.	1
4	RF60(1), RF61	3.6	12	2.0	Latch	.020	10	N/A	47	1	Sol.	1
5	RJ1A	3.5	18	2.5	SPDT	.010	8	8	335	2	Sol.	1
5	RJ1H	2.5 Hot Switch	3	N/A	SPDT	.030	6	6	335	1	Sol.	1
9	RF62, RF63(1)	7.0	12	1.6	SPDT	.020	10	10	290	1	Sol.	1
9	RF63A	7.0	12	1.6	Latch	.020	10	N/A	47	1	Sol.	1
10	RF3A, RF3C(1)	8.0	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
10	RF3D	8.0 Hot Switch	30	4.0	SPDT	.015	18	18	156	1	Sol.	2
15	RB1H, RB1J	12.0	15	1.0	SPDT	.012	18	9	265	1	S, N300, N400	3
15	RJ2B, RJ2C	12.0	50	1.0	SPDT	.012	18	9	270	.5	S, N300, N400	3
15	RJ4	12.0	50	1.0	SPDT	.012	18	9	270	1	S, N300, N400	3
18	RB1D, RB1E	12.0	15	1.0	SPDT	.012	18	8	265	1	S, N300, N400	3
20	RF10B	15.0	75	1.8	SPDT	.012	30	10	225	.1	Sol.	16
30	RE6B	25.0	25	2.5	SPDT	.012	25	10	120	.5	S, N300, N400	7
DPDT/VACUUM												
9	RB7A, RB7B	7.0	14	2.0	DPDT	.020	15	5	270	1	S, N300, N400	2
15/8(2)	RB3	12/6(2)	30	2.5	DPDT	.010	20	8	120	.5	S, N300, N400	6
22	RB2A	20.0	20	2.5	DPDT	.010	20	10	225	.5	S, N300, N400	8
4PDT/VACUUM												
17	RB4	15.0	20	2.5	4PDT	.010	45	10	131	.1	S, N300, N400	16
SPST/GAS FILLED												
70	RGH3	70.0	15	N/A	N/C	1.000	N/A	15	24	5	Solder/ Screw	16
DPDT/GAS FILLED												
14	RGD6	7.5	30	N/A	DPDT	.100	20	N/A	18(3)	.01(4)	Flex	11
20	RGD1	18.0	30	N/A	DPDT	.100	25	N/A	52	.01(4)	Sol.	16

* 26.5 VDC operate at 25°C (other coil voltages available)

S = Standard Nickel Tabs N300 = Copper N400 = Heavy duty copper Bolt Flex = Flying leads Sol. = Solder terminals T = Threaded mount

1 Latching Model 2 Lower Contacts 3 12 volt DC Coil 4 Rated Load Life

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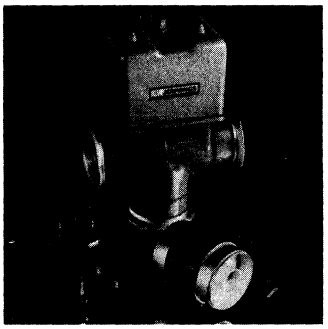
JENNINGS VACUUM/COAXIAL RELAYS

Applications for these units include high speed switching from omnidirectional to directional antennas, transmit-receive switching, and switching between transmitters for standby control.

Other applications include crossbar matrices and switching trees, CCTV, CATV, and microwave telemetry and data acquisition links, as well as general coaxial instrumentation.

Jennings vacuum coaxial relays have a recorded history of dependable, maintenance free operation. Because of this, they were chosen for ground and airborne applications for the tracking network of the Apollo program and the Atlantic Missile Range Communications.



Model Number	Power Rating (CW in KW)	Frequency Range† (MHz)	VSWR†	Crosstalk† (db Isolation)	Actuating Voltage	Insertion Loss† (Max)	Coil Resistance (Ohms ± 10•)	Contact Configuration	Connector size	Position Indicators Auxiliary Contacts	Operate Time†† (Max)	Weight Lbs. (Nom.)
GENERAL TRANSMITTER/RECEIVER SWITCH												
RC41E6000K440	3 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	C	None	25 ms	0.9
RC43E6050N440	5 @ 30 MHz	0-500	1.1:1 Max to 300 MHz	30 @ 300 MHz	26.5 VDC	0.1 dB	265	SPDT	LC	None	25 ms	3.3
CROSS OVER TYPE/4-PORT: 2 INPUT, 2 OUTPUT												
RC53A6300K24B	2.25 @ 30 MHz (connector limited)	0-600	1.1:1 Max to 300 MHz	75 @ 30 MHz	26.5 VDC	0.1 dB	19**	Transfer	N	DPDT	30 ms	2.8
RC54A6325H24B	7.5 @ 30 MHz	0-400	1.1:1 Max to 300 MHz	53 @ 500 MHz	26.5 VDC	0.1 dB	19**	Transfer	LC	DPDT	30 ms	6.4
1 5/8" LINE SIZE												
RC5A5101A24B	25 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	70 @ 30 MHz	26.5 VDC	0.02 dB	Opening 19.9 Closing 18.7	SPST	1 5/8"	DPDT	30 ms	1.8
RC6A5126F14B	25 @ 30 MHz	0-400	1.1:1 Max to 150 MHz	65 @ 30 MHz	26.5 VDC Latching	0.01 dB	15.4	SPDT	1 5/8"	DPDT	50 ms	8.0
3 1/8" LINE SIZE												
RC10C5227A24B	90 @ 30 MHz	0-100	1.05:1 Max to 60 MHz	65 @ 30 MHz	26.5 VDC	0.02 dB	Opening 20.3 Closing 18.7	SPST	3 1/8"	DPDT	30 ms	3.8
RC21A5500F14B	90 @ 30 MHz	0-500	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	4.8	SPDT	3 1/8"	DPDT	40 ms	14.0
SWITCH ASSEMBLY												
RC265552G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPDT	3 1/8"	DPDT	50 ms	14.0
ATTENUATOR												
RC275576G24F	90 @ 30 MHz 2 MW Peak* Spec. Order	0-600	1.1:1 Max to 400 MHz	60 @ 30 MHz	26.5 VDC Latching	0.01 dB	19	SPST	3 1/8"	DPDT	50 ms	13.0

* Power rating applies when connecting line pressurized 45 PSIA Dry Air or 31 PSIA Dry Nitrogen.
** ± 15%
† All measurements with a characteristic impedance of 50 ohms.
†† faster operate times can be obtained on most units by coil pulse circuits. Information available from factory.

NOTE: This power ratings is for the frequency at which the relay is most commonly used.
The power rating for any point in the frequency range of the unit other than that shown may be obtained by consulting factory.

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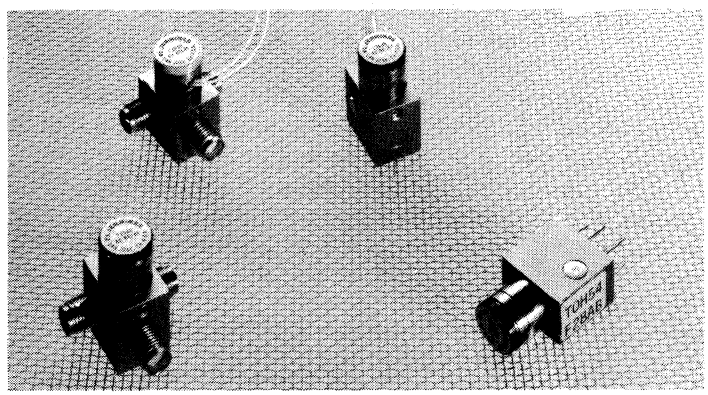
JENNINGS MINIATURE MICROWAVE RELAYS

The FL Jennings TOH Series microwave relays are designed to operate from DC to 2.5 GHz and higher. They are used in coaxial transmission lines to open, close, and divert signal paths. Applications where stringent impedance matching and isolation are required include antenna switching, radar, communications, radio telephones, and cable TV systems. Our technology represents the latest developments in materials, performance and flexibility. The TOH series microwave relays are available in coil terminal, PCB terminal, flying lead, and solder lug configurations. Operating voltages of 6, 12, 24, and 28 VDC can be specified.

The TOH Series are built using a new patented method that offers efficiency in manufacture. The result provides reliable, proven relays at lower cost.



TYPICAL RF CHARACTERISTICS

MICROWAVE DATA TOH 55 SMA CONNECTOR VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.08:1	1.09:1	1.10:1	1.20:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.05 dB	0.08 dB	0.1 dB	0.15 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

MICROWAVE DATA TOH 54 PC BOARD VERSION

FREQUENCY RANGE (GHz)	DC-200 MHz	200-500 MHz	500-1 GHz	1-1.5 GHz	1.5-2.5 GHz*
VSWR (MAX.)	1.05:1	1.1:1	1.17:1	1.22:1	1.3:1
INSERTION LOSS (MAX. dB)	0.05 dB	0.07 dB	0.11 dB	0.15 dB	0.24 dB
ISOLATION (MIN. dB)	60 dB	55 dB	48 dB	45 dB	40 dB
IMPEDANCE	50 OHMS NOMINAL				

*Frequency Range to 12 GHz Available on Special Order

ACTUATION DATA

COIL VOLTAGE (VDC)	6	12	24	28
RESISTANCE (OHMS ± 10%)	15	60	240	330
CURRENT (MA MAX @ 20° C)	445	230	115	95
SWITCHING TIME	20 MS (MAX)			

POWER HANDLING 50 WATTS CW @ 1 GH_z

MECHANICAL **SWITCHING SEQUENCE BREAK BEFORE MAKE**
OPERATING MODE: FAILSAFE

TEMPERATURE RANGE **OPERATING AMBIENT:** −55°C TO +85°C

LIFE **OPERATING LIFE:** 2.5 MILLION CYCLES

COAXIAL CONNECTORS MADE PER MIL-C-39012

MATERIALS AND FINISHES
RF BODY, AL. ALLOY PER QQ-A-250/11 COND. T6 NICKEL PLATED PER MIL-C26074, CL4.
CONNECTOR SHELL, CRES OCMP. 303 Se, PER ASTM-A-582, COND A, PASSIVATED PER QQ-P-35
CONNECTOR DIELECTRIC, VIRGIN TEFLON PER MIL-P-19468, GROUP A.
CONNECTOR CONTACT, BERYLLIUM COPPER PER QQ-C-530, GOLD PLATED PER MIL-G-45204.
SOLENOID HOUSING, CARBON STEEL LEADED PER QQ-S-637, NICKEL PLATED PER MIL-C-26074, CL2.

PATENT PENDING.

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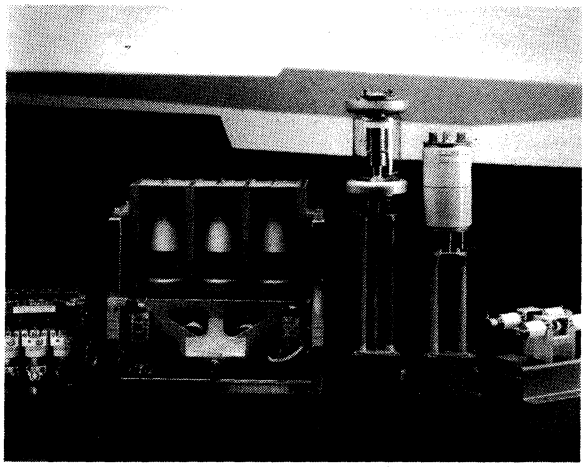
JENNINGS VACUUM CONTACTORS

Vacuum Contactors are used to control large amounts of DC power and RF currents with ratings up to 50 kv and currents up to 600 Amperes continuous. These contactors are recommended wherever high voltage capability, small size, and high speed operation with a long and low maintenance life are important. Applications include primary control of power supplies, industrial motors, and induction heating equipment, RF system tap changing, and fault protection of high power transmitters. The 18 page catalog provides complete specifications with a variety of specific applications for 3-pole, high voltage AC and DC, RF contactors and overcurrent relays actuated by solenoid, air or motor drives.



GENERAL PURPOSE

Model Number	Operate Voltage (Pk KV)	Continuous Current (Amps)	Max. Interrupt AC Current (Amps RMS)	Capacitor Discharge Decaying to 0 in 200 μS (KAmps Pk)	Contact Arrangement	Actuator Voltage (Volts)	Time to Close (Ms)	Break Time (Ms)	Weight (Lbs.)
RP101F4903D21B20 RP101F4904D21B20	30	200 DC	N/A	50	N/O N/C	115 60 Hz	60	50	15
RP101F4304D26B20 RP103F4304D26B20	30	200 DC 200 RMS	N/A 2000	50	N/C	100 DC	55	42	10
RP103F4903D21B20 RP103F4904D21B20	30	200 RMS	2000	50	N/O N/C	115 60 Hz	60 30	50 60	10
RP901K4903D21B30 RP901K4904D21B30	50	400 DC	N/A	100	N/O N/C	115 60 Hz	60 30	50 60	20
RP900K4601D26B30 RP900K4602D26B30	50	400 DC	4000	100	N/O N/C	100 DC	34 27	11 17	15
RP900K4903D21B30 RP900K4904D21B30	50	400 RMS	4000 at 13 KV RMS	100	N/O N/C	115 60 Hz	60 50	50 60	20
RT1G4201C22A10 RT1G4202C21A10	20	100	500	1	N/O N/C	230 AC 115 VAC 50/60	60 60	25 30	4
RT5C4202A21A10	15	30	100	0.5	N/C	115 AC	60	30	3

RF

Unit	Pk Operate Voltage 32 MHz	Contact Current 32 MHz RMS	Contact Resistance Ohms Max.	Contact Capacitance pF	Contact Inductance Nh	Contact Arrangement	Open Time	Close Time	Pull-in Current RMS	Hold Current RMS	Hold Power Watts	Actuating Voltage or Air Pressure	Approx. Weight	Life	Auxiliary Contacts Ratings Volt RMS Current RMS
RT224070A31NB (Solenoid Operated)	5*	25	.0005	2.5	n/a	Latching	< 300 Ms.	< 300 Ms.	.3	n/a	n/a	230 VAC	12 lbs.	2.5×10^5	Form C 230/15
RP233D1585 (Air Operated)	25	35	.0005	2	25	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	40 ± 5 psig	13 oz.	1×10^5	n/a
RF22-D2488 (Air Operated)	20	45	.00075	3	25	N/O	50 Ms.	100 Ms.	n/a	n/a	n/a	20 ± 10 psig	15 oz.	10×10^6	n/a
RF20B1586 (Air Operated)	20	100	.0004	10	2.5	N/O	< 200 Ms.	< 200 Ms.	n/a	n/a	n/a	35 ± 5 psig	2 lbs. 12 oz.	1×10^6	n/a

*Higher voltage ratings available at lower frequencies.

3-PHASE

Model Number	Operate Voltage V (RMS)	Continuous Current 60 Hz	Interrupt Current Amps RMS	Mechanical Life (Min.)	Actuator Voltage	Approx. Pull-in Current Amps Max.	Approx. Hold Current Amps Max.	Interrupt Time	Auxiliary Contacts	Approx. Weight
RP151B4541X44R20 RP151B4541X46R20	600	250	2000	2.5×10^5	26.5 VDC 100 VDC	4.6 1.7	.5 .07	Less than 2 Cycles	DPDT 115/230 VAC	16 lbs.
RP173-2310-00	7200	450	6000	1×10^6	115 VAC 50/60 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	67 lbs.
RP173-2311-00	7200	450	6000	1×10^6	230 VAC 220 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2N/C	67 lbs.
RP133-2332-00	1500	450	4500	1×10^6	115 VAC 50/60, 110 VDC	3.5	.5	Less than 2 Cycles	3 N/O, 2 N/C	30 lbs.

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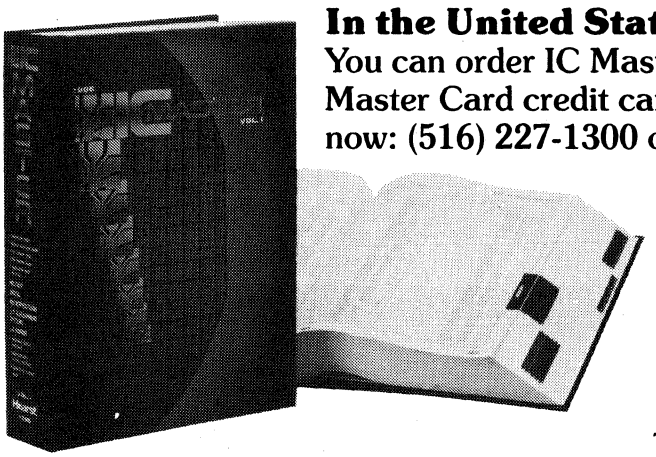

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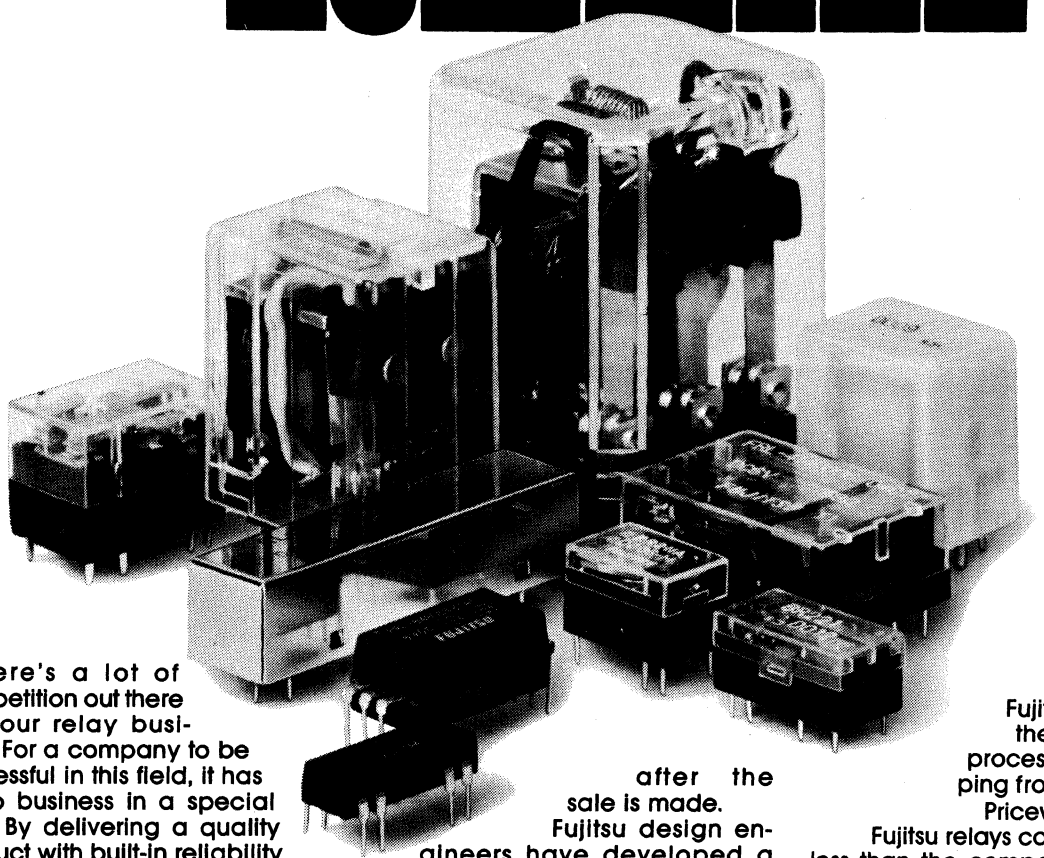
FUJITSU: RELAYS



There's a lot of competition out there for your relay business. For a company to be successful in this field, it has to do business in a special way. By delivering a quality product with built-in reliability, price and service.

Fujitsu relays have it all. Our relays meet or surpass the quality of those made by the competition. They're built to do a job and do it right. And Fujitsu relays are compatible with most relays on the market.

As far as service, Fujitsu considers it a point of pride, as well as good business to cater to your company's needs before, during and after the sale is made.

Fujitsu design engineers have developed a complete line of all the most popular relays in use today. A supply of these standard relays is always readily available. We also offer a customizing service where we work with your engineers to design relays tailored specifically to your needs.

Our warehouse is stocked to supply your company with samples of our fine products. Quantity orders come directly from the factory. And Fujitsu can match the lead time for processing and shipping from any source.

Pricewise, you'll find Fujitsu relays cost the same or less than the competition, leaving little reason not to try us.

For general purpose industrial relays to special application telecommunications relays, from fiery fractional horsepower motor loads to low-level logic circuits, it pays to switch to Fujitsu where quality, reliability and service are part of our product.

For more information on our superior components, call or write your local FCA rep or distributor today.

FUJITSU

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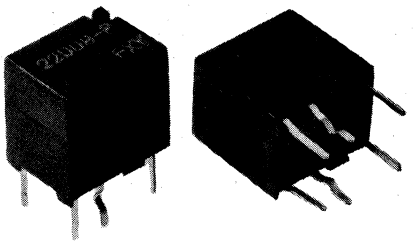
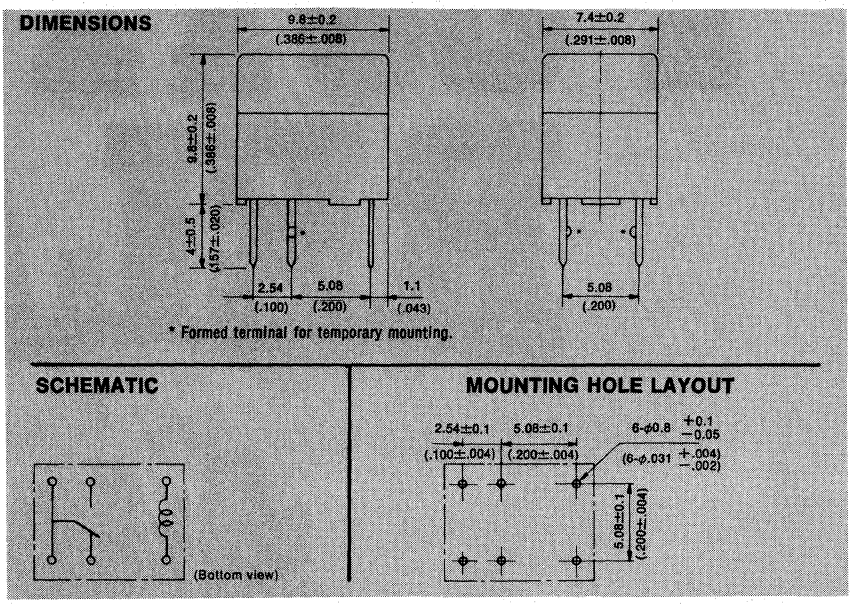
FUJITSU

RELAYS

MICROMINIATURE RELAYS FOR P.C. BOARDS

FBR20 SERIES





Fujitsu FBR20 series relays are designed for PC board mounting with 1A contact ratings — perfect for microminiature applications.

FEATURES

- **Microminiature size**
  Two FBR20 series relays can be mounted in the space now required for a single FBR210 series relay.
- **1A contact rating**
  Despite their microminiature size, FBR20 series relays have contact rating of 1A at 24 VDC for convenient installation.
- **Gold overlay single or bifurcated contact**
  Contact reliability is assured in low level applications by contact shapes and materials especially designed for signal switching applications.
- **Low power consumption**
  With a rated power consumption of only 0.3W, today's expensive energy costs can be reduced significantly.
- **Wide range of drive voltages**
  Drive voltages from 1.5 VDC to 24 VDC are available for a wide range of applications.
- **Strong shock resistance**
  Even with a 50G shock, FBR20 series relays never miss a switch.
- **Easy to pattern-design**
  Separate terminal connection with drive and output sections allow easy pattern design.
- **Formed terminal available for temporary lock**
  The unique design of the forming terminal allows FBR20 series relays to be temporary mounted for greater design flexibility.
- **Automatic soldering provision**
  The terminal is sealed to prevent flux from entering during automatic soldering.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT (1 Form C)
Contact Shape	Single contact (FBR21), Bifurcated contact (FBR22)
Contact Material	Gold overlay silver, Gold overlay silver-palladium alloy (—P)
Contact Rating	24 VDC-1A, 120 VAC-0.5A (resistive load)
Maximum Carrying Current	2A
Maximum Switching Voltage	125 VDC, 125 VAC
Maximum Switching Power	24 WDC, 60 VA AC (resistive load)
Initial Contact Resistance	100mΩ max. (measured at 6V DC-0.1A)
Coil Power	0.3W (at rated voltage, 20°C)
Coil Temperature Rise	45°C (at rated voltage, 20°C)
Insulation Resistance	1,000MΩ min. (at 500 VDC)
Withstanding Voltage	Between contacts: 500 VAC for 1 minute Between contact and coil: 750 VAC for 1 minute
Vibration	20G, 10 ~ 300 Hz (dual amplitude, maximum 3.0 mm). No contact chatter longer than 1.0 ms.
Shock	Operation error: 50G (sine half-wave of 11 ms). No contact chatter longer than 1.0 ms.
Operate Time	5 ms max. (at rated voltage)
Release Time	3 ms max. (after rated operation)
Life Expectancy	Mechanical: 5 x 10^6 cps. min. Electrical: Gold-overlay silver contacts: 100 x 10^3 ops. min. Gold-overlay silver-palladium alloy contacts: 200 x 10^3 ops. min. (at rated contact load)
Maximum Switching Frequency	Mechanical: 18,000 operations/hour Electrical: 1,800 operations/hour (at contact rated load)
Ambient Temperature	−30°C ~ +65°C (at rated operation)
Ambient Humidity	45 ~ 85% RH
Weight	1.7 g (approx.)

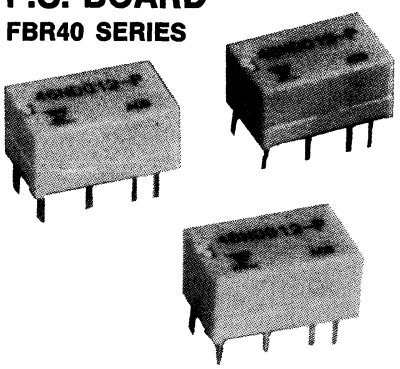
SELECTION TABLE

Type	Voltage Specifications	Coil Rated Voltage	Coil resistance (±10%)	Coil Current (at Rated Voltage)	Pick-Up Voltage	Drop-Out Voltage	Maximum Voltage Allowance	Rated Power Consumption	Coil Temperature Rise	FBR21D01 Designation	FBR21D01 Price	RFBR21D01P Designation	RFBR21D01P Price
Standard Type	D01	DC 1.5V	7.5Ω	approx. 200 mA	Less than 80% of rated voltage	More than 5% of rated voltage	160% of rated voltage	Approx. 300 mW (at rated voltage)	Approx. 45°C (at rated voltage)	FBR21D01	$1.89	FBR21D01P	$2.07
	D03	DC 3 V	30 Ω	approx. 100 mA						FBR21D03	1.89	FBR21D03P	2.07
	D05	DC 5 V	83 Ω	approx. 60 mA						FBR21D05	1.89	FBR21D05P	2.07
	D06	DC 6 V	120 Ω	approx. 50 mA						FBR21D06	1.89	FBR21D06P	2.07
	D09	DC 9 V	270 Ω	approx. 33 mA						FBR21D09	1.89	FBR21D09P	2.07
	D12	DC 12 V	480 Ω	approx. 25 mA						FBR21D12	1.89	FBR21D12P	2.07
	D18	DC 18 V	1,080 Ω	approx. 17 mA						FBR21D18	2.03	FBR21D18P	2.21
	D24	DC 24 V	1,920 Ω	approx. 13 mA						FBR21D24	2.24	FBR21D24P	2.42

Note: Measured at 20°C.

ULTRA-MINIATURE RELAYS FOR P.C. BOARD

FBR40 SERIES

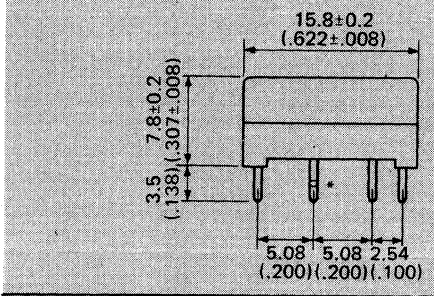


The Fujitsu FBR40 Series relay with a pick-up power consumption reduced to 85 mW is an extremely small DPDT CONTACT relay designed for PC board mounting.

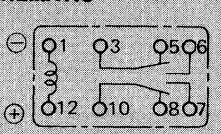
FEATURES

- **Ultra-miniature low-profile design**
  At half the size of the conventional FBR240 relay and requiring only three quarters of the board area, a drastic reduction is size has been achieved in the design of the FBR40.
  15.8 (L) x 9.7 (W) x 7.8 (H) mm.
- **High dielectric strength**
  Dielectric withstanding voltage between contacts and coil is over 1,000 VAC and with the ability to withstand a surge voltage of over 1,500 V, it conforms to FCC 68.302 standard.
- **High-shockproof type**
  Even a shock force of 30 G will not result in a malfunction.
- **Low power consumption**
  With a high efficiency built-in permanent magnet, operating power consumption is only 85 mW. (Rated power consumption is 150 mW.)
- **Formed terminal for temporary lock**
  The terminals of the FBR40 are specially formed so that they can be temporarily attached to the PC board.
- **Pattern design is easy**
  The terminal connections are designed so that the drive portion (coil) and the output portion (contacts) are isolated, which simplifies pattern design.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

DIMENSIONS Unit: mm (inch)

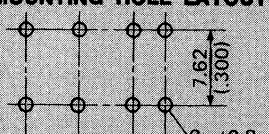


SCHEMATIC



tolerance ±0.1 (.004)
(bottom view)

MOUNTING HOLE LAYOUT



Note 1. This relay is polarized. Please refer to the schematic when designing a circuit.
Note 2. An abbreviated designation is marked on the top surface of the dust cover as follows:
(Ex.) Designation: FBR46D012-P
Marking: 46D012-P
Note 3. Terminal numbers are not shown on the relay.

ENGINEERING DATA

Item	Specifications
Contact Arrangement	DPDT (2 Form C) bifurcated contact
Contact Material	Gold overlay silver-palladium alloy
Initial Contact Resistance	100 mΩ max. measured at 6V DC, 0.1A
Insulation Resistance	100 mΩ min. at 500V DC
Dielectric Withstanding Voltage	Between open contacts 500V AC for 1 min. Between contact and coil and between adjacent contacts 1,000V AC for 1 min.
Surge Voltage (FCC 68.302)	1,500V/10μsec/700μsec 1,500V 750V 10μsec 700μsec Between coil and contact Between adjacent contacts
Electrostatic Capacitance Between Contacts (Reference)	Between open contacts approx. 1 pF Between coil and contact approx. 2 pF
Vibration	Operation malfunction 10-55 Hz (Dual amplitude 1.5 mm) Durability 10-55 Hz (Dual amplitude 1.5 mm)
Shock	Operation malfunction 30 G (11 msec) Durability 100 G (11 msec)
Operate Time	5 msec max. (bounce time not included)
Release Time	5 msec max. (bounce time not included)
Life Expectancy	Mechanical: 10 x 10^6 ops. min. Electrical: 100 x 10^3 ops. min. (At contact rated load)
Maximum Switching Frequency	Mechanical: 18 x 10^3 times/hour Electrical: 1,800 times/hour (At contact rated load)
Operating Temperature Range	−30°C-+70°C (See Figure 2)
Operating Humidity Range	45-85% RH
Weight	3 g approx.

SELECTION TABLE

Type	Rated Coil Voltage	Coil Resistance (±10%)	Rated Current (for rated operation, approx.)	Pick-up Voltage	Drop-out Voltage	Rated Power Consumption	Pick-up Power Consumption	Coil Temperature Rise	Designation	Price
Standard Type	DC 3V	60Ω	50 mA	Less than 75% of rated voltage	More than 5% of rated voltage	150 mW approx. (When rated voltage is applied.)	Less than 85 mW	25 deg. approx.	FBR46D003P	$3.19
	DC 5V	167Ω	30 mA						FBR46D005P	$3.19
	DC 6V	240Ω	25 mA						FBR46D006P	$3.19
	DC 9V	540Ω	17 mA						FBR46D009P	$3.19
	DC 12V	960Ω	13 mA						FBR46D012P	$3.19
	DC 24V	2,880Ω	8 mA			200 mW approx.	Approx. 112 mW max.	30 deg. approx.	FBR46D024P	$3.36

Note: Measured at 20°C

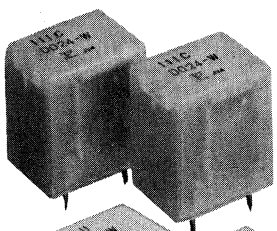
FUJITSU

RELAYS

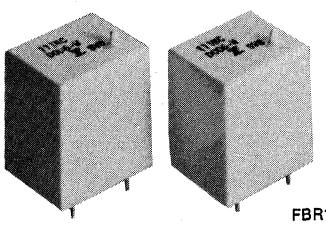
MINIATURE RELAYS FOR P.C. BOARDS

FBR100 SERIES

SPDT 3A-28V DC/120V AC, 6A-28V DC/120V AC



FBR111



FBR111N

The Fujitsu FBR111 and FBR111N Series are low cost SPDT relays with a versatile switching capability. The contact is rated 3A, 28V DC; 3A 120V AC for standard contact, or up to 6A, 28V DC; 6A, 120V AC for special heavy duty contact.

These small size, sensitive relays, designed to be mounted on printed circuit boards, feature simplified construction and a low power dissipation.

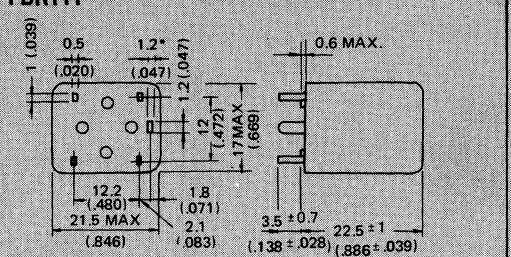
It is ideal for use in audio equipment, business machines, vending machines, security systems, game machines and automotive applications.

The FBR111N Series is the immersion cleanable version where printed circuit board cleaning is required.

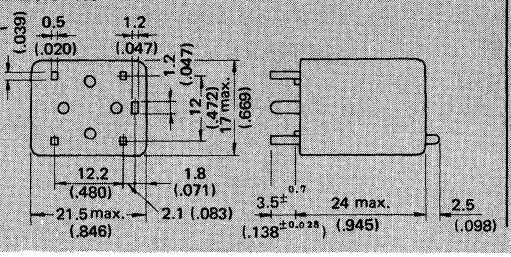
The relay specified FBR111U is UL recognized for office equipment and business machines. (File No. E63615.) CSA certified.

DIMENSIONS Unit: mm (inch)

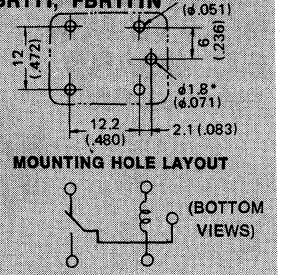
FBR111



FBR111N



FBR111, FBR111N



Notes:
1. Cut-off nib must be removed after relay soldering and board cleaning.
2. Although the plastic cover is bonded to the relay base, it is not hermetically sealed. Therefore, when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning (water temperature is less than 50°C).

ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT
Contact Ratings Contact Materials	Contact Materials: No suffix Silver — Rating 28V DC or 120V AC (Resistive) 3A, UL Rating 28V DC or 120V AC (Resistive) 3A; −K Silver-Cadmium Oxide — 3A, 3A; −M Gold-Plated Silver — 3A, 1A; −W Special Alloy — 6A, 8.5A (0.8 pF @ 120V AC)
Initial Contact Resistance	100mΩ max. (at 6V DC 0.5A for No mark or -M, 6V DC 1A for -K or -W)
Rated Coil Voltage Coil Power Dissipation Coil Temperature Rise	5, 6, 9, 12, 24V DC Standard: 0.36W approx. at rated voltage UL Type: 0.50W approx. at rated voltage Standard: 30°C max. at rated voltage UL Type: 40°C max. at rated voltage
Insulation Resistance Dielectric Withstanding Voltage	100MΩ min. at 500V DC 500V AC tor 1 minute
Operate Time Release Time	20 ms max. at rated voltage 10 ms max.
Life Expectancy — Mechanical Electrical	10 x 10^6 ops. min. 100 x 10^3 ops. min. at rated load
Vibration	10 to 50Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Temperature Range	Standard, −30°C ~ +65°C — UL Type, −30°C ~ +55°C
Weight	15 gr. approx.

SELECTION TABLES

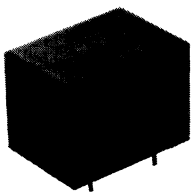
FBR111 Type	Contacts: Arrangement	Contacts: Materials*	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	Designation	Price
Standard	SPDT	No Suffix	5	70	Less Than	FBR111CD005	$1.75
		−K	6	100	80% of	FBR111CD006	1.75
		−M	9	225	Rated	FBR111CD009	1.75
		−W	12	400	Voltage	FBR111CD012	1.75
			24	1600		FBR111CD024	1.89
UL Type	SPDT	No Suffix	5	50	Less Than	FBR111UD005	$1.89
		−K	6	72	75% of	FBR111UD006	1.89
		−M	9	160	Rated	FBR111UD009	1.89
		−W	12	290	Voltage	FBR111UD012	1.89
			24	1150		FBR111UD024	2.03

FBR111N Type	Contacts: Arrangement	Contacts: Materials*	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	Designation	Price
Standard	SPDT	No Suffix	5	70	Less Than	FBR111NCD005	$2.10
		−K	6	100	80% of	FBR111NCD006	2.10
		−M	9	225	Rated	FBR111NCD009	2.10
		−W	12	400	Voltage	FBR111NCD012	2.10
			24	1600		FBR111NCD024	2.24
UL Type	SPDT	No Suffix	5	50	Less Than	FBR111NUD005	$2.24
		−K	6	72	80% or	FBR111NUD006	2.24
		−M	9	160	Rated	FBR111NUD009	2.24
		−W	12	290	Voltage	FBR111NUD012	2.24
			24	1150		FBR111NUD024	2.38

Note 1. 48V rated voltage relays are available on special order.
2. Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.
* Add $0.14 to price for −K, $0.28 for −M, $0.14 for −W.
For CSA certified relays, −CSA suffix must be added to part number of UL type. Price is same as UL type.

SMALL CONTROL RELAYS FOR P.C. BOARDS

FBR160 SERIES

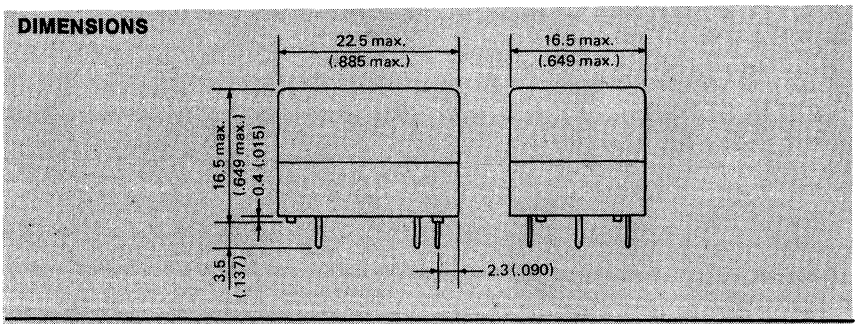


Fujitsu FBR160 series small control relays are PC board mounted and have excellent cost performance.

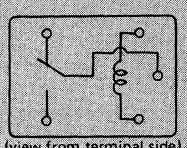
FEATURES

- **Same terminal array as FBR100**
  These relays have the same foot print as Fujitsu's conventional FBR100 series.
- **Lower profile**
  Since their profile is 7 mm lower than that of the FBR100 series relays, they can be used in smaller equipment.
- **Flux-prevention structure**
  The contacts are located on the top of the relay to protect them from solder flux from the terminals.
- **Meets major safety standards**
  The relays structure is designed to meet the Japan Electric Appliance Control Law (150V or less) and UL standards (114).
- **Choices of contact materials**
  Two different kinds of contact materials can be specified according to the load.
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.
- **Contact Ratings**
  • Standard (Silver)
  3A 28V DC 120V AC
  • –K (Silver-Cadmium Oxide)
  3A 28V DC 120V AC
  • –H (Silver-Cadmium Oxide)
  5A 28V DC 120V AC

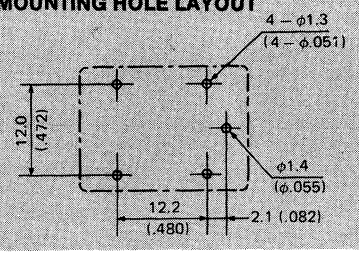
DIMENSIONS



SCHEMATICS



MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT or SPST – NO (Form A)
Contact Material	See Selection Table
Initial Contact Resistance	100 mΩ max. Silver contacts: Measured at 6 VDC, 0.5A Other contacts: Measured at 6 VDC, 1.0A
Insulation Resistance	100 mΩ min. (at 500 VDC)
Withstanding Voltage	Between open contacts: 500 VAC for 1 minute Between contact and coil: 1,500 VAC for 1 minute
Vibration	10 to 55 Hz (dual amplitude: 1.5 mm)
Shock	Operation malfunction: Less than 0.1 ms at 10G (11 ms) Durability: 100G (11 ms)
Operate Time	10 ms max. (at rated voltage, bounce time not included)
Release Time	5 ms max. (after operation at rated voltage, bounce time not included)
Life Expectancy	Mechanical: 10×10^6 ops. min. (maximum switching frequency: 18×10^3/hour) Electrical: 100×10^3 ops. min. (at rated contact load, maximum switching frequency: 18×10^2/hour)
Ambient Temperature	−30°C to +60°C
Ambient Humidity	45% to 85% RH
Weight	11 gr. (approx.)

SELECTION TABLE

FBR161 Type	Contacts: Arrangement	Contacts: Materials*	Rated Voltage in VDC	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	Designation	Price
Standard	SPDT	No Suffix: Silver -H, -K: Silver Cad Oxide	5	70	Less than 80% of rated voltage	FBR161SED005	$1.75
			6	100		FBR161SED006	1.75
			9	225		FBR161SED009	1.75
			12	400		FBR161SED012	1.75
			24	1,600		FBR161SED024	1.89

*Add $0.11 to price for -H contacts.
*Add $0.07 to price for -K contacts.

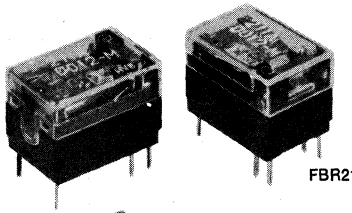
FUJITSU

RELAYS

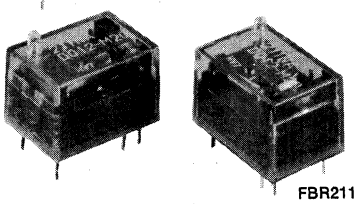
ULTRA-MINIATURE RELAYS FOR P.C. BOARDS

FBR210 SERIES

SPDT 1A-28V DC, 0.5A-120V AC



FBR211



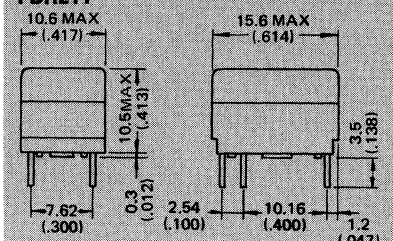
FBR211N

The FBR211 and FBR211N Series of ultra-miniature relays allow high component densities for savings in both equipment size and cost for the printed circuit board. The FBR-211N Series is suitable for immersion cleaning in freon and aqueous systems.

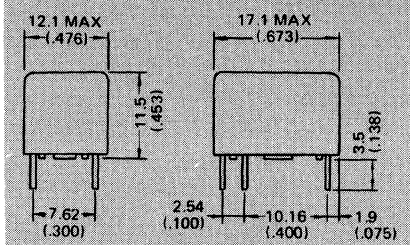
These highly sensitive relays with gold-clad SPDT contact arrangements are ingeniously designed so as to offer flux-contamination-immunity and load handling capabilities of 1A at 28V DC or 0.5A at 120V AC under a resistive load. The 0.1″ grid spacing of terminals makes these relays ideally suited for printed circuit board applications requiring high density mounting and for use in audio and wireless communications, office and vending machines, automobiles and various control applications.

DIMENSIONS Unit: mm (inch)

FBR211

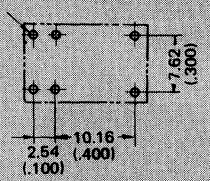


FBR211N

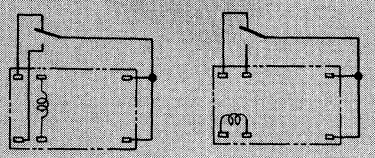


FBR211, FBR211N

MOUNTING HOLE LAYOUT



SCHEMATICS (BOTTOM VIEWS)



Notes:
1. For low level or dry circuit switching, use of gold thick-overlay silver-palladium alloy contact relays are recommended.
2. *Cut off nib must be removed after relay soldering and board cleaning.
3. Although the plastic cover is bonded to the relay board, it is not hermetically sealed. Therefore when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning.

ENGINEERING DATA

Item	Specifications	
	Standard Model	High Sensitivity Model
Contact Arrangement	SPDT	
Contact Ratings	1A at 28V DC, 0.5A at 120V AC (resistive)	
Initial Contact Resistance	100mΩ max. at 6V DC, 0.5A	
Contact Materials	Standard: Gold overlay silver (—M) — Low Level: Gold overlay silver-palladium alloy (—P)	
Rated Coil Voltage	1.5, 3, 5, 6, 9, 12, 24V DC	
Coil Power Dissipation	0.45W at rated voltage	0.20W at rated voltage
Coil Temperature Rise	45°C approx. at rated voltage	25°C approx. at rated voltage
Insulation Resistance	100MΩ min. at 500V DC (at 20°C 65% RH)	
Dielectric Withstanding Voltage	500V AC for 1 minute	
Operate Time	5 ms approx. (at rated voltage, 20°C)	
Release Time	5 ms approx.	
Life Expectancy — Mechanical	5 x 16^6 ops. min.	
Electrical	300 x 10^3 ops. min. at 1A 28V DC, resistive 100 x 10^3 ops. min. at 0.5A 120V AC, resistive	
Vibration	10 to 40Hz (Dual amplitude: 1.5mm)	
Shock	10G (11 ms)	6G (11 ms)
Temperature Range	—25°C to +55°C	—25°C to +75°C
Weight	4 gr. approx.	

SELECTION TABLE

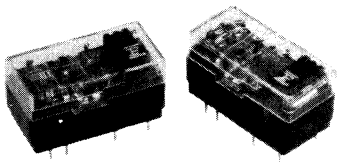
Type	Contact: Arrangement	Contact: Materials	Schematics	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-up Voltage at 20°C	FBR211: Designation	FBR211: Price* —M Type	FBR211N: Designation	FBR211N: Price* —M Type
Standard	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	A	1.5	5	Less Than 70% of Rated Voltage	FBR211AD001—M or P	$1.82	FBR211NAD001—M or P	$2.00
				3	20		FBR211AD003—M or P	1.82	FBR211NAD003—M or P	2.00
				5	56		FBR211AD005—M or P	1.82	FBR211NAD005—M or P	2.00
				6	80		FBR211AD006—M or P	1.82	FBR211NAD006—M or P	2.00
				9	180		FBR211AD009—M or P	1.82	FBR211NAD009—M or P	2.00
				12	320		FBR211AD012—M or P	1.82	FBR211NAD012—M or P	2.00
				24	1280		FBR211AD024—M or P	1.98	FBR211NAD024—M or P	2.14
Standard	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	B	1.5	5	Less Than 70% of Rated Voltage	FBR211BD001—M or P	$1.82	FBR211NBD001—M or P	$2.00
				3	20		FBR211BD003—M or P	1.82	FBR211NBD003—M or P	2.00
				5	56		FBR211BD005—M or P	1.82	FBR211NBD005—M or P	2.00
				6	80		FBR211BD006—M or P	1.82	FBR211NBD006—M or P	2.00
				9	180		FBR211BD009—M or P	1.82	FBR211NBD009—M or P	2.00
				12	320		FBR211BD012—M or P	1.82	FBR211NBD012—M or P	2.00
				24	1280		FBR211BD024—M or P	1.98	FBR211NBD024—M or P	2.14
High Sensitivity	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	C	1.5	12	Less Than 70% of Rated Voltage	FBR211CD001—M or P	$1.96	FBR211NCD001—M or P	$2.07
				3	45		FBR211CD003—M or P	1.96	FBR211NCD003—M or P	2.07
				5	120		FBR211CD005—M or P	1.96	FBR211NCD005—M or P	2.07
				6	180		FBR211CD006—M or P	1.96	FBR211NCD006—M or P	2.07
				9	400		FBR211CD009—M or P	1.96	FBR211NCD009—M or P	2.07
				12	700		FBR211CD012—M or P	1.96	FBR211NCD012—M or P	2.07
				24	2800		FBR211CD024—M or P	2.12	FBR211NCD024—M or P	2.21
High Sensitivity	SPDT	Gold Overlay Silver (M) or Gold Overlay Silver-Palladium Alloy (P)*	E	1.5	12	Less Than 70% of Rated Voltage	FBR211ED001—M or P	$1.96	FBR211NED001—M or P	$2.07
				3	45		FBR211ED003—M or P	1.96	FBR211NED003—M or P	2.07
				5	120		FBR211ED005—M or P	1.96	FBR211NED005—M or P	2.07
				6	180		FBR211ED006—M or P	1.96	FBR211NED006—M or P	2.07
				9	400		FBR211ED009—M or P	1.96	FBR211NED009—M or P	2.07
				12	700		FBR211ED012—M or P	1.96	FBR211NED012—M or P	2.07
				24	2800		FBR211ED024—M or P	2.12	FBR211NED024—M or P	2.21

Note: Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.
* To get price to —P type add $0.44.

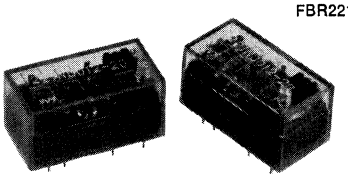
ULTRA-MINIATURE RELAYS FOR P.C. BOARDS

FBR220 SERIES

DPDT 1A-28V DC, 0.5A-120V AC



FBR221



FBR221N

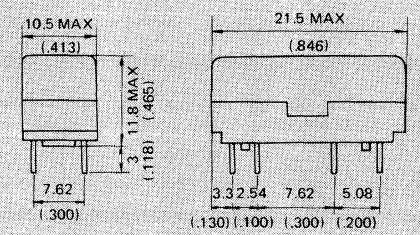
The FBR221 and FBR221N Series of ultra-miniature relays are designed to provide high component densities for savings in both equipment size and cost.

These highly sensitive relays with gold-clad DPDT contact arrangements can switch loads up to 1A at 28V DC or 0.5A at 120V AC.

The .1″ grid spacing of terminals makes these relays ideally suited for printed circuit board applications requiring high density mounting — and for use in audio and wireless communications, office machines, various control applications and automobiles.

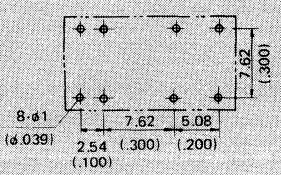
DIMENSIONS Unit: mm (inch)

FBR221

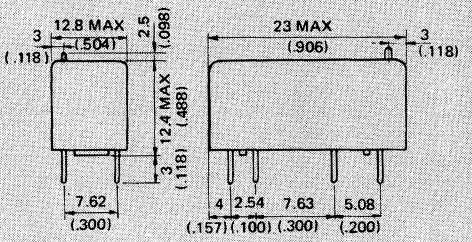


FBR221, FRB221N

MOUNTING HOLE LAYOUT



FRB221N



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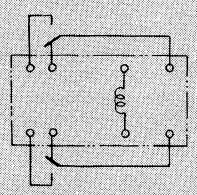


(BOTTOM VIEW)

Notes:
1. For low level or dry circuit switching, use of gold thick-overlay silver-palladium alloy contact relays is recommended.
2. Cut-off nib must be removed after relay soldering and board cleaning.
3. Although the plastic cover is bonded to the relay base, it is not hermetically sealed. Therefore when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning.

ENGINEERING DATA

Item	Specifications
Contact Arrangement	DPDT
Contact Rating	1A at 28V DC, 0.5A at 120V AC (resistive)
Initial Contact Resistance	100mΩ max. at 6V DC, 0.1A initial
Contact Materials	Standard: Gold overlay silver — Low Level Type: Gold overlay silver-palladium alloy
Rated Coil Voltage	3, 5, 6, 9, 12, 24V DC
Coil Power Dissipation	Typical 0.5W at rated coil voltage at 20°C
Coil Temperature Rise	50°C approx. at rated voltage at 20°C
Insulation Resistance	100MΩ min. at 500V DC (at 20°C 65% RH)
Dielectric Withstanding Voltage	500V RMS (60Hz) for 1 minuate
Operate Time	10 ms max. at rated voltage at 20°C
Release Time	5 ms max.
Life Expectancy — Mechanical	5×10^6 ops. min.
Electrical	300×10^3 ops. min. at 28V DC, 1A, resistive 100×10^3 ops. min. at 120V AC, 0.5A, resistive
Vibration	10 to 55Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Temperature Range	−25°C to +50°C
Weight	5 gr. approx.

SELECTION TABLE

Type	Contact Arrangements	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	FBR221 Designation	FBR221 Price	FBR221N Designation	FBR221N Price
Standard	DPDT (Gold Overlay Silver)	3	18	Less Than 75% of Rated Voltage	FBR221D003	$2.98	FBR221ND003	$3.26
		5	50		FBR221D005	2.98	FBR221ND005	3.26
		6	72		FBR221D006	2.98	FBR221ND006	3.26
		9	162		FBR221D009	2.98	FBR221ND009	3.26
		12	290		FBR221D012	2.98	FBR221ND012	3.26
		24	1150		FBR221D024	3.12	FBR221ND024	3.40
Low Level Load	DPDT (Gold Overlay Silver-Palladium Alloy)	3	18	Less Than 75% of Rated Voltage	FBR221D003P	$3.78	FBR221ND003P	$4.06
		5	50		FBR221D005P	3.78	FBR221ND005P	4.06
		6	72		FBR221D006P	3.78	FBR221ND006P	4.06
		9	162		FBR221D009P	3.78	FBR221ND009P	4.06
		12	290		FBR221D012P	3.78	FBR221ND012P	4.06
		24	1150		FBR221D024P	3.92	FBR221ND024P	4.20

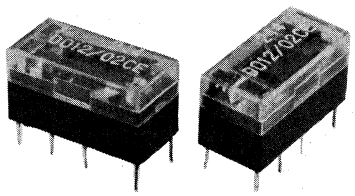
Note: Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.

FUJITSU

RELAYS

LOW PROFILE RELAYS FOR P.C. BOARDS

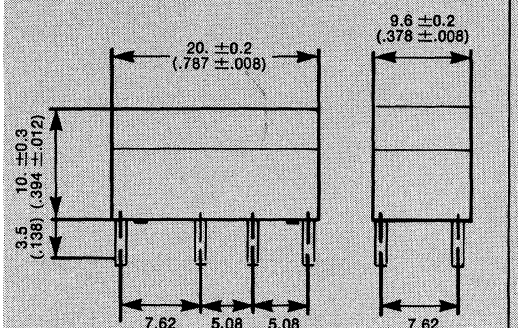
FBR240 SERIES



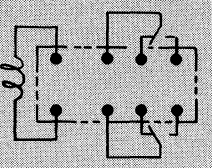
FBR244 and FBR244N Series Relays are low profile, P.C. board relays with 2 Form C (DPDT) contact arrangements in D.I.P.-compatible plastic housing and have a 2.54mm pinout grid spacing to provide 16-pin-DIP-socket compatibility. Watertight terminal sealing prevents relay from contamination by soldering flux and N type allows automatic wave soldering and board washing without relay damage. Single or bifurcated contacts switch 1A at 28V DC or 0.5A at 120V AC and have a rated-load life-time of 5×10^5 operations. These relays are suitable for telecommunication equipment, audio equipment and business machines.

- High sensitivity versions are available in 200 mw

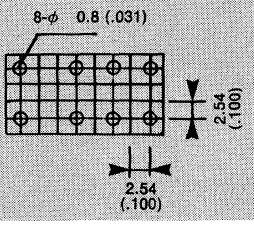
DIMENSIONS Unit: mm (inch)



SCHEMATICS



MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specifications
Contact Arrangement	2 Form C
Contact Material	Gold overlay silver Gold overlay silver-palladium alloy
Contact Rating	1A at 28V DC (resistive) 0.5A at 120V AC (resistive)
Initial Contact Resistance	100mΩ max. at 6V DC 0.1A
Coil Power Dissipation	Typical 0.5W at rated coil voltage
Coil Temperature Rise	50°C approx. at rated voltage 20°C
Insulation Resistance	100MΩ min. at 500V DC
Dielectric Withstanding Voltage	500V AC for 1 minute
Vibration	10 to 55 Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Operate Time	10 ms max. at rated coil voltage
Release Time	5 ms max.
Life Expectancy — Mechanical	10^7 ops. min.
Electrical	5×10^5 ops. min. at 1A 28V DC (resistive) — 0.3A 120V AC (resistive) 10^5 ops. min. at 0.5A 120V AC (resistive)
Ambient Temperature Range	−30°C to +50°C
Weight	4.5 gr approx.

SELECTION TABLE

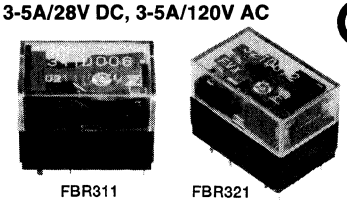
Contact Materials*	Rated Voltage in V CD	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	FBR244 Designation	FBR244 Price	FBR244N Designation	FBR244N Price
S: Single Gold overlay silver P: Single Gold overlay silver-palladium alloy T: Bifurcated Gold overlay silver E: Bifurcated Gold overlay silver-palladium alloy	3	18	Less Than 75% of Rated Voltage	FBR244D003/02CS	$2.52	FBR244ND003/02CS	$2.80
	5	50		FBR244D005/02CS	2.52	FBR244ND005/02CS	2.80
	6	72		FBR244D006/02CS	2.52	FBR244ND006/02CS	2.80
	9	162		FBR244D009/02CS	2.52	FBR244ND009/02CS	2.80
	12	290		FBR244D012/02CS	2.52	FBR244ND012/02CS	2.80
	24	1150		FBR244D024/02CS	2.63	FBR244ND024/02CS	2.91

* Substitute S with P, T or E for alternate contact materials and add $0.21 to price for P or T or $0.56 for E.
For 48V relays add $0.45 to the prices of the 24V relays.

MINIATURE RELAYS FOR P.C. BOARDS

FBR310 (SPDT) AND FBR320 (DPDT) SERIES

3-5A/28V DC, 3-5A/120V AC

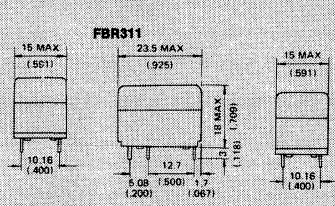


FBR311 FBR321

The FBR311 (SPDT) and FBR321 (DPDT) Series miniature relays were designed to provide 3 amps ratings contacts, accommodated in truly compact packages for P.C. boards.

These sensitive miniature relays, featuring high density mounting, flux-contamination immunity, versatile switching performance from signal level to handling 3 amps, are ideally suited for such applications as audio equipment, office machines, vending machines and automotive or other control application. These relays are UL Recognized (E63615) and CSA Certified (add —CSA suffix to P/N).

DIMENSIONS Unit: mm (inch)



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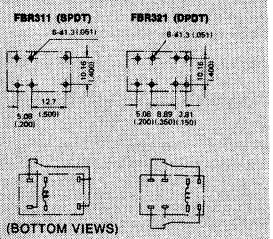


ENGINEERING DATA FBR311, 321

Item	Specifications	
Contact Arrangement	SPDT (FBR311) DPDT (FBR321)	-K (Silver-Cadmium Oxide)
Contact Rating	3A at 28V DC, 120V AC	Contacts:
Initial Contact Resistance	100mΩ max. at 6V DC, 0.5A	SPDT (FBR311) 5A 28V DC, 120V AC
Contact Material	Gold overlay silver	DPDT (FBR321) 4A 28V DC, 120V AC
Rated Coil Voltage	5, 6, 9, 12, 24V DC	
Coil Power Dissipation	0.45W approx. at rated voltage	
Coil Temperature Rise	35°C approx. at rated voltage	
Insulation Resistance	100MΩ min. at 500V DC (initial)	
Dielectric Withstanding Voltage	500V AC for 1 minute	
Operate Time	20 ms max. at rated voltage	
Release Time	10 ms max.	
Life Expectancy — Mechanical	10 x 10^6 ops. min.	
Electrical	100 x 10^3 ops. min. at rated load	
Vibration	10 to 55Hz (Dual amplitude: 1.5mm)	
Shock	10G (11ms)	
Temperature Range	−30°C to +50°C	
Weight	12 gr. approx.	

SELECTION TABLE

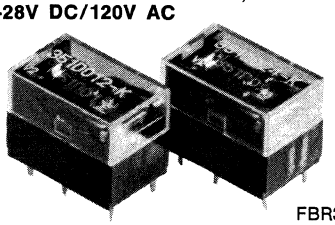
Contact Arrangement	Rated Voltage in V DC	Coil Resistance in Ω ±15% at 20°C	Pick-Up Voltage at 20°C	Designation	Price
SPDT	5	58	Less Than	FBR311D005	$2.07
	6	85	80% of	FBR311D006	2.07
	9	180	Rated	FBR311D009	2.07
	12	300	Voltage	FBR311D012	2.07
	24	1250		FBR311D024	2.21
DPDT	5	42	Less Than	FBR321D005	$3.33
	6	60	80% of	FBR321D006	3.33
	9	135	Rated	FBR321D009	3.33
	12	230	Voltage	FBR321D012	3.33
	24	960		FBR321D024	3.47

Note: Each product bears its own designation on the top of the cover, but initial 'FBR' is omitted.
For 48V relays add $0.28 to prices of 24V relays. -K contacts, add $0.07 to prices.

MINIATURE RELAYS FOR P.C. BOARDS

FBR350 SERIES

SPDT 3A-28V DC/120V AC, 6A-28V DC/120V AC

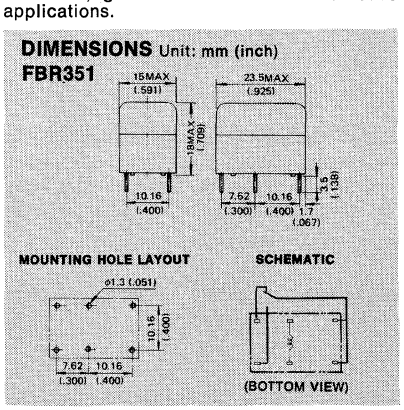


FBR351

FBR351 Series miniature relays are 1 Form C compact relays which can be used for a wide range of current switching from low levels to heavy loads. Two types are available: gold overlay contacts with contact ratings of 3A, 28V DC or 120V AC, and silver cadmium oxide contacts in 6A, 28V DC or 120V AC. These relays can be easily mounted on a PC board and use 3 pitch (7.62mm) pin arrangements. What's more, FBR351 Series relays endure 6KV at 40μ second in lightening. They are ideal for use in audio equipment, business machines, game machines and automotive applications.

DIMENSIONS Unit: mm (inch)

FBR351



ENGINEERING DATA FBR351

Item	Specifications	
	Standard	High-power Type
Contact Arrangement	1 Form C (SPDT)	
Contact Ratings	3A at 28V DC or 120V AC (resistive)	6A at 28V DC or 120V AC (resistive)
Contact Materials	Gold overlay	Silver-cadmium oxide
Initial Contact Resistance	100mΩ max. at 6V DC, 0.5A	100mΩ max. at 6V DC, 1A
Rated Coil Voltage	5, 6, 9, 12, 24V DC	
Coil Power Dissipation	0.45W approx. at rated voltage	
Coil Temperature Rise	35°C approx. at rated voltage	
Insulation Resistance	100MΩ min. at 500V DC	
Dielectric Withstanding Voltage	Between open contacts: 750V AC for 1 minute	
	Between coil and contact: 2000V AC for 1 minute	
Lightening	6KV at 1 x 40 μs	
Operate Time	8 ms approx. at rated voltage	
Release Time	2.5 ms approx.	
Life Expectancy — Mechanical	10 x 16^6 ops. min.	
Electrical	200 x 10^3 ops. min. at 28V DC, 3A	100 x 10^3 ops. min. at 28V DC, 6A
	100 x 10^3 ops. min. at 120V AC, 3A	50 x 10^3 ops. min. at 120V AC, 6A
Vibration	10~50Hz (Dual amplitude: 1.5mm)	
Shock	10G (11 ms)	
Temperature Range	−40°C~+70°C at 2A carrying current	
	−40°C~+50°C at 5A carrying current (without freezing)	
	−40 C~+40°C at 6A carrying current	
Weight	12 gr. approx.	

SELECTION TABLE

Type	Contact Rating	Contact Materials	Rated Voltage in V DC	Coil Resistance in Ω ±10% at 20°C	Pick-Up Voltage at 20°C	Designation	Price
Standard	3A at 28V DC or 120V AC, resistive	Gold Overlay	5	58	Less Than	FBR351D005	$2.28
			6	85	80% of	FBR351D006	2.28
			9	180	Rated	FBR351D009	2.28
			12	300	Voltage	FBR351D012	2.28
			24	1250		FBR351D024	2.42
High-Power Type	6A at 28V DC or 120V AC, resistive	Silver-Cadmium Oxide	5	58	Less Than	FBR351D005K	$2.35
			6	85	80% of	FBR351D006K	2.35
			9	180	Rated	FBR351D009K	2.35
			12	300	Voltage	FBR351D012K	2.35
			24	1250		FBR351D024K	2.49

Note: Each product bears its own designation on the top of the cover, but initial code 'FBR' is omitted.
For 48V relays add $0.28 to prices of 24V relays.

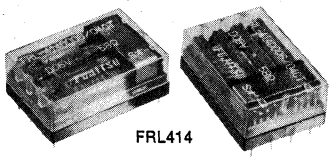
FUJITSU

RELAYS

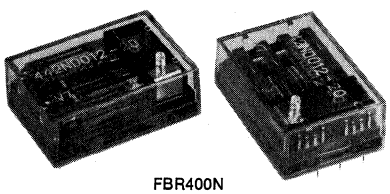
FLAT PACKAGE RELAYS

FRL410 AND FBR400N SERIES

4PDT, DPDT 1A-30V DC, 1A-120V AC



FRL414



FBR400N

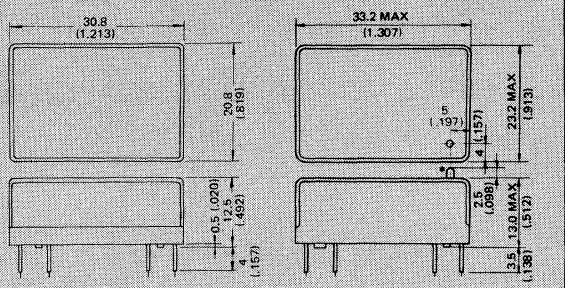
The Fujitsu FRL414 and FBR400N (immersion cleanable) Series Flat Package Relays have been designed for P.C. board mounting and are ingeniously constructed so as to offer the advantages of flux-contamination-immunity.

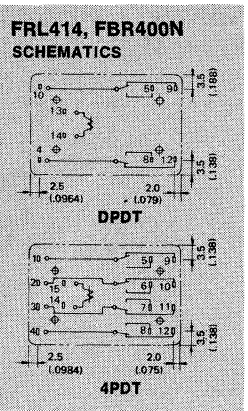
The low power consumption relays are available in both DPDT and 4PDT contact arrangements and in coil voltage ratings to 48V DC. The wide selection is useful for numerous demanding applications, including communications, data processing and controls.

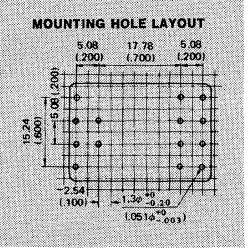
Bifurcated contacts assure high reliability. These relays are capable of handling resistive loads of up to 1A at 30V DC or 120V AC.

A low level load version with gold overlay silver-palladium alloy contacts is also available. Electrical life expectancy is more than three million operations at 1A-50V DC resistive load.

DIMENSIONS Unit: mm (inch)







Notes:
1. For low level or dry circuit switching, use of gold overlay silver-palladium alloy contact relays is recommended.
2. *Cut-off nib must be removed after relay soldering and board cleaning.
3. Although the plastic cover is bonded to the relay base, it is not hermetically sealed. Therefore when the board on which the relay is soldered is cleaned by immersion, cleaning time must not exceed 2 minutes. Please use alcohol, freon or water for cleaning.

ENGINEERING DATA

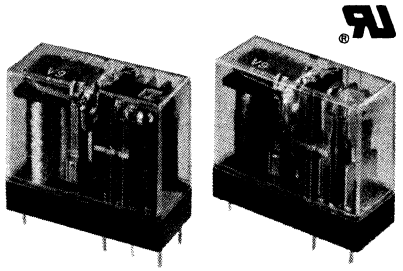
Item	Characteristics
Contact Arrangement	DPDT and 4PDT with bifurcated contacts
Contact Rating	1A at 120V AC (resistive) — 1A at 30V DC (resistive)
Initial Contact Resistance	100mΩ max. at 3V DC, 0.5A initial
Contact Materials	Standard: Gold-overlay silver — Low-level Load: Gold-overlay silver-palladium alloy
Rated Coil Voltage	5, 6, 12, 24, 48V DC
Coil Power Dissipation	DPDT: 0.45W — 4PDT: 0.60W at rated voltage at 20°C
Coil Temperature Rise	DPDT: 30°C approx. — 4PDT: 40°C approx. at rated voltage at 20°C
Insulation Resistance	100MΩ min. at 500V DC (at 20°C 65% RH)
Dielectric Withstanding Voltage	500V rms (60 Hz) for 1 minute
Operate Time	15 ms max. at rated coil voltage at 20°C
Release Time	5 ms max.
Life Expectancy — Mechanical	30 x 10^6 ops. min.
Electrical	3 x 10^4 ops. min. at 30V DC, 1A (resistive) 100 x 10^3 ops. min. at 120V AC, 1A (resistive)
Shock	10G
Temperature Range	−30°C to +50°C (without freezing)
Weight	15 gr. approx.

SELECTION TABLES

Load	Contact		Rated Voltage in V	Pick-Up Voltage at 20°C	Coil Resistance in Ω ±15%	FRL414		FBR400N	
	Materials	Arrangements				Designation	Price	Designation	Price
Standard	Gold Overlay Silver	DPDT	5	Less Than 80% of Rated Voltage	56	FRL-414D005/02CT	$4.73	FBR422ND005	$5.25
			6		78	FRL-414D006/02CT	4.73	FBR422ND006	5.25
			12		320	FRL-414D012/02CT	4.73	FBR422ND012	5.25
			24		1250	FRL-414D024/02CT	4.73	FBR422ND024	5.25
			48		4000	FRL-414D048/02CT	5.36	FBR422ND048	5.88
Standard	Gold Overloy Silver	4PDT	5	Less Than 80% of Rated Voltage	42	FRL-414D005/04CT	$5.39	FBR442ND005	$5.92
			6		58	FRL-414D006/04CT	5.39	FBR442ND006	5.92
			12		220	FRL-414D012/04CT	5.39	FBR442ND012	5.92
			24		960	FRL-414D024/04CT	5.39	FBR442ND024	5.92
			48		2800	FRL-414D048/04CT	6.02	FBR442ND048	6.55
Low-Level Load	Gold Overlay Silver-Palladium Alloy	DPDT	5	Less Than 80% of Rated Voltage	56	FRL-414D005/02CE	$5.39	FBR422ND005 P	$5.92
			6		78	FRL-414D006/02CE	5.39	FBR422ND006 P	5.92
			12		320	FRL-414D012/02CE	5.39	FBR422ND012 P	5.92
			24		1250	FRL-414D024/02CE	5.39	FBR422ND024 P	5.92
			48		4000	FRL-414D048/02CE	6.02	FBR422ND048 P	6.55
Low-Level Load	Gold Overlay Silver-Palladium Alloy	4PDT	5	Less Than 80% of Rated Voltage	42	FRL-414D005/04CE	$6.72	FBR442ND005 P	$7.25
			6		58	FRL-414D006/04CE	6.72	FBR442ND006 P	7.25
			12		220	FRL-414D012/04CE	6.72	FBR442ND012 P	7.25
			24		960	FRL-414D024/04CE	6.72	FBR442ND024 P	7.25
			48		2800	FRL-414D048/04CE	7.39	FBR442ND048 P	7.91

MINIATURE HIGH-POWER RELAYS

FBR600 SERIES

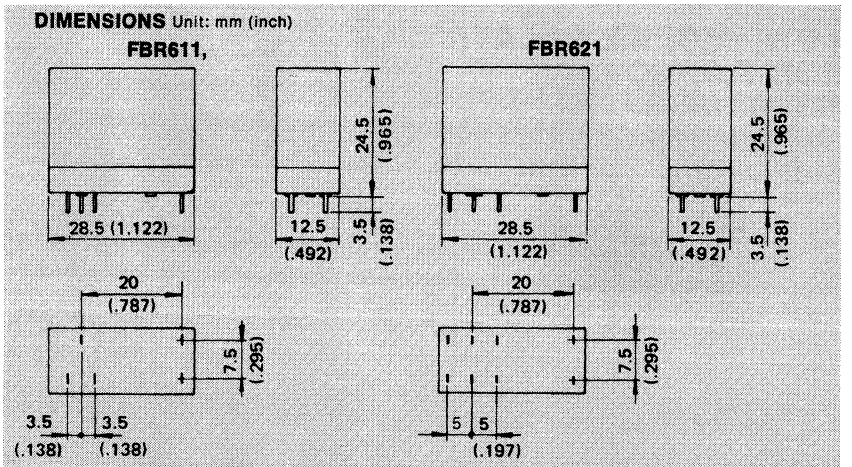


The FBR600 Series are miniature high-power relays with a switching capability of 10A, 30V DC or 240V AC for 1 Form C contact; and 5A, 30V DC or 240V AC for 2 Form C contacts. These relays, conforming to VDE, UL and CSA standards, are designed for mounting on printed circuit boards. Dielectric withstanding voltage is 500V AC for 1 minute and creeping distance is 8mm. These FBR600 Series relays are ideal for use in audio equipment, TV, vending machines, control machines, etc.

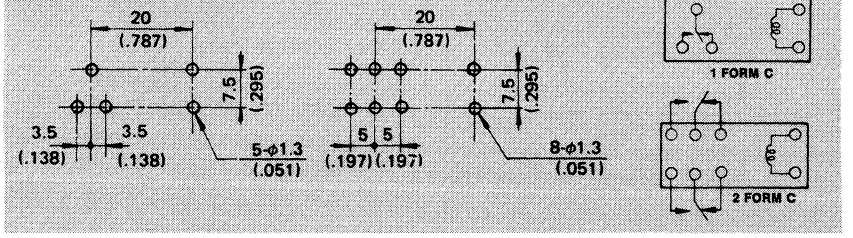
UL recognized (E63615) for industrial control equipment per UL508.

- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

DIMENSIONS Unit: mm (inch)



MOUNTING HOLE LAYOUT



SCHEMATICS

ENGINEERING DATA

Item	Specifications
Contact Arrangement	FBR611, 1 Form C — FBR621, 2 Form C
Contact Ratings	FBR611, 10A at 30V DC or 240V AC — FBR621, 5A at 30V DC or 240V AC
Carrying Current	FBR611, 10A — FBR621, 5A
Contact Material	Silver-alloy
Initial Contact Resistance	100mΩ max. at 6V DC, 1A
Rated Coil Voltage	5, 6, 9, 12, 18, 24, 48, 60V DC
Coil Power Dissipation	FBR611/621, 0.5W at 20°C
Coil Temperature Rise	FBR611/621, 35°C at rated voltage at 20°C
Insulation Resistance	1000Ω min. at 500V DC (initial) at 20°C, 65% RH
Dielectric Withstanding Voltage	
Between Coil and Contact	5000V AC for 1 minute at 20°C, 65% RH
Between Open Contacts	1000V AC for 1 minute at 20°C, 65% RH
Between Adjacent Contacts	FBR621, 3000V AC for 1 minute at 20°C, 65% RH
Lightening (1 x 40μ sec)	
Between Coil and Contact	10,000V min
Between Adjacent Contacts	FBR621, 6000V min.
Operate Time	8 ms approx. at rated voltage at 20°C
Release Time	2.5 ms approx. at 20°C
Life Expectancy — Mechanical	20 x 10^6 ops. min.
Electrical	100 x 10^3 ops. min. at rated voltage
Vibration	10~55 Hz (Dual amplitude: 1.5mm)
Shock	10G (11 ms)
Temperature Range	FBR611/621, −40°C~+70°C
Weight	16 gr. approx.

SELECTION TABLE

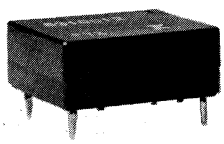
Contact Material	Rated Voltage in V DC	Coil Resistance in Ω at 20°C	Pick-Up Voltage at 20°C	Open Voltage at 20°C	FBR611 Designation	FBR611 Price	FBR621 Designation	FBR621 Price
Silver-Alloy	5	50	Less Than 70% of Rated Voltage	More Than 10% of Rated Voltage (reference)	FBR611D005	$3.19	FBR621D005	$3.50
	6	72			FBR611D006	3.19	FBR621D006	3.50
	9	160			FBR611D009	3.19	FBR621D009	3.50
	12	285			FBR611D012	3.19	FBR621D012	3.50
	18	640			FBR611D018	3.19	FBR621D018	3.50
	24	1150			FBR611D024	3.33	FBR621D024	3.64
	48	4600			FBR611D048	3.89	FBR621D048	4.20
	60	7200			FBR611D060	4.38	FBR621D060	4.69

FUJITSU

RELAYS

LOW PROFILE RELAYS FOR P.C. BOARDS

FBR630 SERIES



Fujitsu's compact FBR630-series relays are only 10 mm in height, but they provide a remarkable contact rating of 10A.

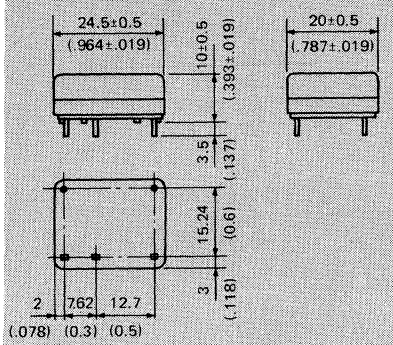
Compactness and high capacity make these low-profile power relays ideally suited to mounting on PC boards.

FEATURES

- Low profile — only 10 mm high
- 5 kV minimum lightning surge (between coil and contact)
- 2.5 kV minimum dielectric withstanding voltage (between coil and contact)
- Sealed terminals to protect against flux
- Input/output isolated terminal arrangement for easy pattern design
- Wide operating temperature range— −30°C to +70°C
- Maximum contact rating: 10A (30 VDC/ 120 VAC)
- High-reliability design meeting various safety standards:

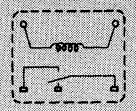
  Japan Electric Appliance Control Law
  UL508 Standard
  CSA-Class 3211 Standard
  FCC 68-302 Standard

DIMENSIONS



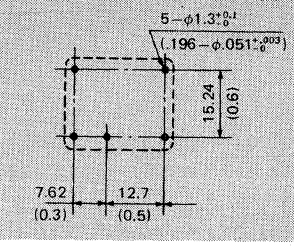
Unit: mm (inch)

SCHEMATICS



(BOTTOM VIEW)

MOUNTING HOLE LAYOUT



ENGINEERING DATA

Item	Specification
Contact Arrangement	SPDT (1 Form C)
Contact Rating	10A 30 VDC/120 VAC, 8A 240 VAC, ½ HP at 240VAC
Contact Configuration	Single
Contact Material	Silver alloy
Initial Contact Resistance	100 mΩ max. at 6 VDC, 1A
Insulation Resistance	100 MΩ min. at 500 VDC
Dielectric Withstanding Voltage	Between open contacts: 1,000 VAC for 1 minute Between coil and contact: 2,500 VAC for 1 minute
Lightning	5,000 V/1 μs/40 μs 5,000V (Between coil and contact) 2,500V 1 μsec 40 μsec
Vibration	10 to 55 Hz (Dual amplitude: 1.5 mm)
Shock	Operating malfunction: 10G (11 ms) Durability: 100G (11 ms)
Operate Time	15 ms max. (excluding bounce time)
Release Time	5 ms max. (excluding bounce time)
Life Expectancy	Mechanical: 10 x 10^6 ops/min. Electrical: 100 x 10^3 ops/min. at rated contact load
Maximum Switching Frequency	Mechanical: 18,000 ops//hr Electrical: 1,800 ops//hr (at rated contact load)
Operating Temperature	−30°C to +70°C
Operating Humidity	45% to 85% RH
Weight	Approx. 10 g

Remarks: The table shows characteristic values at 20°C.

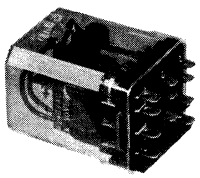
SELECTION TABLE

Rated Coil Voltage	VOLTAGE Specifications	Coil Resistance (±10%)	Coil Current (at Rated Voltage)	Pick-up Voltage	Drop-out Voltage (Reference Value)	Maximum Voltage Allowance	Rated Power Consumption	Coil Temperature Rise	Designation	Price
DC 5V	D005	50Ω	100 mA	Less than 75% of rated voltage	More than 10% of rated voltage	Refer to reference data	Approx. 500 mW (at rated voltage)	Approx. 35 deg. (at rated voltage)	FBR631D005	$2.63
DC 6V	D006	72Ω	83 mA						FBR631D006	2.63
DC 9V	D009	160Ω	56 mA						FBR631D009	2.63
DC 12V	D012	288Ω	42 mA						FBR631D012	2.63
DC 18V	D018	650Ω	28 mA						FBR631D018	2.63
DC 24V	D024	1,150Ω	21 mA						FBR631D024	2.80
DC 48V	D048	4,600Ω	10 mA						FBR631D048	3.50

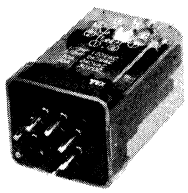
HEAVY DUTY GENERAL PURPOSE RELAYS

FRL250 AND FRL256 SERIES

SPDT, DPDT, 3PDT 10A-30V DC, 10A-240V AC



FRL250

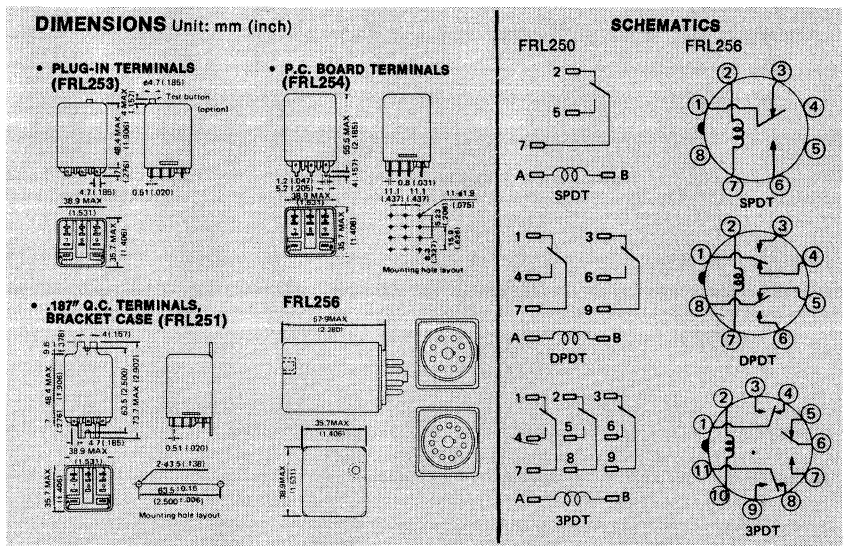


FRL256

The FRL250 Series Relays have been designed with particular attention to reliability, cost performance and versatility of application. These heavy duty general purpose relays provide SPDT, DPDT or 3PDT contacts with switching ability of 10A at 30V DC or 240V AC. The FRL-250 Series Relays provide various mounting styles such as plug-in, bracket case, tapped core, stud or P.C. board, and their terminals are convenient quick-connect/solder or P.C. board. The optional features are with or without test button for manual circuit checking and indicator lamp to indicate whether power is reaching relay.

These relays are particularly desirable for use in automation control, communication circuit and many other applications where high power switching and rugged construction are required.

The FRL250 Series relays are UL recognized (File No. E63614) and C.S.A. certified (File No. LR40304).



ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT, DPDT, 3PDT
Contact Rating	10A at 30V DC (resistive) — 10A at 240V AC (resistive) ⅓ HP at 120V AC, ½ HP at 240V AC
Initial Contact Resistance	100mΩ max. at 6V DC, 1A
Contact Material	Gold flashed silver-cadmium oxide
Rated Coil Voltage	6, 12, 24, 48, 110V DC — 12, 24, 48, 120, 240V AC
Coil Power Dissipation	DC: 1.2W, AC: 3PDT — 2.7VA, DPDT, SPDT — 2VA at rated voltage, 60 Hz
Coil Temperature Rise	DC: 40°C max., AC: 60° max.
Insulation Resistance	100MΩ min. at 500V DC
Dielectric Withstanding Voltage	2000V AC for 1 minute (1000V AC between open contacts)
Operate Time	30 ms max. at rated coil voltage
Release Time	30 ms max.
Life Expectancy — Mechanical	10×10^6 ops. min.
Electrical	100×10^3 ops. min. at rated load
Vibration	600 to 1500 rpm (Dual amplitude: 1mm)
Shock	10G (11 ms)
Temperature Range	DC: −45°C to +70°C/AC: 3PDT: −45°C to +45C°/DPDT, SPDT: −45°C to +55°C
Weight	80 gr. approx.

SELECTION TABLES

DC RELAYS

Contacts	Coil: Rated V DC	Coil: Resistance Ohms	Coil: Power Watts	Fujitsu Number QC/Solder Bracket Case*	Price	Fujitsu Number Plug-In	Price	Fujitsu Number PC Board	Price	Fujitsu Number Plug-In	Price
SPDT	6	32	1.2	FRL251D006/01CS-0C	$ 7.47	FRL253D006/01CS	$ 7.47	FRL254D006/01CS	$ 7.47	FRL256D006/01CS	$ 9.56
	12	120	1.2	FRL251D012/01CS-0C	7.47	FRL253D012/01CS	7.47	FRL254D012/01CS	7.47	FRL256D012/01CS	9.56
	24	470	1.2	FRL251D024/01CS-0C	7.47	FRL253D024/01CS	7.47	FRL254D024/01CS	7.47	FRL256D024/01CS	9.56
	48	1800	1.2	FRL251D048/01CS-0C	7.47	FRL253D048/01CS	7.47	FRL254D048/01CS	7.47	FRL256D048/01CS	9.56
	110	10000	1.2	FRL251D110/01CS-0C	8.16	FRL253D110/01CS	8.16	FRL254D110/01CS	8.16	FRL256D110/01CS	10.25
DPDT	6	32	1.2	FRL251D006/02CS-0C	$10.06	FRL253D006/02CS	$10.06	FRL254D006/02CS	$10.06	FRL256D006/02CS	$12.44
	12	120	1.2	FRL251D012/02CS-0C	10.06	FRL253D012/02CS	10.06	FRL254D012/02CS	10.06	FRL256D012/02CS	12.44
	24	470	1.2	FRL251D024/02CS-0C	10.06	FRL253D024/02CS	10.06	FRL254D024/02CS	10.06	FRL256D024/02CS	12.44
	48	1800	1.2	FRL251D048/02CS-0C	10.06	FRL253D048/02CS	10.06	FRL254D048/02CS	10.06	FRL256D048/02CS	12.44
	110	10000	1.2	FRL251D110/02CS-0C	10.72	FRL253D110/02CS	10.72	FRL254D110/02CS	10.72	FRL256D110/02CS	13.09
3PDT	6	32	1.2	FRL251D006/03CS-0C	$11.75	FRL253D006/03CS	$11.75	FRL254D006/03CS	$11.75	FRL256D006/03CS	$15.59
	12	120	1.2	FRL251D012/03CS-0C	11.75	FRL253D012/03CS	11.75	FRL254D012/03CS	11.75	FRL256D012/03CS	15.59
	24	470	1.2	FRL251D024/03CS-0C	11.75	FRL253D024/03CS	11.75	FRL254D024/03CS	11.75	FRL256D024/03CS	15.59
	48	1800	1.2	FRL251D048/03CS-0C	11.75	FRL253D048/03CS	11.75	FRL254D048/03CS	11.75	FRL256D048/03CS	15.59
	110	10000	1.2	FRL251D110/03CS-0C	12.44	FRL253D110/03CS	12.44	FRL254D110/03CS	12.44	FRL256D110/03CS	16.25

AC RELAYS

Contacts	Coil: Rated V AC	Coil: Current mA	Coil: Power VA	Fujitsu Number QC/Solder Bracket Case*	Price	Fujitsu Number Plug-In	Price	Fujitsu Number PC Board	Price	Fujitsu Number Plug-In	Price
SPDT	12	168	2.0	FRL251A012/01CS-0C	$ 7.47	FRL253A012/01CS	$ 7.47	FRL254A012/01CS	$ 7.47	FRL256A012/01CS	$ 9.56
	24	84	2.0	FRL251A024/01CS-0C	7.47	FRL253A024/01CS	7.47	FRL254A024/01CS	7.47	FRL256A024/01CS	9.56
	48	42	2.0	FRL251A048/01CS-0C	7.47	FRL253A048/01CS	7.47	FRL254A048/01CS	7.47	FRL256A048/01CS	9.56
	120	18	2.0	FRL251A120/01CS-0C	8.16	FRL253A120/01CS	8.16	FRL254A120/01CS	8.16	FRL256A120/01CS	10.25
	240	9	2.0	FRL251A240/01CS-0C	8.59	FRL253A240/01CS	8.59	FRL254A240/01CS	8.59	FRL256A240/01CS	10.69
DPDT	12	168	2.0	FRL251A012/02CS-0C	$10.06	FRL253A012/02CS	$10.06	FRL254A012/02CS	$10.06	FRL256A012/02CS	$12.44
	24	84	2.0	FRL251A024/02CS-0C	10.06	FRL253A024/02CS	10.06	FRL254A024/02CS	10.06	FRL256A024/02CS	12.44
	48	42	2.0	FRL251A048/02CS-0C	10.06	FRL253A048/02CS	10.06	FRL254A048/02CS	10.06	FRL256A048/02CS	12.44
	120	18	2.0	FRL251A120/02CS-0C	10.72	FRL253A120/02CS	10.72	FRL254A120/02CS	10.72	FRL256A120/02CS	13.09
	240	9	2.0	FRL251A240/02CS-0C	11.19	FRL253A240/02CS	11.19	FRL254A240/02CS	11.19	FRL256A240/02CS	13.53
3PDT	12	230	2.7	FRL251A012/03CS-0C	$11.75	FRL253A012/03CS	$11.75	FRL254A012/03CS	$11.75	FRL256A012/03CS	$15.59
	24	115	2.7	FRL251A024/03CS-0C	11.75	FRL253A024/03CS	11.75	FRL254A024/03CS	11.75	FRL256A024/03CS	15.59
	48	57	2.7	FRL251A048/03CS-0C	11.75	FRL253A048/03CS	11.75	FRL254A048/03CS	11.75	FRL256A048/03CS	15.59
	120	24	2.7	FRL251A120/03CS-0C	12.44	FRL253A120/03CS	12.44	FRL254A120/03CS	12.44	FRL256A120/03CS	16.25
	240	12	2.7	FRL251A240/03CS-0C	13.09	FRL253A240/03CS	13.09	FRL254A240/03CS	13.09	FRL256A240/03CS	16.69

*To order No. 6-32 tapped core mounting style, change suffix, **-0C** to **-0A-01** and add $1.13 to price shown; to order No. 6-32 stud mounting style, change suffix **-0C** to **-0B-01** and add $1.03 to price shown.

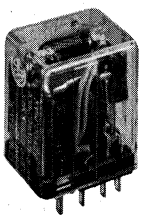
FUJITSU

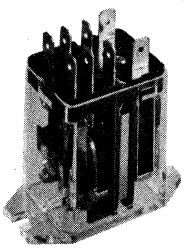
RELAYS

GENERAL PURPOSE RELAYS

FRL260 SERIES

4PDT-5A, 3PDT-5A, DPDT-10A, SPDT-15A





The FRL260 series relays with proven performance and top quality have been designed with emphasis on reliability, safety, cost performance and applicability to a wide range of uses.

These relays provide SPDT to 4PDT contacts, which are offered for contact ratings from 1 amp to 15 amps at 30V DC or 240V AC, resistive. Moreover, they are also available with 4 transfer bifurcated contacts that enable them to meet signal level or other light loads.

The FRL260 series relays are available in both DC- and AC-rated coils, and with a selection of mountings, such as solder, plug-in, P.C. boards and quick connect terminals.

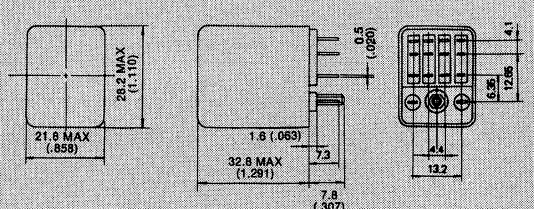
The FRL260 series is UL recognized (File No. 163614/E63615) and C.S.A. certified.

ENGINEERING DATA

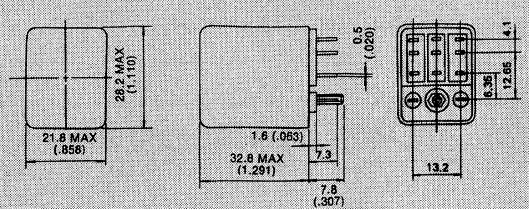
Item	Specifications
Contact Ratings (Resistive Load).	As per SELECTION TABLE
Initial Contact Resistance	General (S, K, V Contact): 100mΩ max. (at 6V DC, 1A) Low Level (T, L Contact): 50mΩ max. (at 6V DC, 0.1A)
Operate Time Release Time	25 ms max. (at rated coil voltage) 25 ms max.
Coil Power Dissipation	DC: 0.9W (at rated coil voltage) AC: 1.2 VA (120V max.) at rated coil voltage of 60 Hz 1.4 VA (200V min.) at rated coil voltage of 60 Hz
Coil Temperature Rise	DC: 50°C max. AC: 60°C max.
Life Expectancy — Mechanical Electrical	50 x 10^6 ops. min. (at rated load) Medium Load SPDT: 500 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min. 3PDT: 500 x 10^3 ops. min. 4PDT: 200 x 10^3 ops. min. 4PST: 100 x 10^3 ops. min. Heavy Load SPDT: 200 x 10^3 ops. min. SPST: 200 x 10^3 ops. min. DPDT: 500 x 10^3 ops. min.
Insulation Resistance	100MΩ min. (at 500V DC)
Dielectric Withstanding Voltage	1500V AC (1000V AC between open contacts) for 1 minute
Vibration	50 Hz (Dual Amplitude: 0.5mm)
Shock	10G (11 ms)
Temperature Range	−30°C to +55°C
Weight	35 gr. approx.

DIMENSIONS Unit: mm

04CL: DIMENSION AND CONSTRUCTION
04CS: DIMENSION AND CONSTRUCTION
04CT: DIMENSION AND CONSTRUCTION
04CV: DIMENSION AND CONSTRUCTION



03CS: DIMENSION AND CONSTRUCTION



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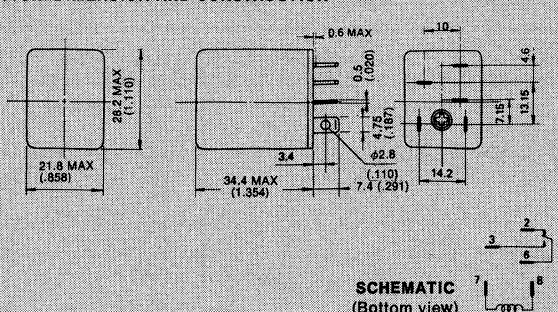

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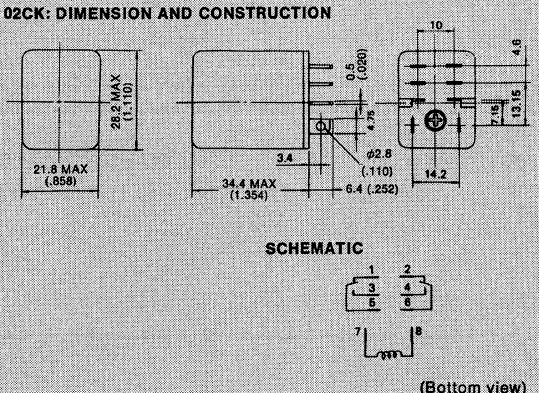


FRL260 SERIES RELAYS SELECTION TABLE — DC COIL

Contact Arrangement and Material	Contact Ratings		Rated Voltage V DC 50/60 Hz	Coil Resistance ±15% Ohms @ 20°C	Pick-Up Voltage @ 20°C	Fujitsu Part Numbers (Plug-In)*	Price
	Resistive	Horsepower					
SPDT AgCdO	15A @ 30V DC or 150V AC 10A @ 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	40	4.5	FRL263D006/01CK	$4.31
			12	160	9	FRL263D012/01CK	4.31
			24	650	18	FRL263D024/01CK	4.31
			48	2600	36	FRL263D048/01CK	4.31
			110	13300	82.5	FRL263D110/01CK	5.36
DPDT AgCdO	10A @ 30V DC or 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	40	4.5	FRL263D006/02CK	$4.48
			12	160	9	FRL263D012/02CK	4.48
			24	650	18	FRL263D024/02CK	4.48
			48	2600	36	FRL263D048/02CK	4.48
			110	13300	82.5	FRL263D110/02CK	5.50
3PDT AgCdO	5A @ 30V DC or 240V AC	1/6 HP @ 120V AC	6	40	4.5	FRL263D006/03CS	$4.48
			12	160	9	FRL263D012/03CS	4.48
			24	650	18	FRL263D024/03CS	4.48
			48	2600	36	FRL263D048/03CS	4.48
			110	13300	82.5	FRL263D110/03CS	5.50
4PDT Ag + Au Clad	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CL	$4.80
			12	160	9	FRL263D012/04CL	4.80
			24	650	18	FRL263D024/04CL	4.80
			48	2600	36	FRL263D048/04CL	4.80
			110	13300	82.5	FRL263D110/04CL	5.81
4PDT Ag	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CS	$4.48
			12	160	9	FRL263D012/04CS	4.48
			24	650	18	FRL263D024/04CS	4.48
			48	2600	36	FRL263D048/04CS	4.48
			110	13300	82.5	FRL263D110/04CS	5.50
4PDT (Bifurcated) Ag + Au Clad	1A @ 30V AC or 120V AC	1/10 HP @ 120V AC	6	40	4.5	FRL263D006/04CT	$5.18
			12	160	9	FRL263D012/04CT	5.18
			24	650	18	FRL263D024/04CT	5.18
			48	2600	36	FRL263D048/04CT	5.18
			110	13300	82.5	FRL263D110/04CT	6.20
4PDT AgCdO	5A @ 30V AC or 240V AC 5A @ 120V AC General Purpose	1/6 HP @ 120V AC	6	40	4.5	FRL263D006/04CV	$4.80
			12	160	9	FRL263D012/04CV	4.80
			24	650	18	FRL263D024/04CV	4.80
			48	2600	36	FRL263D048/04CV	4.80
			110	13300	82.5	FRL263D110/04CV	5.81

For CSA Certified Relays, —CSA suffix must be added to part number. Price is same.
* For PCB type terminals change prefix to FRL264

FRL260 SERIES RELAYS SELECTION TABLE — AC COIL

Contact Arrangement and Material	Contact Ratings		Rated Voltage V AC 50/60 Hz	Coil Resistance ±15% Ohms @ 20°C	Pick-Up Voltage @ 20°C	Fujitsu Part Numbers (Plug-In)*	Price
	Resistive	Horsepower					
SPDT AgCdO	15A @ 30V DC or 150V AC 10A @ 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	9.5	4.8	FRL263A006/01CK	$4.31
			12	40	9.6	FRL263A012/01CK	4.31
			24	165	19.2	FRL263A024/01CK	4.31
			48	630	38.4	FRL263A048/01CK	4.31
			120	4400	96.0	FRL263A120/01CK	4.62
			240	13000	192.0	FRL263A240/01CK	6.16
DPDT AgCdO	10A @ 30V DC or 240V AC	1/3 HP @ 120V AC 1/2 HP @ 240V AC	6	9.5	4.8	FRL263A006/02CK	$4.48
			12	40	9.6	FRL263A012/02CK	4.48
			24	165	19.2	FRL263A024/02CK	4.48
			48	630	38.4	FRL263A048/02CK	4.48
			120	4400	96.0	FRL263A120/02CK	4.80
			240	13000	192.0	FRL263A240/02CK	6.34
3PDT AgCdO	5A @ 30V DC or 240V AC	1/6 HP @ 120V AC	6	9.5	4.8	FRL263A006/03CS	$4.48
			12	40	9.6	FRL263A012/03CS	4.48
			24	165	19.2	FRL263A024/03CS	4.48
			48	630	38.4	FRL263A048/03CS	4.48
			120	4400	96.0	FRL263A120/03CS	4.80
			240	13000	192.0	FRL263A240/03CS	6.34
4PDT Ag + Au Clad	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CL	$4.80
			12	40	9.6	FRL263A012/04CL	4.80
			24	165	19.2	FRL263A024/04CL	4.80
			48	630	38.4	FRL263A048/04CL	4.80
			120	4400	96.0	FRL263A120/04CL	5.11
			240	13000	192.0	FRL263A240/04CL	6.65
4PDT Ag	3A @ 30V AC or 120V AC 3A @ 120V AC General Purpose	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CS	$4.48
			12	40	9.6	FRL263A012/04CS	4.48
			24	165	19.2	FRL263A024/04CS	4.48
			48	630	38.4	FRL263A048/04CS	4.48
			120	4400	96.0	FRL263A120/04CS	4.80
			240	13000	192.0	FRL263A240/04CS	6.34
4PDT (Bifurcated) Ag + Au Clad	1A @ 30V AC or 120V AC	1/10 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CT	$5.18
			12	40	9.6	FRL263A012/04CT	5.18
			24	165	19.2	FRL263A024/04CT	5.18
			48	630	38.4	FRL263A048/04CT	5.18
			120	4400	96.0	FRL263A120/04CT	5.50
			240	13000	192.0	FRL263A240/04CT	7.04
4PDT AgCdO	5A @ 30V AC or 240V AC 5A @ 120V AC General Purpose	1/6 HP @ 120V AC	6	9.5	4.8	FRL263A006/04CV	$4.80
			12	40	9.6	FRL263A012/04CV	4.80
			24	165	19.2	FRL263A024/04CV	4.80
			48	630	38.4	FRL263A048/04CV	4.80
			120	4400	96.0	FRL263A120/04CV	5.11
			240	13000	192.0	FRL263A240/04CV	6.65

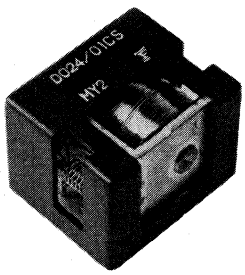
For CSA Certified Relays, —CSA suffix must be added to part number. Price is same.
* For PCB type terminals change prefix to FRL264

FUJITSU

RELAYS

P.C. BOARD RELAYS FOR AUTOMOTIVE APPLICATIONS

FRL270 SERIES



Fujitsu FRL270 series power relays are for PC board mounting and are designed especially for automotive applications.

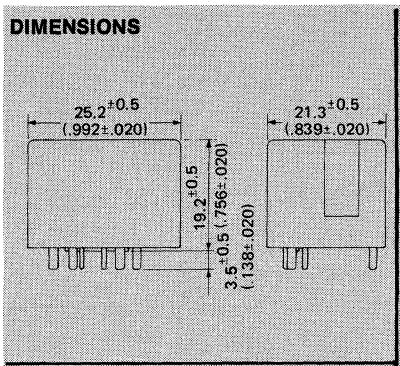
FEATURES

- **Maximum current: 30A**
  The relays are designed for high ambient and storage temperatures to ensure the contacts will endure continuous current of up to 30A.
- **Rigid, shock-resistant construction**
- **1 mm-gap contacts**
  1 mm-gap contacts are also available for controlling 24V motors in trucks and other large vehicles.
- **Welding resistant contact materials**
  Three types of welding resistant contact materials are available as standard.
- Choice of wide terminal model (−01 and −11 suffix) for maximum heat/power transfer or standard terminal model (no suffix or −10) for conventional hole/conductor sizes, at no extra charge.
- Available with case as shown (no suffix and −01) or without case (−10 and −11 suffix).

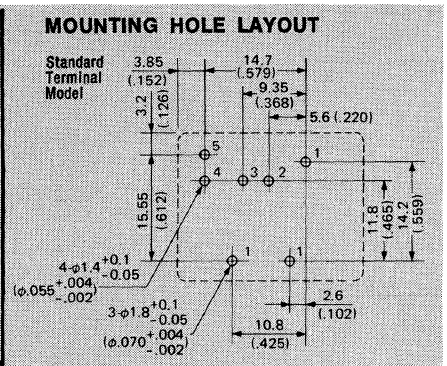
Main Uses

- **Engine control**
  Electronic fuel injection units
- **Lamp control**
  Flasher control units
  Headlight control units
- **Motor, solenoid, and heater controls**
  Windshield wiper control units for trucks
  Automatic door-lock control units
  Defogger control units
  Other various control units
- **Immersion cleaning**
  A sealed type is available for immersion cleaning.

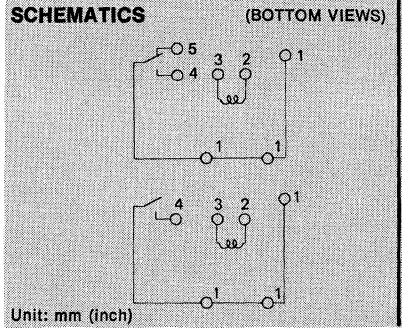
DIMENSIONS

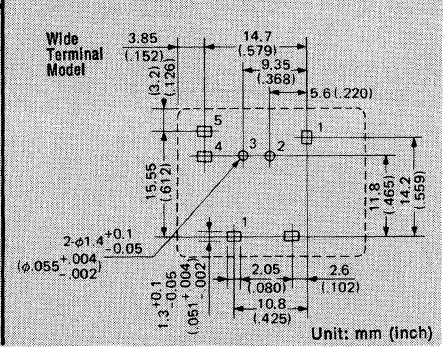


MOUNTING HOLE LAYOUT



SCHEMATICS (BOTTOM VIEWS)





Unit: mm (inch)

Unit: mm (inch)

ENGINEERING DATA

Item	Specifications
Contact Arrangement	SPDT (1 Form C) or SPST (1 Form A)
Contact Material	Silver-copper alloy (S) Silver-cadmium oxide (K) Silver-tin oxide (Y)
Contact Gap	01 type (Standard gap) 51 type (1 mm gap)
Contact Rating	N.O. contact: 12 VDC, 15A or 24 VDC, 10A N.C. contact: 12 VDC, 10A or 24 VDC, 7A (resistive load)
Rated Current	15A (Continuous)
Maximum Current	30A (Overload current when motor locks)
Voltage Drop Across Contacts	Initial: 0.3V max. After life testing: 0.5V max. (after several operations at rated current)
Coil Power	Standard coil. 1.7W approx. Low-power coil: 0.6W approx. (with rated voltage applied at 20°C)
Coil Temperature Rise	Standard coil: 75 deg. approx. Low-power coil: 35 deg. approx. (with rated voltage applied at 20°C)
Insulation Resistance	100 MΩ min. (at 500 VDC)
Withstanding Voltage	500 VAC for 1 minute
Vibration	Operation error: With 1.5 mm vibration applied at full amplitude at 10 ~ 55 Hz, contact chatter lasts less than 1 ms.
Shock	Operation error: 10G (11 ms sine half-wave) Durability: 100G (11 ms sine half-wave)
Operate Time	10 ms max. (Standard coil with 01-type contact gap)
Release Time	5 ms max. (01-type contact gap) 8 ms max. (51-type contact gap)
Life Expectancy	Mechanical: 100 x 10^6 operations or more Electrical: 250 x 10^3 operations or more (Silver-copper alloy under the rated contact load)
Ambient Temperature	−30°C ~ +80°C
Storage Temperature	−40°C ~ +100°C
Weight	20 g approx.

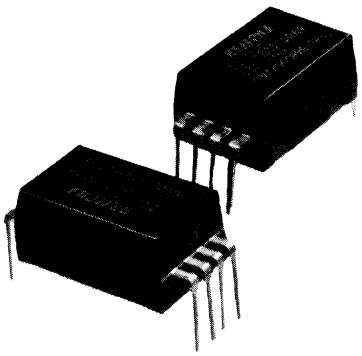
SELECTION TABLE

Type of Coil (Spec. Code)	Rated Voltage (Spec. Code)	Contact Gap (Spec. Code)	Coil Resistance (±10%)	Rated Power Consumption	Pick-Up Voltage	Drop-Out Voltage	All case/terminal suffix codes: none, −01, −10 or −11	
							Designation	Price
Standard (D)	12 VDC (012)	Standard (01)	85	1.7W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274 D012/01AS-A (or CS-A)	$2.45 (or $2.52)
		1 mm (51)	85	1.7W approx.	Less than 6.5 VDC	More than 1.0 VDC	FRL274 D012/51AS-A (or CS-A)	$2.45 (or $2.52)
Low Power (H)		Standard (01)	240	0.6W approx.	Less than 8.4 VDC	More than 0.8 VDC	FRL274 H012/01AS-A (or CS-A)	$2.56 (or $2.62)
Standard (D)	24 VDC (024)	Standard (01)	340	1.7W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274 D024/51AS-A (or CS-A)	$2.59 (or $2.66)
		1 mm (51)	340	1.7W approx.	Less than 13.0 VDC	More than 2.0 VDC	FRL274 D024/01AS-A (or CS-A)	$2.59 (or $2.66)
Low Power (H)		Standard (01)	960	0.6W approx.	Less than 16.8 VDC	More than 1.6 VDC	FRL274 H024/01AS-A (or CS-A)	

Notes: 1. Values listed in the table are measured at 20°C.
2. For silver cadmium oxide contacts (code "K") add $0.10.
3. For silver-tin oxide contact (code "Y") add $0.18.

MICRO REED RELAYS FOR P.C. BOARDS

FRL640 SERIES



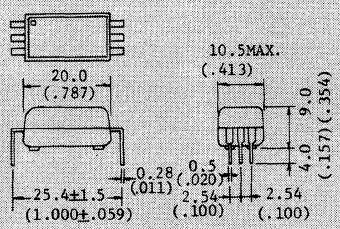
The FRL648 Series Micro Reed Relays offer a wide selection and outstanding performance to meet those demanding on-board switching requirements and high density packaging applications.

These relays, available in 1 Form A/B and 2 Form A/B, feature a standard contact rating of 50VA/10W for S type/K type, compact size with a mounting height of only 9mm (.354"), epoxy-molded construction for immersion cleaning safety, low power consumption, and the option of magnetic shielding for isolation from the effects of adjacent relays.

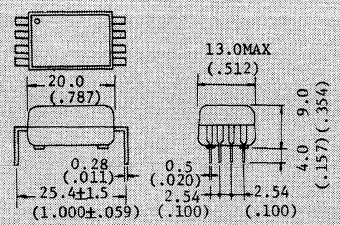
These relays are ideally used for various applications for audio equipment, data processing systems, communications, measuring and control equipment.

Fujitsu field proven dry reed switches are employed as the switching element in the relays in order to offer an excellent low resistance contact and low noise characteristics.

DIMENSIONS Unit: mm (inch)

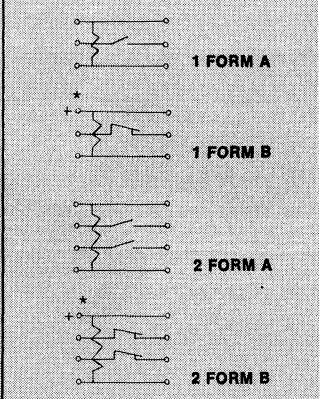


1 FORM A OR 1 FORM B



2 FORM A OR FORM B

SCHEMATICS (TOP VIEW)



* : dotted mark
Positive voltage should be applied at the terminal signed with (+) for correct operation.

ENGINEERING DATA

Item	Characteristics
Contact Arrangement	1 Form A/B, 2 Form A/B
Contact Rating	Type K: 50VA max. (100V AC, 0.5A max.) 30W max. (100V DC, 0.7A max.) Type S: 10W max. (100V DC, 0.5A max.)
Initial Contact Resistance	150mΩ max. at rated voltage
Contact Materials	Rhodium
Rated Coil Voltage	5, 6, 12, 24V DC
Coil Temperature Rise	20°C max.
Insulation Resistance	100MΩ min. at 100V DC
Dielectric Withstanding Voltage	500V DC (200V DC between open contacts)
Operate Time	1.0 ms max. including bounce time
Release Time	Form A: 0.1 ms max. including bounce time Form B: 1.0 ms max. including bounce time
Life Expectancy	K type 1 x 10^6 min at rated load S type: 5 x 10^6 min. at rated load
Vibration	10 to 55Hz (Dual amplitude: 1.5mm)
Shock	30G
Temperature Range	Form A: −10°C to +70°C Form B: −10°C to +50°C
Weight	6 gr. approx.

SELECTION TABLE

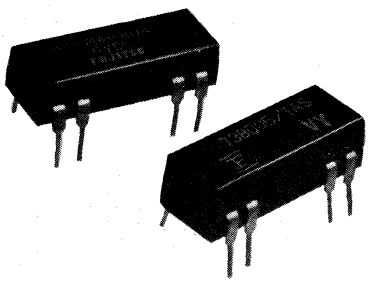
Type	Contact: Materials	Contact: Arrangements	Rated Voltage in V DC	Pick-Up Voltage in V DC at 20°C	Coil Resistance in Ohm ±15% at 20°C	Coil Power Dissipation in mW	Designation	Price
Standard	Rhodium	1 Form A (Make)	5	3.8	550	45	FRL648D05/1AS	$1.72
			6	4.5	550	65	FRL648D06/1AS	1.72
			12	9.0	1050	140	FRL648D12/1AS	1.72
			24	18.0	2800	200	FRL648D24/1AS	2.03
Standard	Rhodium	1 Form B (Break)	5	3.8	300	85	FRL648D05/1BS	$3.44
			6	4.5	300	120	FRL648D06/1BS	3.44
			12	9.0	1300	110	FRL648D12/1BS	3.44
			24	18.0	3800	150	FRL648D24/1BS	3.75
Standard	Rhodium	2 Form A (Make)	5	3.8	210	120	FRL648D05/2AS	$2.03
			6	4.5	210	170	FRL648D06/2AS	2.03
			12	9.0	800	180	FRL648D12/2AS	2.03
			24	18.2	2600	220	FRL648D24/2AS	2.34
Standard	Rhodium	2 Form B (Break)	5	3.8	80	300	FRL648D05/2BS	$3.91
			6	4.5	105	340	FRL648D06/2BS	3.91
			12	9.0	460	310	FRL648D12/2BS	3.91
			24	18.0	1500	380	FRL648D24/2BS	4.22
Heavy Load	Rhodium	1 Form A (Make)	5	3.8	550	45	FRL648D05/1AK	$1.88
			6	4.5	550	65	FRL648D06/1AK	1.88
			12	9.0	1050	140	FRL648D12/1AK	1.88
			24	18.0	2800	200	FRL648D24/1AK	2.19
Heavy Load	Rhodium	1 Form B (Break)	5	3.8	300	85	FRL648D05/1BK	$3.59
			6	4.5	300	120	FRL648D06/1BK	3.59
			12	9.0	1300	110	FRL648D12/1BK	3.59
			24	18.0	3800	150	FRL648D24/1BK	3.91
Heavy Load	Rhodium	2 Form A (Make)	5	3.8	210	120	FRL648D05/2AK	$2.91
			6	4.5	210	170	FRL648D06/2AK	2.19
			12	9.0	800	180	FRL648D12/2AK	2.19
			24	18.0	2600	220	FRL648D24/2AK	2.50
Heavy Load	Rhodium	2 Form B (Break)	5	3.8	80	300	FRL648D05/2BK	$4.06
			6	4.5	105	340	FRL648D06/2BK	4.06
			12	9.0	460	310	FRL648D12/2BK	4.06
			24	18.0	1500	380	FRL648D24/2BK	4.38

FUJITSU

RELAYS

D.I.P. REED RELAYS

FRL730 SERIES

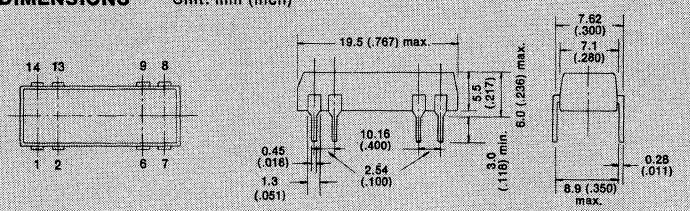


The FRL730 Series D.I.P. Reed Relays are available in 1 Form A contact with contact rating capability of up to 10VA.

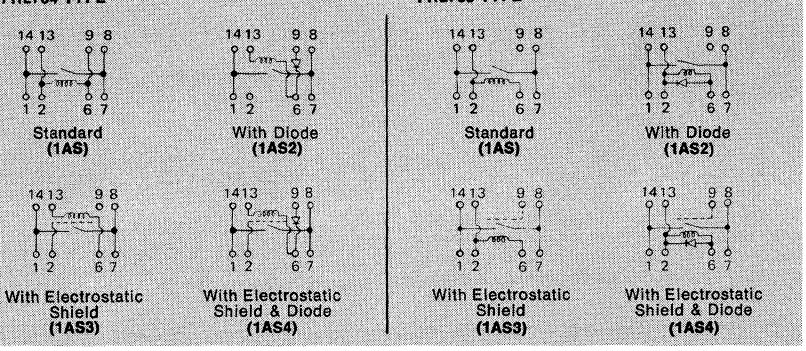
These relays can be mounted in the standard 14-pin dual-in-line package with epoxy-molded construction for safe immersion cleaning. Models with diode and/or electrostatic shield are available.

These FRL730 D.I.P. reed relays are ideal for use in data processing systems and communications, measuring and control equipment.

DIMENSIONS Unit: mm (inch)



SCHEMATICS (TOP VIEW)



ENGINEERING DATA

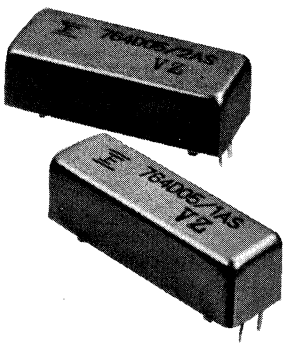
Item	Characteristics
Contact Arrangement	1 Form A
Contact Rating	10 VA max. (100V DC or peak AC max., 0.5A max.) 2.0A max. carry only
Initial Contact Resistance	150mΩ max.
Contact Material	Rhodium
Rated Coil Voltage	5, 6, 12V DC
Coil Temperature Rise	20°C max.
Insulation Resistance	10^{10}Ω min. at 100V DC, +20°C, 40% RH
Dielectric Withstanding Voltage	250V DC min. across open contacts 500V DC min. (between other mutually insulated terminals)
Operate Time	1.0 ms max. including bounce time
Release Time	0.1 ms max.
Life Expectancy	1 x 10^6 min. at rated load (resistive)
Vibration	10 to 55 Hz (Dual amplitude: 1.5mm)
Shock	50G
Temperature Range	−10°C to +70°C
Weight	4 gr. approx.

SELECTION TABLE

Contact Arrangement	Rated Coil Voltage in V DC	Coil Resistance at 20°C in Ω ±15%	Must Operate Voltage at 20°C in V DC	FRL-734 Type		FRL-738 Type	
				Designation	Price	Designation	Price
1A Standard	5	380	3.8	FRL734D05/1AS	$2.91	FRL738D05/1AS	$2.91
	6	380	4.5	FRL734D12/1AS	2.91	FRL738D06/1AS	2.91
	12	530	9.0	FRL734D06/1AS	3.22	FRL738D12/1AS	3.22
1A With Diode	5	380	3.8	FRL734D05/1AS2	$3.72	FRL738D05/1AS2	$3.72
	6	380	4.5	FRL734D06/1AS2	3.72	FRL738D06/1AS2	3.72
	12	530	9.0	FRL734D12/1AS2	4.03	FRL738D12/1AS2	4.03
1A With Electrostatic Shield	5	380	3.8	FRL734D05/1AS3	$3.22	FRL738D05/1AS3	$3.22
	6	380	4.5	FRL734D06/1AS3	3.22	FRL738D06/1AS3	3.22
	12	530	9.0	FRL734D12/1AS3	3.53	FRL738D12/1AS3	3.53
1A With Electrostatic Shield & Diode	5	380	3.8	FRL734D05/1AS4	$4.03	FRL738D05/1AS4	$4.03
	6	380	4.5	FRL734D06/1AS4	4.03	FRL738D06/1AS4	4.03
	12	530	9.0	FRL734D12/1AS4	4.34	FRL738D12/1AS4	4.34

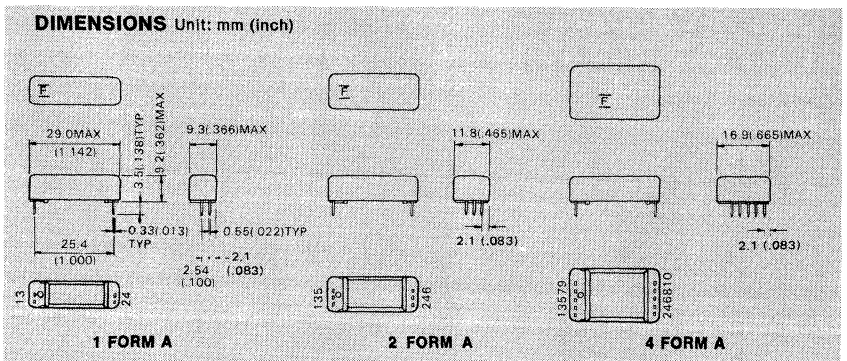
MICRO REED RELAYS FOR P.C. BOARDS

FRL760 SERIES

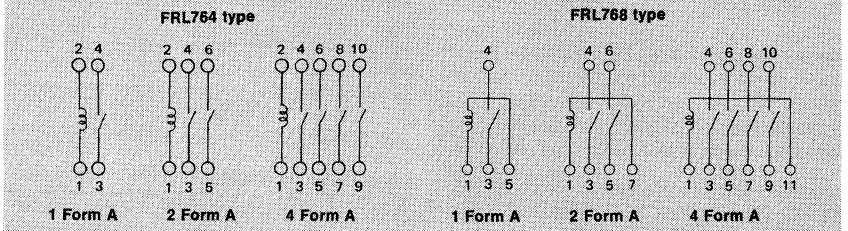


FRL764 and 768 Series Micro Reed Relays offer excellent operating characteristics such as fast operating time, high reliability and long life. Available in a choice of contact arrangements (1 Form A, 2 Form A and 4 Form A) and contact rating capabilities (10W for standard type and 30W DC, 50VA AC for heavy load type), they are potted by polyurethane resin. These low-profile relays are compatible with 1 x .1 inch grid spacing for P.C. board mounting. These micro reed relays are ideal for use in telecommunications, audio equipment, process control systems and vending machines.

DIMENSIONS Unit: mm (inch)



SCHEMATICS



ENGINEERING DATA

Item	Characteristics
Contact Arrangement	1 Form A, 2 Form A, 4 Form A
Contact Rating Power	Standard: 10W max. (resistive) — Heavy Load Type: 30W DC, 50VA AC max. (resistive)
Voltage	Standard: 100V DC max. (resistive) — Heavy Load Type: 100V DC/100V AC max. (resistive)
Current	Standard: 0.5A DC switched max. (resistive) — Heavy Load Type: 0.5A AC switched max. 2.0A carry only max. (resistive)
Initial Contact Resistance	150mΩ max.
Contact Material	Rhodium
Rated Coil Voltage	5, 6, 12, 24V DC
Coil Temperature Rise	30°C max.
Insulation Resistance	10^{10}Ω min. at 100V DC at 20°C, 40% RH
Dielectric Withstanding Voltage	200V DC min. across open contacts 500V DC min. between other mutually insulated terminals
Operate Time	1.0 ms max. including bounce
Release Time	0.1 ms max.
Life Expectancy	K type: 1 x 10^6 min. at rated load S type: 5 x 10^6 min. at rated load
Vibration	10~55 Hz (Dual amplitude: 1.5mm)
Shock	30G, 11 ms half-sinewave
Temperature Range	−10°C~+70°C
Weight	8.5 gr. approx. (2 Form A)

SELECTION TABLES

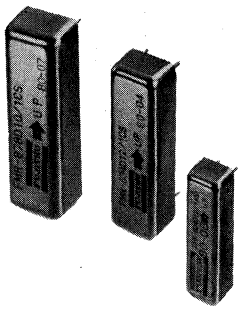
Type	Contact Arrangement	Coil Rated Voltage in V DC	Must Operate Voltage in V DC at 20°C	Coil Resistance in Ω ±15% at 20°C	Coil Power Dissipation in mW	Designation FRL764	Price	Designation FRL768	Price
Standard	1 Form A	5	3.8	310	80	FRL764D05/1AS	$1.88	FRL768D05/1AS	$1.88
		6	4.5	310	116	FRL764D06/1AS	1.88	FRL768D06/1AS	1.88
		12	9.0	1500	96	FRL764D12/1AS	1.88	FRL768D12/1AS	1.88
		24	18.0	4400	131	FRL764D24/1AS	2.19	FRL768D24/1AS	2.19
Standard	2 Form A	5	3.8	150	167	FRL764D05/2AS	$2.38	FRL768D05/2AS	$2.38
		6	4.5	150	240	FRL764D06/2AS	23.8	FRL768D06/2AS	23.8
		12	9.0	730	198	FRL764D12/2AS	23.8	FRL768D12/2AS	23.8
		24	18.0	2500	231	FRL764D24/2AS	2.69	FRL768D24/2AS	2.69
Standard	4 Form A	5	3.8	60	417	FRL764D05/4AS	$3.91	FRL768D05/4AS	$3.91
		6	4.5	90	400	FRL764D06/4AS	3.91	FRL768D06/4AS	3.91
		12	9.0	330	436	FRL764D12/4AS	3.91	FRL768D12/4AS	3.91
		24	18.0	1300	443	FRL764D24/4AS	4.22	FRL768D24/4AS	4.22
Heavy Load	1 Form A	5	3.8	310	80	FRL764D05/1AK	$2.03	FRL768D05/1AK	$2.03
		6	4.5	310	116	FRL764D06/1AK	2.03	FRL768D06/1AK	2.03
		12	9.0	1500	96	FRL764D12/1AK	2.03	FRL768D12/1AK	2.03
		24	18.0	4400	131	FRL764D24/1AK	2.34	FRL768D24/1AK	2.34
Heavy Load	2 Form A	5	3.8	150	167	FRL764D05/2AK	$2.69	FRL768D05/2AK	$2.69
		6	4.5	150	240	FRL764D06/2AK	2.69	FRL768D06/2AK	2.69
		12	9.0	730	198	FRL764D12/2AK	2.69	FRL768D12/2AK	2.69
		24	18.0	2500	231	FRL764D24/2AK	3.00	FRL768D24/2AK	3.00
Heavy Load	4 Form A	5	3.8	60	417	FRL764D05/4AK	$4.53	FRL768D05/4AK	$4.53
		6	4.5	90	400	FRL764D06/4AK	4.53	FRL768D06/4AK	4.53
		12	9.0	330	436	FRL764D12/4AK	4.53	FRL768D12/4AK	4.53
		24	18.0	1300	443	FRL764D24/4AK	4.84	FRL768D24/4AK	4.84

FUJITSU

RELAYS

MERCURY WETTED CONTACT RELAYS

FMR800 SERIES

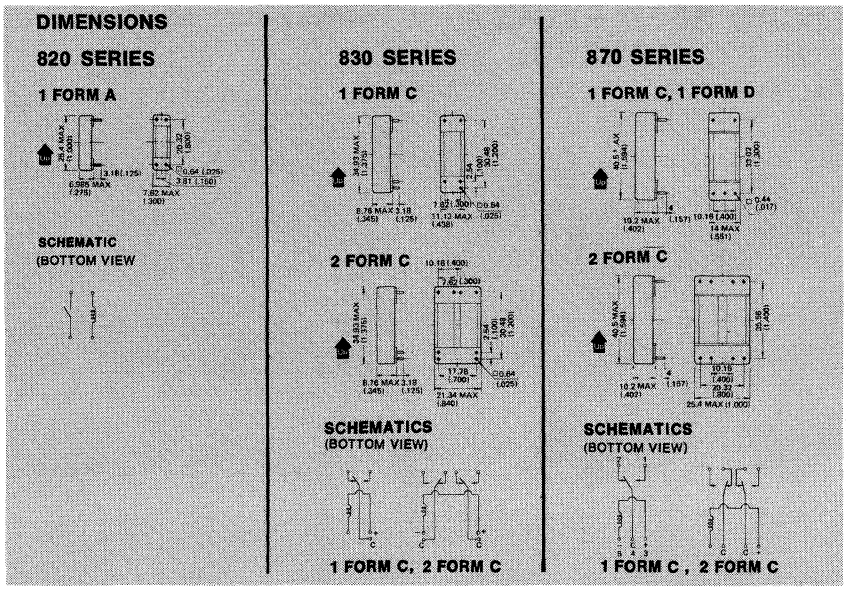


Fujitsu FMR-800 Series mercury wetted contact relays are compact for P.C. board mounting.

Highly stable, they can be used for a wide range of current switching from very low levels to heavy loads. Conventional flux cleaning can be used after P.C. board mounting as these relays are potted with polyurethane resin. The mercury switching gives these relays a bounce-free contact and an extremely long operating life. Therefore, Fujitsu mercury wetted contact relays are ideal for use in measuring equipment, communications systems, computer systems, automatic control systems etc.

FEATURES

- Extremely long life expectancy (10 x 10^9 operations)
- Short operate/release time (2 ms) and no contact bounce
- Stable, low contact resistance
- Available for wide current range switching from low level signals to 2 amps
- Contacts are independent from atmospheric conditions



SELECTION TABLE

Series	Contact Arrangement	Rated Voltage in V DC	Coil Resistance in Ω at 20°C	Coil Power Dissipation in mW	Operate in V DC at 20°C	Release in V DC at 20°C	Designation	Price
820 Series	1 Form A	5	350	72	4.0	0.5	FMR824D05/1AS	$10.25
		6	350	103	4.8	0.6	FMR824D06/1AS	10.25
		12	950	152	9.6	1.2	FMR824D12/1AS	10.25
		24	2742	210	19.2	2.4	FMR824D24/1AS	11.13
830 Series	1 Form C	5	117	214	2.9	0.52	FMR834D05/1CS	$17.59
		6	196	184	3.5	0.66	FMR834D06/1CS	17.59
		12	720	200	7.0	1.3	FMR834D12/1CS	17.59
		24	2730	211	14.0	2.6	FMR834D24/1CS	18.75
		48	10,000	231	28.0	5.2	FMR834D48/1CS	19.91
830 Series	2 Form C	5	56	447	2.9	0.52	FMR834D05/2CS	$29.31
		6	90	400	3.5	0.66	FMR834D06/2CS	29.31
		12	392	368	7.0	1.3	FMR834D12/2CS	29.31
		24	1440	400	14.0	2.6	FMR834D24/2CS	29.62
		48	5460	422	28.0	5.2	FMR834D48/2CS	31.66
830 Series	2 Form C (with C.O.T.)	5	56	447	2.9	0.52	FMR834D05/2CT	$31.66
		6	90	400	3.5	0.66	FMR834D06/2CT	31.66
		12	392	368	7.0	1.3	FMR834D12/2CT	31.66
		24	1440	400	14.0	2.6	FMR834D24/2CT	32.81
		48	5460	422	28.0	5.2	FMR834D48/2CT	33.47
870 Series*	1 Form C	5	125	200	2.9	0.61	FMR874D05/1CS	$16.88
		6	125	290	3.5	0.75	FMR874D06/1CS	16.88
		12	685	210	7.1	1.5	FMR874D12/1CS	16.88
		24	2650	220	14.0	3.0	FMR874D24/1CS	18.03
870 Series*	1 Form D	5	125	200	2.9	0.61	FMR874D05/1DS	$16.88
		6	125	290	3.5	0.75	FMR874D06/1DS	16.88
		12	685	210	7.1	1.5	FMR874D12/1DS	16.88
		24	2650	220	14.0	3.0	FMR874D24/1DS	18.03
870 Series*	2 Form C	5	55	455	2.6	0.55	FMR874D05/2CS	$28.16
		6	55	655	3.4	0.7	FMR874D06/2CS	28.16
		12	370	390	6.7	1.4	FMR874D12/2CS	28.16
		24	1370	421	13.0	2.7	FMR874D24/2CS	30.00
870 Series*	2 Form C (with C.O.T.)	5	55	455	2.6	0.55	FMR874D05/2CT	$30.47
		6	55	655	3.4	0.7	FMR874D06/2CT	30.47
		12	370	390	6.7	1.4	FMR874D12/2CT	30.47
		24	1370	421	13.0	2.7	FMR874D24/2CT	32.34

* FMR878 Series is available with .093 inch grid spacing instead of .100 inch grid. Price is same as FMR874 Series.

ENGINEERING DATA

	FMR821	FMR830			FMR870			
Contact Arrangements	1 Form A	1 Form C	2 Form C	2 Form C (with C.O.T.)	1 Form C	1 Form D	2 Form C	2 Form C (with C.O.T.)
Contact Ratings — Switching Carry Current	50 VA max. 1A max. 350V DC max. 2A max.	100 VA max. 2A max., 500V DC max. 5A max.						
Initial Contact Resistance	50 mΩ max.	30 mΩ max.	30 mΩ max.	30 mΩ max.	30 mΩ max.	30 mΩ max.	30 mΩ max.	30 mΩ max.
Operate Time Release Time	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.	2.0 ms max. 2.0 ms max.
Insulation Resistance Dielectric Withstanding Voltage	1000 MΩ min. (500V DC) 1000V AC min.	100 MΩ min. (500V DC) 1000V AC min.	100 MΩ min. (500V DC) 1000V AC min.	100 MΩ min. (500V DC) 1000V AC min.	100 MΩ min. (500V DC) 1000V AC min.	100 MΩ min. (500V DC) 1000V AC min.	1000 MΩ min. (500V DC) 1000V AC min.	1000 MΩ min. (500V DC) 1000V AC min.
C.O.T. (Common Open Type)	—	—	—	50 μs min. (100 Hz, 50% duty)	—	—	—	50 μs min. (100 Hz, 50% duty)
Operating Temptrature Range	−38°C to +90°C (include coil temperature rise)							
Vibration	10 Hz to 55 Hz (Dual amplitude: 1.5mm)							
Shock	30G							

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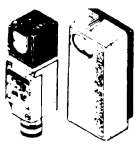
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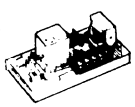
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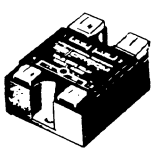
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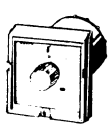
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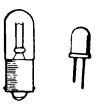
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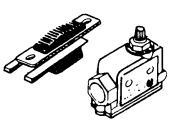
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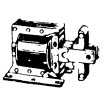
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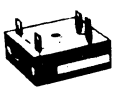
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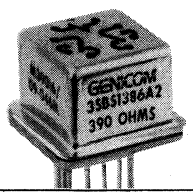
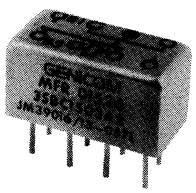
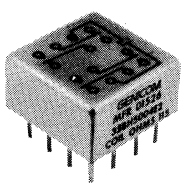
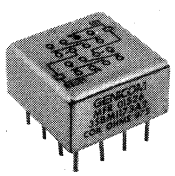
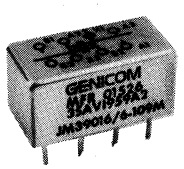
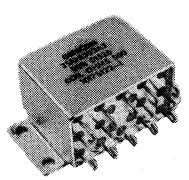
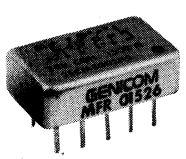
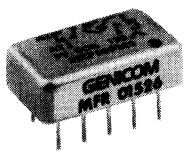
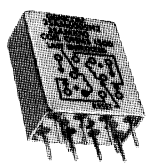
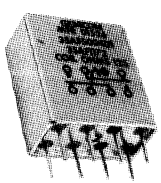
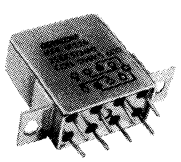
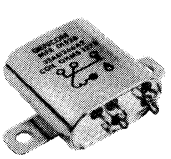
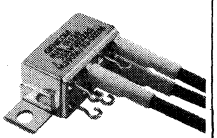
SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SBS Transistor Size Relay		2PDT	1A DC Res .2A DC Ind Low Level	10^5 / 10^6	Size .37 × .37 × .275 Weight 0.09	120 mW	39016/9 39016/15 39016/20	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBC 1/5 Size Two Pole 150 Grid Hybrid		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 / 10^6	Size .61 × .31 × .32 Weight 0.13	135 mW	39016/13 39016/37 39016/38	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBH 1/5 Size Four Pole 150 Grid Hybrid		4PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.24	250 mW	39016/14	100G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SBM 1/2 Size 150 Grid Latching Hybrid		4PDT	2A DC Res .5A DC Ind .5A-DC Low Level	10^5 / 10^6	Size .61 × .61 × .32 Weight 0.28	100mW Single Coil or 180mW Dual Coil	39016/31 39016/35 39016/36	150G @ 11 ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAV Half-Size Sensitive R.F.		2PDT	2A DC Res .5A DC Ind .75 A-AC Low Level	10^5 / 10^6	Size .80 × .40 × .40 Weight 0.30	100mW to 260mW	39016/6 39016/22 39016/33 39016/44	100G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
3SAH Four Pole Grid		4PDT	2A DC Res .5A DC Ind 1A-AC Low Level	2×10^5 at 2A dc at 1A AC / 2×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW	39016/39	50G @ 11ms	30G 55-3000 Hz	−65C +125C Special +200C
		2PDT	.5A DC .1A DC Ind Low Level	10^5 / 10^6	Size .575 × .350 × .170 Weight .075	2.0 mJ at 5ms	39016/47	100G @ 6ms	30G 55-3000 Hz	−65C +125C

*Single-phase load, case not grounded

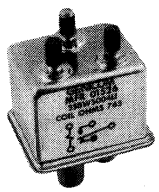
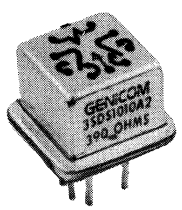
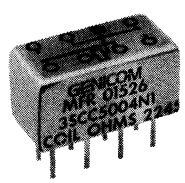
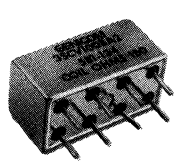
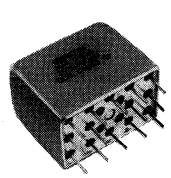
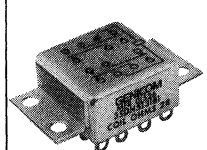
GENICOM®

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SCP DeciGrid® Mono-stable 1/10 Size		2PDT	.5A DC .1A DC Ind Low Level	10^5 10^6	Size .575 × .350 × .170 Weight .075	68 mW	39016/48	100G @ 6ms	30G 55- 3000 Hz	−65C +125C
3SAM Mag-Latch Grid-Space		2PDT	2A DC Res .5A DC Ind 1A-AC Low Level	10^5 at 2A DC at 1A AC 10^6	Size .80 × .40 × .90 Weight 0.60	50mW Single Coil 75mW Dual Coil	39016/32	150G @ 11ms	30G 55- 3000 Hz	−65C +125C Special +200C
3SAF Grid Spaced Micro Crystal Can		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC 10^6	Size .80 × .40 × .90 Weight 0.50	300 mW	5757/10	100G @ 11 ms	30G 55- 2000 Hz	−65C +125C
3SBK Power Relay		2PDT	5A DC 2A AC 2A DC Ind Low Level	10^5 10^6	Size .80 × .40 × .90 Weight 0.7 max	300 mW	5757	90G @ 11ms	30G 55- 2000 Hz	−65C +125C
3SAC Crystal Can "S" Header		2PDT 1PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × 1.187 Weight .090	200 mW	5757/10	50G @ 11ms	10G 55- 500 Hz	−65C +125C
3SAE Crystal Can "S" Header		2PDT	2A DC Res 1A DC Ind 1A-AC Low Level	10^5 at 2A DC at 2A AC 10^6	Size .797 × .359 × .875 Weight 0.45	330mW	5757/10	100G @ 11ms	20G 55- 2000 Hz	−65C +125C
3SAV-RF with Co-ax Cables		2PDT 1PDT	25 Watts 10 Watts	10^5 10^6	Size .86 × .40 × .46 Weight .35 oz. max	260 mW 100 mW	39016/33	100G @ 11ms	30G 55- 3000Hz	−65C +125C

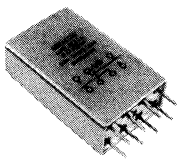
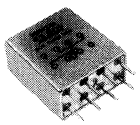
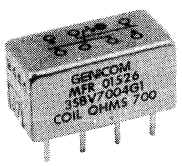
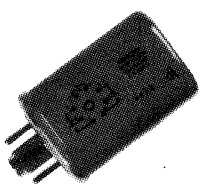
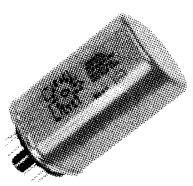
*Single-phase load, case not grounded

Continued on next page.

SEALED RELAY Selection Guide

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE NO MOUNT L" × W" × H" & WEIGHT (OZ.)	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SBW RF Relay		1PDT	150 Watts RF 0-150 Watts RF Dry Switching	4×10^4 2×10^5 at RF 10^6	1.150 × .950 × .840 Weight 1.3	250mW			10G 55-500 Hz	−65C +85C
3SDS Long Life		2PDT	1A DC .5A AC Low Level	10^5 50×10^6	Size .37 × .37 × .275 Weight 0.13	120 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCC Long Life		2PDT 1PDT 1A, 1B	2A DC Res .5A DC Ind .5-AC Low Level	10^5 100×10^6	Size .61 × .31 × .32 Weight 0.13	135 mW		100G @ 11ms	30G 55-3000Hz	−40C +125C
3SCV Long Life Half-Size		2PDT	2A DC Res .5A DC Ind .5A-AC Low Level	10^5 100×10^6	Size .80 × .40 × .40 Weight .30	340mW				−40C + 125C
3SCH Long Life		4PDT	2A Res .5A DC Ind 1A-AC Low Level	2×10 at 2A dc at 1A AC 75×10^6	Size 1.01 × .61 × .81 Weight 1.0	400 mW		50G @ 11ms	30G 55-3000Hz	−40C +125C
3SDH Long Life		4PDT	2A DC .5A AC Low Level	10^5 100×10^6	Size .61 × .61 × .32 Weight 0.24	250 mW		100G @ 11ms	55-3000Hz	−40C +125C

*Single-phase load, case not grounded

RELAY TYPE	PICTURE	CONTACT ARRANGEMENT	CONTACT LIFE: CURRENT LEVELS AT 28 VDC AT 115 VAC*	CONTACT LIFE: OPERATIONS	SIZE & WEIGHT (OZ.) NO MOUNT L × W × H	OPERATE SENSITIVITY (MILLIWATTS)	APPLICABLE MIL SPEC MIL-R-	SHOCK	VIBRATION	TEMPERATURE RANGE
3SAT Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 / 10^6	Size .80 × .400 × 1.125 Weight .95	40 mW & 25 mW	5757	90G @ 11ms	20G 55-3000Hz	−65C +125C Special 200C
3SBF Sensitive Mil Quality		2PDT 1PDT	2A DC 1A AC Low Level	10^5 / 10^6	Size .80 × .40 × .90 Weight .50	75 mW & 50 mW	5757	90G @ 11ms	25G 55-2500Hz	−65C +125C Special 200C
3SBV Industrial Half-Size		2PDT	2A DC Res .5A-AC Low Level	10^5 / 10^6	Size .88 × .48 × .49 Weight 0.30	285 mW				−45C +71C
3SAA Power Relay Mil Quality		1Pole to 6 Poles	Low Level to 10 Amps	Depends on Rating	Size 1.67 × 1.48 × 2.1 Weight 4.5	600 mW		30G @ 11ms	55-500 Hz	−65C +125C
3SCA Miniature Industrial Relays		2PDT 4PDT 6NO	10A 5A DC Res 2A DC Ind 5A-AC Low Level	Depends on Contact Rating	1.67 × 1.48 × 2.1 Weight 4.5	350mW 600mW 815mW				0C +71C

Note: Long Life relays are rated at 50 μA, 50 mV open circuit DC or Peak AC for the number of operations indicated in selection guide with the contact resistance during life test not to exceed 50 ohms. Testing plan is available on request.

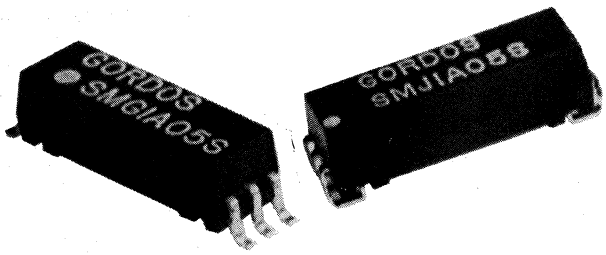
***Single-phase load, case not grounded**

For additional publications and product information contact:
GENICOM Corporation, GENICOM Relays
Waynesboro, VA 22980, 1-703-949-1471

GENICOM®
Relays You Can Rely On.

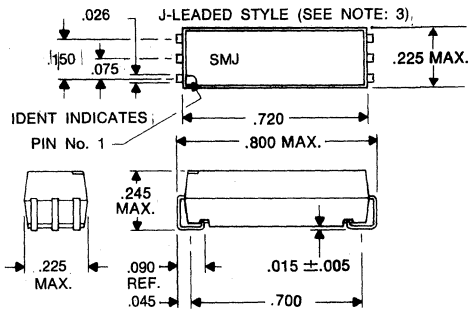
GORDOS

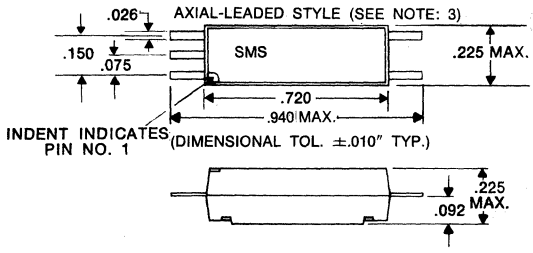
SURFACE MOUNT REED RELAYS

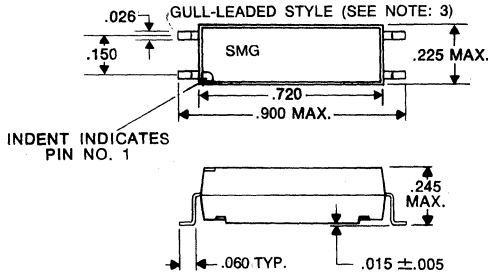


- All Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Withstand continuous exposure for 3 minutes at 215°C
- RF Characteristics
  - Insertion Loss: 0.3 dB max. from 1 to 500 MHz
  - Isolation: 30 dB min. from 1 to 600 MHz
  - Characteristic Impedance: 50, 75, or 93 ohms available

Nominal Coil Voltage DC	5	12
Must Operate Voltage DC	4.0	9.0
Must Release Voltage DC	0.5	1.2
Maximum Voltage DC	10	20







Contact Arrangement Model Type		Standard 1A	Standard 1C	Coaxially Shielded Versions for RF Switching			
				1A05-S 1A12-S	1A05-5	1A05-7	1A05-9
Max. Switching DC[2]	Watts	10	3	10	10	10	10
	Volts	200	30	200	200	200	200
Max. Current DC Amps	Switch	0.5	0.2	0.5	0.5	0.5	0.5
	Carry	1.5	0.5	1.5	1.5	1.5	1.5
Max. Initial Contact Resistance (ohms)[1]		.150	.150	.150	.150	.150	.150
Min. Breakdown Voltage DC	Across Contacts	300	200	300	300	300	300
	Contact to Shield	~	~	1000	1000	1000	1000
	Contact to Coil	1000	1000	1000	1000	1000	1000
	Coil to Shield	~	~	1000	1000	1000	1000
Characteristic Impedance (typical) Ohms		~	~	50	50	75	93
Capacitance (typical) pF	Across Contacts	1.0	1.5	0.6	0.6	0.6	0.5
	Contact to Coil	2.0	2.0	1.5	1.5	1.4	1.1
Capacitance (typical) pF (guarded meas.)	Across Contacts	~	~	0.1	0.1	0.1	0.1
	Contact to Coil	~	~	0.3	0.2	0.2	0.1
Insulation Resistance /typical) Ohms @ 25°C 50% R.H.		10^{14}	10^{12}	10^{14}	10^{14}	10^{14}	10^{14}
Operate Time (typical) mSec (including bounce)		0.3	1.0	0.3	0.3	0.3	0.3
Realese Time (typical) mSec (diode suppressed)		0.2	1.5	0.2	0.2	0.2	0.2

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

Nom. Coil Volt.	Coil Resistance (ohms) ±10%	(See Notes: 3 &4) Part Number	Contact Arrangement Schematics (Top View)
5	500	SMJ1A05 SMG1A05 SMS1A05	STANDARD 1 FORM-A
12	1000	SMJ1A12 SMG1A12 SMS1A12	
5	380	SMJ1A05-S SMG1A05-S SMS1A05-S	COAXIALLY SHIELDED 1 FORM-A
12	800	SMJ1A12-S SMG1A12-S SMS1A12-S	
5	150	SMJ1A05-5 SMG1A05-5 SMS1A05-5	
5	150	SMJ1A05-7 SMG1A05-7 SMS1A05-7	(PIN NUMBERS ARE FOR REFERENCE ONLY)
5	150	SMJ1A05-9 SMG1A05-9 SMS1A05-9	
5	150	SMJ1C05 SMG1C05 SMS1C05	STANDARD 1 FORM-C
12	800	SMJ1C12 SMG1C12 SMS1C12	

Notes: All specifications are based on a 25°C ambient temperature.

1. Measured with nominal coil voltage applied.
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Lead styles are available in all contact configurations and voltages listed.
4. The prefixes used in the model number designate the following lead styles.
   "SMJ" — J-Leaded
   "SMG" — Gull-Leaded
   "SMS" — Axial-Leaded

Consult factory for magnetic shield requirements.

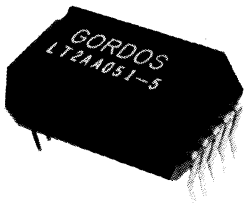
Products and specifications subject to change without notice.

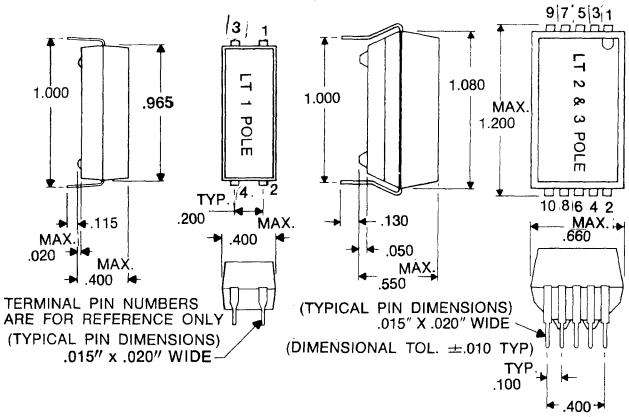
Consult factory for technical data sheet and application assistance.

1000 N. SECOND ST., ROGERS, AR 72756 USA / TEL: 800-643-3500, 501-636-5000 / TWX: 910-720-7998 / FAX: 501-636-2305

GORDOS

MOLDED LOW THERMAL EMF REED RELAYS





- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Insulation resistance $>10^{14}$ ohms
- Thermal EMF rating $<1\ \mu V$ available

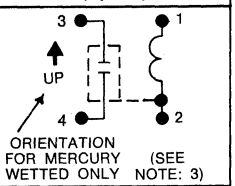
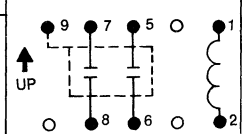
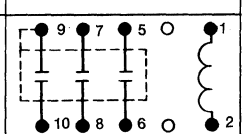
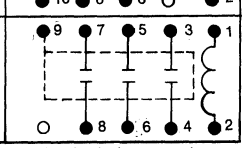
Nominal Coil Voltage	5	12
Must Operate Voltage DC	4.0	9.6
Must Release Voltage DC	0.5	1.2
Maximum Voltage DC	10	20

Contact Arrangement Model Type		"A" Standard	"E" High Volt.	"H" Mercury Wet
Max. Switching DC(2)	Watts	10	10	50
	Volts	200	1000	500
Max. Current DC Amps	Switch	0.5	0.5	1.0
	Carry	1.5	2.0	2.0
Max. Initial Contact Resistance (ohms)(1)		.100	.100	.050
Insulation Resistance (typical) Ohms @ 25°C 50% R.H.		10^{14}	10^{14}	10^{14}
Operate Time (typical) mSec including Bounce		1.0	1.0	2.0
Release Time (typical) mSec Diode Suppressed		0.5	0.5	1.5

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

Example Part Number — LT 1A A 05 1 — 5

Family Series	Contact Arrangement	Contact Type	Nominal Coil Voltage	Schematic Style	Thermal Offset Voltage* (μV Max.)	Coil Resistance (ohms) ±10%	Minimum Breakdown Voltage DC: Across Contacts	Contact to Shield	Contact to Coil	Shield to Coil	Capacitance** (typical pF): Across Contacts	Contact to Shield	Contact to Coil	Shield to Coil	Schematic (top view)
LT	1A	A	5	1	5	500	250	1500	1500	NA	0.2	2.0	1.0	~	
			12		5	2000									
	1A	E	5	1	5	500	1500	1500	1500	NA	0.8	2.0	1.0	~	
			12		5	2000									
	1A	H	5	1	10	500	1000	1500	1500	NA	0.2	3.0	2.0	~	
			12		10	2000									
	2A	A	5	1	1	400	250	500	1500	1000	0.2	1.5	0.4	12	
					5										
			12		1	2000									
					5										
	2A	E	5	1	5	200	1500	1500	1500	1000	0.8	2.0	0.5	15	
					10										
			12		5	1000									
					10										
	2A	H	5	1	5	200	1000	1000	1500	1000	0.1	2.5	0.6	15	
					10										
			12		5	1000									
					10										
	3A	A	5	1	1	400	250	500	1500	1000	0.2	2	0.4	25	
					5										
			12		1	2000									
					5										
	3A	A	5	2	1	400	250	500	1000	1000	0.2	1.5	0.4	25	
					5										
			12		1	2000									
					5										

* Thermal offset voltage measured between pins 5 and 7 with pins 6 and 8 shorted

** Capacitance values obtained with all other leads tied to guard.

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied.
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

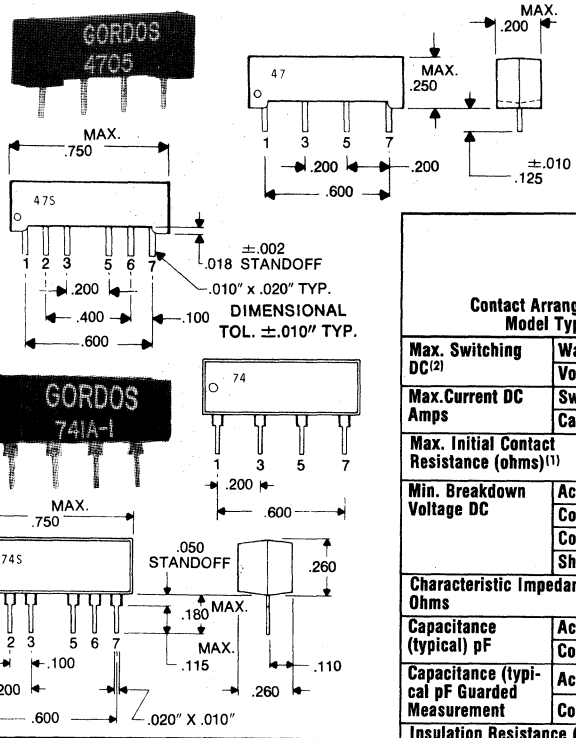
Products and specifications subject to change without notice.

Consult factory for technical data sheet and application assistance.

1000 N. SECOND ST., ROGERS, AR 72756 USA / TEL: 800-643-3500, 501-636-5000 / TWX: 910-720-7998 / FAX: 501-636-2305

GORDOS

47 SERIES MINI-SIP DRY REED RELAY
74 SERIES SIP DRY & MERCURY WETTED REED RELAY



- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- RF Characteristics
  - Insertion Loss: 0.3 dB max. from 1 to 500 MHz
  - Isolation: 30 dB min. from 1 to 600 MHz
  - Characteristic Impedance: 50, 75, or 93 ohms available
- Compatible with automatic insertion
- Logic Compatible

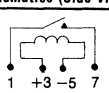
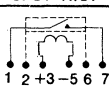
Contact Arrangement Model Type			1 Form-A Std. Dry 47/741A	1 Form-A (4) Mercury Wetted 741AH	(3) 1 Form-B 741B	1 Form-C 741C	Coaxially Shielded 1 Form-A Versions for RF Switching 4705S 4712S 741AS	47055 741A5	47057 741A7	47059 741A9
Max. Switching DC(2)	Watts		10	50	10	3	10	10	10	10
	Volts		200	500	200	30	200	200	200	200
Max.Current DC Amps	Switch		0.5	1.0	0.5	0.2	0.5	0.5	0.5	0.5
	Carry		1.5	2.0	1.5	0.5	1.5	1.5	1.5	1.5
Max. Initial Contact Resistance (ohms)(1)		47	.100	.050	.200	.200	.100	.100	.100	.100
		74	.200	.050	.200	.200	.200	.200	.200	.200
Min. Breakdown Voltage DC	Across Contacts		300	1500	300	200	300	300	300	300
	Contact to Shield		—	—	—	—	1000	1000	1000	1000
	Contact to Coil		1000	1000	1000	1000	1000	1000	1000	1000
	Shield to Coil		—	—	—	—	1000	1000	1000	1000
Characteristic Impedance (typical) Ohms			—	—	—	—	50	50	75	93
Capacitance (typical) pF	Across Contacts		1.0	1.1	—	2.0	0.6	0.6	0.6	0.5
	Contact to Coil		2.0	2.0	3.8	2.0	1.5	1.0	1.0	1.1
Capacitance (typical pF Guarded Measurement	Across Contacts		—	—	—	—	0.1	0.1	0.1	0.1
	Contact to Coil		—	—	—	—	0.3	0.2	0.2	0.1
Insulation Resistance (typical) Ohms at 25°C 50% R.H.		47	10^{14}	10^{12}	10^{10}	10^{9}	10^{14}	10^{14}	10^{14}	10^{14}
		74	10^{10}	10^{12}	10^{10}	10^{9}	10^{10}	10^{10}	10^{10}	10^{10}
Operate Time (typical mSec) Including Bounce			0.5	2.0	0.5	1.0	0.5	0.5	0.5	0.5
Release Time (typical mSec) Diode Suppressed			0.3	1.5	0.5	1.5 includes bounce on N.C. Pole	0.3	0.3	0.3	0.3

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

	Series 47/74	Series 47/74	Series 74
Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	3.8	9.0	18.0
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

REED RELAY SELECTION CHART

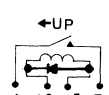
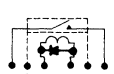
SERIES 47 MINI-SIP

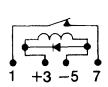
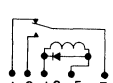
Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	500	No	4705	 1 FORM-A SPST N.O.
		Yes	4705D	
12	1200	No	4712	
		Yes	4712D	
5	150	No	4705-5 4705-7 4705-9	 1 FORM-A SPST N.O. COAXIALLY SHIELDED
	380	No	4705-S	
12	800	No	4712-S	

SERIES 74 STANDARD SIP

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	380	No	741A-1	1 FORM-A SPST N.O.
		Yes	741A-2	
	500	No	741A-9	
		Yes	741A-10	
12	1000	No	741A-3	
		Yes	741A-4	
24	1750	No	741A-7	
		Yes	741A-8	

SERIES 74 STANDARD SIP (cont.)

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	200	No	741AH-1	 Hg WETTED 1 FORM-A SPST N.O. UP (SEE NOTE: 4)
		Yes	741AH-2	
12	575	No	741AH-3	
		Yes	741AH-4	
24	1750	No	741AH-7	
		Yes	741AH-8	
5	380	No	741A5-1	 1 FORM-A SPST N.O. COAXIALLY SHIELDED
		Yes	741A5-2	
		No	741A7-1	
		Yes	741A7-2	
		No	741A9-1	
		Yes	741A9-2	
	500	No	741AS-9	
		Yes	741AS-10	
12	1000	No	741AS-3	
		Yes	741AS-4	

Nom. Coil Volt.	Coil Res. Ohms ±10%	Clamp Diode	Part Number	Contact Arrangement Schematics (Side View)
5	200	No	741B-3	 1 FORM-B SPST N.C. (SEE NOTE: 3)
		Yes	741B-4	
	500	No	741B-9	
		Yes	741B10	
12	500	No	741B-5	
		Yes	741B-6	
24	1750	No	741B-7	
		Yes	741B-8	
5	200	No	741C-1	 1 FORM-C SPDT
		Yes	741C-2	
12	500	No	741C-3	
		Yes	741C-4	
24	1750	No	741C-5	
		Yes	741C-6	

Notes: All specifications are based on a 25°C ambient temperature.

1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact re-closure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Consult factory for magnetic shield requirements.
Products and specifications subject to change without notice.

Consult factory for technical data sheet and application assistance.

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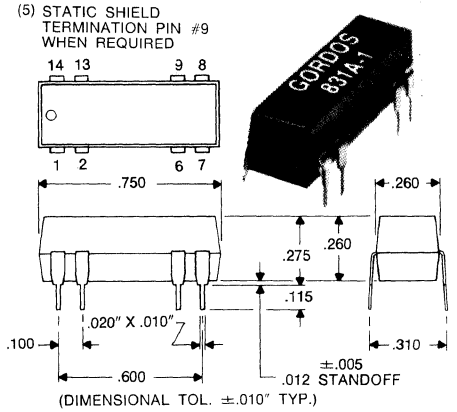
GORDOS

83 SERIES MOLDED DIP DRY AND MERCURY WETTED REED RELAYS



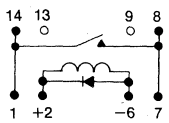
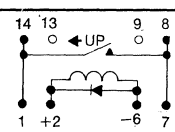
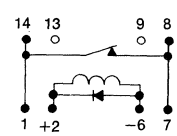
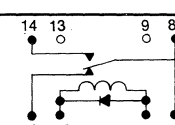
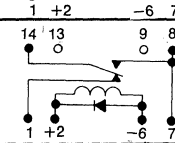
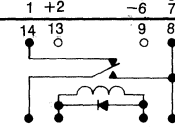
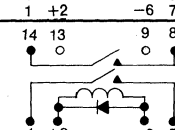
Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	3.8	9.0	18.0
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Compatible with automatic insertion

Contact Arrangement		Form-A		Form-B(3)	Form-C		
Model Type		831A 832A	Mercury Wet (4) 831AH	831B	831C	835C	836C
Max. Switching DC[2]	Watts	10	50	10	3		
	Volts	200	500	200	30		
Max. Current DC (amps)	Switch	0.5	1.0	0.5	0.2		
	Carry	1.5	2.0	1.5	0.5		
Max. Initial Contact Resistance (ohms)[1]		.200	.050	.200	.200		
Min. Breakdown Voltage DC	Across Contacts	300	1000	300	200		
	Contact to Coil	1000	1000	1000	1000		
Capacitance (typical pF)	Across Contacts	1.0	1.0	~	1.5		
	Contact to Coil	2.0	2.0	3.8	2.0		
Insulation Resistance (typical ohms)		10^{10}	10^{12}	10^{10}	10^{9}		
Operate Time (typ. mSec) Including Bounce Except Form-B		0.5	2.0	0.5	1.0		
Release Time (typ. mSec) Diode Suppressed		0.5	1.5	0.5	1.5 Including Bounce on N.C. Pole		

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

Contact Arrangement	Nominal Coil Voltage (VDC)	Coil Resistance (ohms) ±10% @ 25°C	Suppression Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	380	No	831A-1	
			Yes	831A-2	
		500	No	831A-3	
			Yes	831A-4	
	12	1000	No	831A-5	
			Yes	831A-6	
	24	1750	No	831A-7	
			Yes	831A-8	
1A Mercury Wetted SPST N.O.	5	200	No	831AH-1	 (See Note: 4) Orientation arrow for mercury wetted models only
			Yes	831AH-2	
	12	575	No	831AH-5	
			Yes	831AH-6	
	24	1750	No	831AH-7	
			Yes	831AH-8	
1B (See Note 3) SPST N.C.	5	200	No	831B-1	
			Yes	831B-2	
		500	No	831B-3	
			Yes	831B-4	
	12	500	No	831B-5	
			Yes	831B-6	
	24	1750	No	831B-7	
			Yes	831B-8	
1C SPDT	5	200	No	831C-1	
			Yes	831C-2	
	12	500	No	831C-3	
			Yes	831C-4	
	24	1750	No	831C-5	
			Yes	831C-6	
1C SPDT	5	200	No	835C-1	
			Yes	835C-2	
	12	500	No	835C-3	
			Yes	835C-4	
	24	1750	No	835C-5	
			Yes	835C-6	
1C SPDT	5	200	No	836C-1	
			Yes	836C-2	
	12	500	No	836C-3	
			Yes	836C-4	
	24	2200	No	836C-5	
			Yes	836C-6	
2A DPST N.O.	5	200	No	832A-1	
			Yes	832A-2	
	12	500	No	832A-3	
			Yes	832A-4	
	24	1750	No	832A-5	
			Yes	832A-6	

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact reclosure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow .
5. Consult factory for electrostatic shield and/or magnetic shield requirements.

Products and specifications subject to change wihout notice.

Consult factory for technical data sheet and application assistance.

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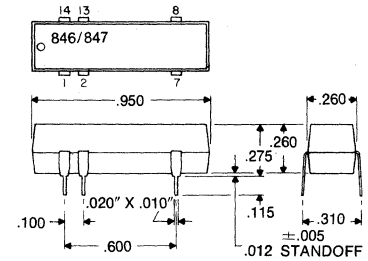
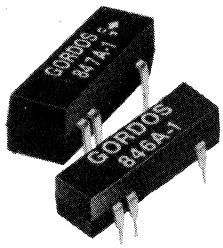
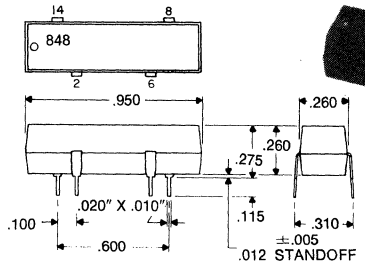
GORDOS

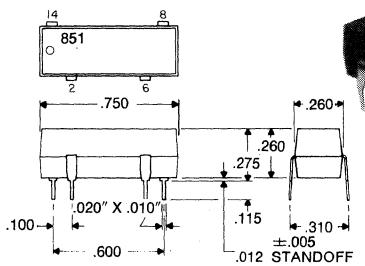
DIP REED RELAYS

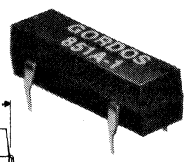
846 SERIES High Voltage / 847 SERIES Mercury wetted
848 SERIES High Voltage & High Isolation / 851 SERIES High Isolation











DIMENSIONAL TOL. ±.010" TYP.

- These Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Compatible with automatic insertion
- Logic compatible
- High voltage contacts recommended for FCC Part 68 use

Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	4.0	9.6	19.2
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC (3)	10	20	35

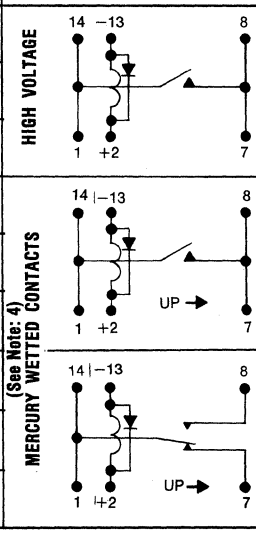
Contact Arrangement		Form-A				Form-B	Form-C
Model Type		846A	Mercury Wetted(4) 847A	848A	851A	(3) 851B	Mercury Wetted(4) 847C
Maximum Switching DC[2]	Watts	25	50	25	10	10	50
	Volts	1000	500	1000	200	200	500
Maximum Current DC (amps)	Switch	1.0	1.0	1.0	0.5	0.5	1.0
	Carry	2.0	2.0	2.0	1.5	1.5	2
Maximum Initial Contact Resistance (ohms)[1]		.200	.050	.200	.200	.200	.050
Min. Breakdown Voltage DC	Across Contacts	1500	1000	1500	500	500	1000
	Contact to Coil	1500	1500	2500	2000	2000	1000
Capacitance (maximum pF)	Across Contacts	1	1.1	1	1	—	1.3
	Contact to Coil	2	2	2	2	3.8	6
Insulation Resistance (typical ohms)		10^{10}	10^{12}	10^{10}	10^{10}	10^{10}	10^{8}
Operate Time (typical mSec) (including bounce except Form-B)		0.5	2.5	0.5	0.5	0.5	2.5
Release Time (typical mSec) (diode) suppressed)		0.3	2.0	0.3	0.3	0.5	2.0

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART

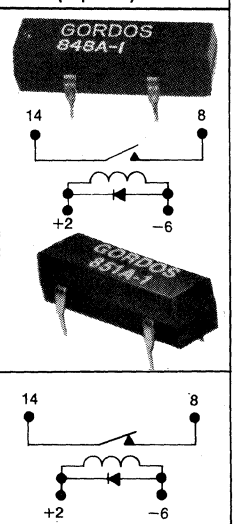
6 PIN DIP RELAYS
846 SERIES HIGH VOLTAGE
847 SERIES MERCURY WETTED

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Clamp Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	150	No	846A-1	HIGH VOLTAGE
			Yes	846A-2	
	12	575	No	846A-3	
			Yes	846A-4	
	24	1750	No	846A-5	
			Yes	846A-6	
	5	150	No	847A-1	MERCURY WETTED CONTACTS (See Note: 4)
			Yes	847A-2	
	12	575	No	847A-3	
			Yes	847A-4	
	24	1750	No	847A-5	
			Yes	847A-6	
1C SPDT	5	70	No	847C-1	
			Yes	847C-2	
	12	320	No	847C-3	
			Yes	847C-4	
	24	1600	No	847C-5	
			Yes	847C-6	



4 PIN DIP RELAYS
848 SERIES HIGH VOLTAGE, HIGH ISOLATION
851 SERIES HIGH ISOLATION

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Clamp Diode	Part Number	Schematics (Top View)
1A SPST N.O.	5	150	No	848A-1	HIGH VOLTAGE HIGH ISOLATION
			Yes	848A-2	
	12	575	No	848A-3	
			Yes	848A-4	
	24	1750	No	848A-5	
			Yes	848A-6	
	5	380	No	851A-1	
			Yes	851A-2	
		500	No	851A-5	
			Yes	851A-6	
	12	1000	No	851A-3	
			Yes	851A-4	
	24	1750	No	851A-7	
			Yes	851A-8	
(See Note: 3) 1B SPST N.C.	5	200	No	851B-3	HIGH ISOLATION
			Yes	851B-4	
	12	500	No	851B-5	
			Yes	851B-6	
	24	1750	No	851B-7	
			Yes	851B-8	



Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied (except Form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Excessive voltage (maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact reclosure on Form B models.
4. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Products and specifications subject to change without notice.

Consult factory for technical data sheet and application assistance.

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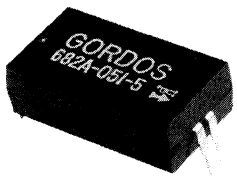
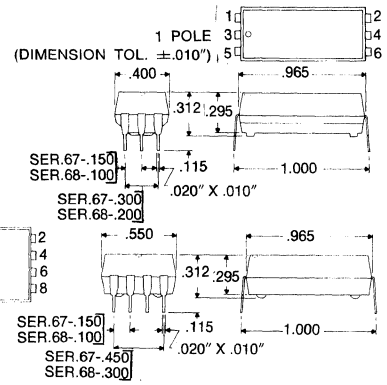
GORDOS

MIP DRY AND MERCURY WETTED REED RELAYS

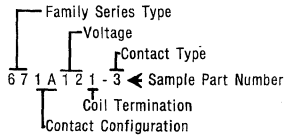
67 SERIES .150" x 1.000" / 68 SERIES .100" x 1.000"





- All Gordos Relays are molded in semiconductor-grade molding compounds that meet Underwriters Laboratories 94V-0 flammability rating
- Dry reed, high-voltage, high-power, and mercury wetted versions available
- High voltage contacts recommended for FCC Part 68 use
- Logic compatible

Nominal Coil Volage DC	5	12	24
Must Operate Voltage DC	4.0	9.6	19.2
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC	10	20	35



Contact Type-Legend

1A { -1 Standard; -2 High Voltage; -3 High Power; -5 Mercury Wetted

1C { -1 & -2 Standard; -5 Mercury Wetted

Contact Configuration		Form-A				Form-C	
Contact Type (ref. legend)		-1	-2	-3	-5	-1 & -2	-5
Max. Switching DC(2)	Watts	10	25	50	50	3	50
	Volts	200	1000	220	500	30	500
Max. Current DC (amps)	Switch	.500	1.0	3.0	1.0	.200	1.0
	Carry	2.0	2.0	5.0	2.0	.500	2.0
Max. Initial Contact Resistance (ohms)(1)		.200	.200	.200	.050	.200	.050
Min. Breakdown Voltage DC	Across Contacts	350	1500	400	1000	200	1000
	Contact to Coil	1000	1000	1000	1000	1000	1000
Capacitance (typical pF)	Across Contacts	1.0	1.0	1.0	1.1	1.5	1.3
	Contact to Coil	2.0	2.0	2.0	2.0	2.0	6.0
Insulation Resistance (typical ohms)		10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{8}
Operate Time (typ. mSec)		0.5	0.5	3.0	2.5	1.0	2.5
Release Time (typ. mSec)		0.3	0.3	1.0	2.0	1.5	2.0

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

REED RELAY SELECTION CHART (To specify diode add "D" after part number. All schematics show location of diode)

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Part Number End Terminated		Schematics (Top View) End Termination
1A Standard SPST N.O.	5 12 24	500 1200 2400	671A051-1 671A121-1 671A241-1	681A051-1 681A121-1 681A241-1	Orientation Arrows are for Mercury Wetted Models Only (See Note: 3)
1A High Volt. SPST N.O.	5 12 24	200 1000 2150	671A051-2 671A121-2 671A241-2	681A051-2 681A121-2 681A241-2	
1A High Power SPST N.O.	5 12 24	200 575 2150	671A051-3 671A121-3 671A241-3	681A051-3 681A121-3 681A241-3	
1A Mercury Wetted SPST N.O.	5 12 24	200 800 2200	671A051-5 671A121-5 671A241-5	681A051-5 681A121-5 681A241-5	
2A Standard DPST N.O.	5 12 24	200 800 2150	672A051-1 672A121-1 672A241-1	682A051-1 682A121-1 682A241-1	
2A High Volt. DPST N.O.	5 12 24	125 350 1500	672A051-2 672A121-2 672A241-2	682A051-2 682A121-2 682A241-2	
2A High Power DPST N.O.	5 12 24	75 350 1500	672A051-3 672A121-3 672A241-3	682A051-3 682A121-3 682A241-3	
2A Mercury Wetted DPST N.O.	5 12 24	75 300 1300	672A051-5 672A121-5 672A241-5	682A051-5 682A121-5 682A241-5	
1C Standard SPDT	5 12 24	380 1200 2400	671C051-1 671C121-1 671C241-1	681C051-1 681C121-1 681C241-1	
1C Mercury Wetted SPDT	5 12 24	70 320 1600	671C051-5 671C121-5 671C241-5	681C051-5 681C121-5 681C241-5	
1C Alternate SPDT	5 12 24	380 1200 2400	671C051-2 671C121-2 671C241-2	681C051-2 681C121-2 681C241-2	
2C DPDT	5 12 24	100 500 1500	672C051-1 672C121-1 672C241-1	682C051-1 682C121-1 682C241-1	

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Part Number Side Terminated		Schematics (Top View) Side Termination
1A Standard SPST N.O.	5 12 24	500 1200 2400	671A052-1 671A122-1 671A242-1	681A052-1 681A122-1 681A242-1	Orientation Arrows are for Mercury Wetted Models Only (See Note: 3)
1A High Volt. SPST N.O.	5 12 24	200 1000 2150	671A052-2 671A122-2 671A242-2	681A052-2 681A122-2 681A242-2	
1A High Power SPST N.O.	5 12 24	200 575 2150	671A052-3 671A122-3 671A242-3	681A052-3 681A122-3 681A242-3	
1A Mercury Wetted SPST N.O.	5 12 24	200 800 2200	671A052-5 671A122-5 671A242-5	681A052-5 681A122-5 681A242-5	
2A Standard DPST N.O.	5 12 24	200 800 2150	672A052-1 672A122-1 672A242-1	682A052-1 682A122-1 682A242-1	
2A High Volt. DPST No.	5 12 24	125 350 1500	672A052-2 672A122-2 672A242-2	682A052-2 682A122-2 682A242-2	
2A High Power DPST N.O.	5 12 24	75 350 1500	672A052-3 672A122-3 672A242-3	682A052-3 682A122-3 682A242-3	
2A Mercury Wetted DPST N.O.	5 12 24	75 300 1300	672A052-5 672A122-5 672A242-5	682A052-5 682A122-5 682A242-5	
1C Standard SPDT	5 12 24	380 1200 2400	671C052-1 671C122-1 671C242-1	681C052-1 681C122-1 681C242-1	
1C Mercury Wetted SPDT	5 12 24	125 500 1750	671C052-5 671C122-5 671C242-5	681C052-5 681C122-5 681C242-5	
1C Alternate SPDT	5 12 24	380 1200 2400	671C052-2 671C122-2 671C242-2	681C052-2 681C122-2 681C242-2	

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied.
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.

Products and specifications subject to change without notice.

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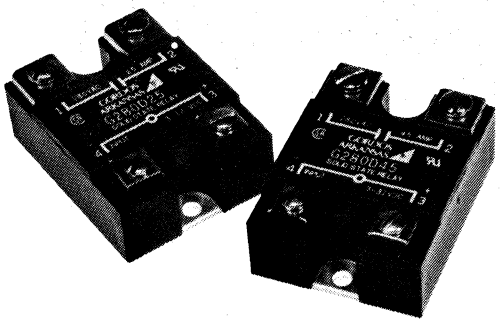
GORDOS

PANEL MOUNT SOLID STATE RELAYS



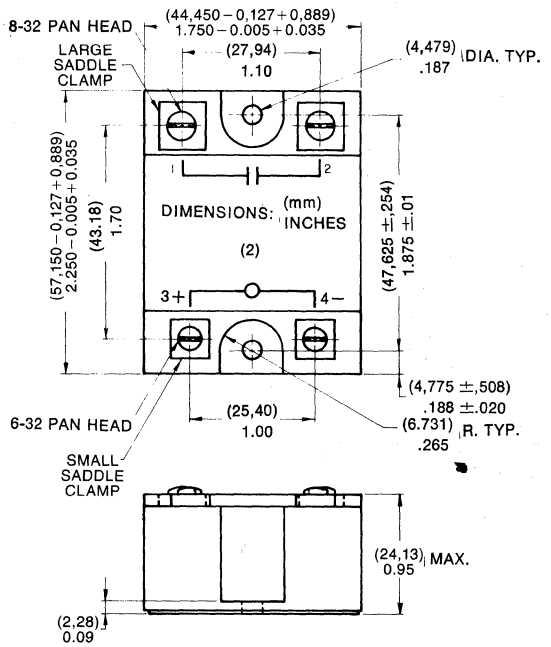
G SERIES POWER RELAYS

- Back-to-back (dual) SCR output for severe inductive loads
- Superior false turn-on immunity and positive turn-off at high dv/dt.

GA5 SERIES POWER RELAYS

- Economical triac output for general purpose applications

G SERIES AND GA5 SERIES OUTLINE DIMENSIONS



Products and specifications subject to change without notice.

G, GA5 SERIES POWER RELAYS

- Current Ratings to 45A
- Output Voltage Ratings to 480VAC with 24VAC Minimum
- AC or DC Inputs
- 4KV Optical Isolation
- Zero Voltage Turn-on
- RC Snubber Network for Inductive Loads
- UL Recognized, CSA Certified
- VDE Approval on Many Models

G Series					
Maximum Output Voltage Rating (VAC)				Output Current Rating	Control Voltage
140	250	280	480		
G120A10	G240A10	G280A10	G480A10	10A	90-280VAC
G120A25	G240A25	G280A25	G480A25	25A	90-280VAC
G120A45	G240A45	G280A45	—	45A	90-280VAC
G120D10*	G240D10*	G280D10*	G480D10	10A	3-32VDC
G120D25*	G240D25*	G280D25*	G480D25	25A	3-32VDC
G120D45*	G240D45*	G280D45*	—	45A	3-32VDC
G120E10	G240E10	G280E10	—	10A	18-32VAC
G120E25	G240E25	G280E25	—	25A	18-32VAC
G120E45	G240E45	G280E45	—	45A	18-32VAC

** VDE approved versions optional; Add **V** suffix*

GA5 Series				
Maximum Output Voltage Rating (VAC)			Output Current Rating	Control Voltage
140	250	280		
GA5-2A05	GA5-4A05	GA5-6A05	5A	90-280VAC
GA5-2A10	GA5-4A10	GA5-6A10	10A	90-280VAC
GA5-2A25	GA5-4A25	GA5-6A25	25A	90-280VAC
GA5-2D05*	GA5-4D05*	GA5-6D05*	5A	3-32VDC
GA5-2D10*	GA5-4D10*	GA5-6D10*	10A	3-32VDC
GA5-2D25*	GA5-4D25*	GA5-6D25*	25A	3-32VDC
GA5-2E10	GA5-4E10	GA5-6E10	10A	18-32VAC
GA5-2E25	GA5-4E25	GA5-6E25	25A	18-32VAC

G and GA5 series SSR's require a 1°C/watt heat sink to achieve full output current rating.

Consult factory for technical data sheet, dimensional tolerances and application assistance.

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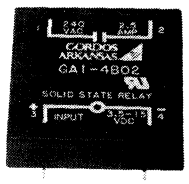
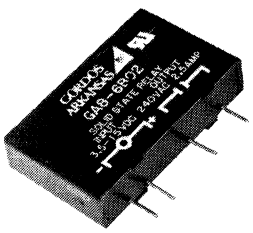
GORDOS

PRINTED CIRCUIT BOARD MOUNTABLE SOLID STATE RELAYS



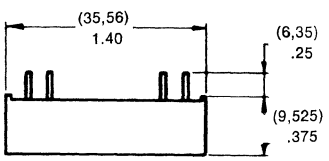


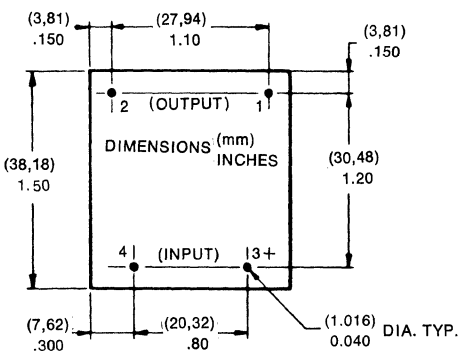
GA1, GA8 SERIES

- Thick Film Hybrid Construction and Vapor Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- High Current Thyristor for 100A Surge Capability
- UL Recognized/CSA Certified
- 4KV Optical Isolation
- Zero Voltage Turn-on
- Industry Standard Packaging

Maximum Output Voltage (VAC)			Output Current Rating (AMPS)	Control Voltage
140	250	280		
GA1-2B02	GA1-4B02	GA1-6B02	3 @ 40°C Ambient 4 @ 20°C Ambient	3-24VDC

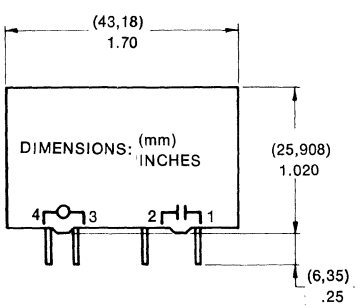
GA1 SERIES FLAT PACK

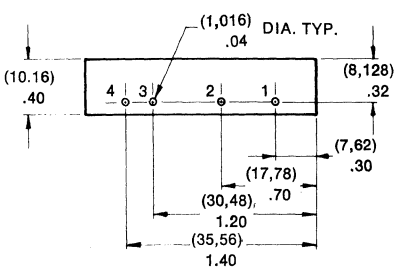




GA8 SERIES SINGLE INLINE

Maximum Output Voltage (VAC)			Output Current Rating (AMPS)	Control Voltage
140	250	280		
GA8-2B02	GA8-4B02	GA8-6B02	3 @ 40°C Ambient 4 @ 20°C Ambient	3-24VDC





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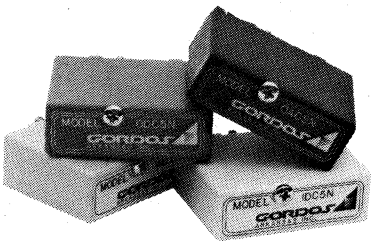
GORDOS

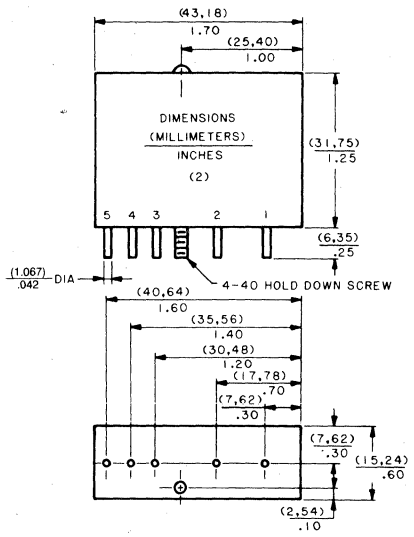
SINGLE POINT I/O MODULES

- Thick Film Hybrid Construction, Vapor-Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- UL Recognized/CSA Certified



SINGLE POINT I/O MODULES

- Zero AC or Random Turn-On Output Modules
- Industry Standard Packaging
- Plug into Standard I/O Mounting Racks



INPUT MODULES

Model	Input Voltage	DC Logic Voltage	Options N	F	24
IAC5	90-140 VAC/VDC	5	●		●
IAC5A	90-280 VAC/VDC	5	●		●
IAC15	90-140 VAC/VDC	15	●		●
IAC15A	90-280 VAC/VDC	15	●		●
IAC24	90-140 VAC/VDC	24	●		●
IAC24A	90-280 VAC/VDC	24	●		●
IDC5	3.3-32 VDC	5	●	●	
IDC15	3.3-32 VDC	15	●	●	
IDC24	3.3-32 VDC	24	●	●	

Available Options:

Order "N" suffix to obtain an enhanced level of noise immunity per NEMA ICS2-230. The "N" version of the IDC series modules also provides a line input voltage of 10.0 to 60 VDC/VAC.

Order "RN" suffix to obtain a non-zero voltage turn-on AC (Random) output.

Order "24" suffix for 24 VAC input version

Order "F" suffix to obtain a high speed DC switching device. The IDC module input voltage range with "F" suffix is 3.3 to 30 VDC.

Note: F & N are not available together.

OUTPUT MODULES

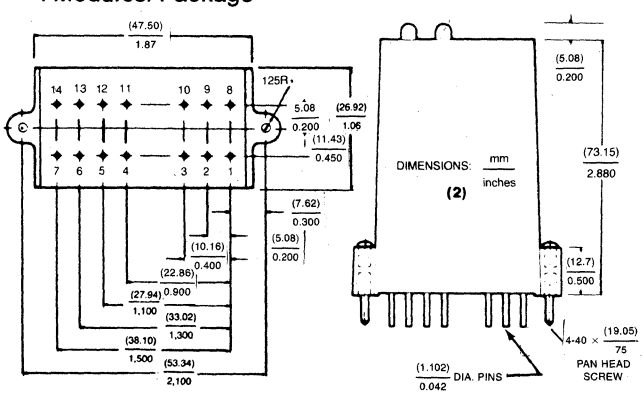
Model	DC Input Voltage	Output Voltage Rating	Current Rating (AMPS)	Options N	RN	F
OAC5	5	12-140 VAC	3.5	●	●	
OAC5A	5	24-280 VAC	3.5	●	●	
OAC15	15	12-140 VAC	3.5	●	●	
OAC15A	15	24-280 VAC	3.5	●	●	
OAC24	24	12-140 VAC	3.5	●	●	
OAC24A	24	24-280 VAC	3.5	●	●	
ODC5	5	3-60 VDC	3.0			●
ODC5A	5	5-200 VDC	1.0			
ODC15	15	3-60 VDC	3.0			●
ODC15A	15	5-200 VDC	1.0			
ODC24	24	3-60 VDC	3.0			●
ODC24A	24	5-200 VDC	1.0			

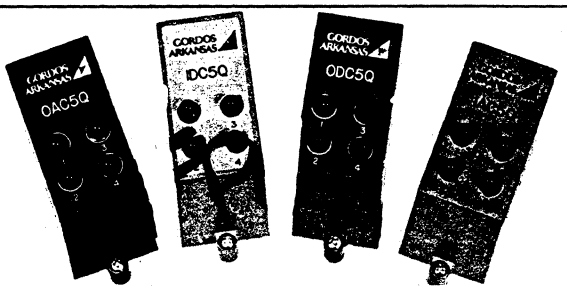
ELECTRICAL CONNECTIONS

Plus	1	2	3	4	5
Input Modules	Input Voltage (+)	(−)	Logic +	N.O. Output	Logic − N.O. Output
Output Modules	N.O. Output (+)	(−)	Input Voltage +	−	

QUAD-PACK I/O MODULES

- 4 Modules/Package





OUTPUT MODULES

Model	DC Input Voltage	Output Voltage Rating	Current Rating (AMPS)
OAC5Q	5	12-140 VAC	3
OAC5AQ	5	24-280 VAC	3
ODC5Q	5	3-60 VDC	3

INPUT MODULES

Model	Input Voltage	DC Logic Voltage
IAC5Q	90-140 VAC/VDC	5
IAC5AQ	90-280 VAC/VDC	5
IDC5Q	10-60 VAC/VDC	5

Products and specifications subject to change without notice.

Consult factory for technical data sheet, dimensional tolerances and application assistance.

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GORDOS

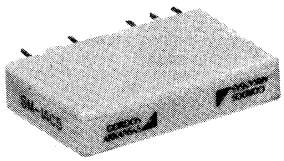
SUBMINIATURE I/O MODULES

- Thick Film Hybrid Construction, Vapor Phase Soldering for Superior Reliability
- Ceramic Substrate for Proper Thermal Management
- Computerized Laser Trimming of Resistors for Optimum Performance
- Plastic Retaining Pin for Fast, Secure Installation
- High Current Thyristor for 100A Surge Capability
- 4KV Optical Isolation
- 33% Thinner than Standard I/O Modules
- UL Recognized/CSA Certified

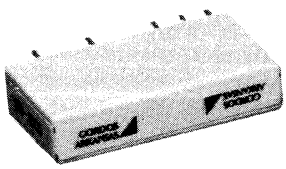
SM SERIES

- Zero AC or Random Turn-on Output Modules
- Plug into Standard I/O Mounting Racks

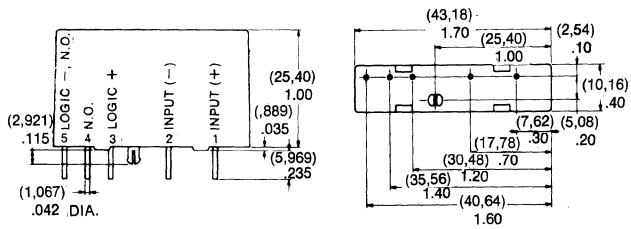
INPUT MODULES



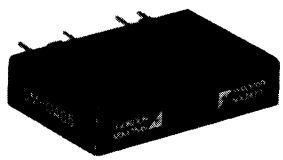
	SM-IAC5	SM-IAC5A
Input Voltage	90-140 VAC/VDC	90-280 VAC/VDC
Logic Voltage	5 VDC	5 VDC
Max. On-State Current	50 mA	50 mA
Isolation Voltage	4000 VAC	4000 VAC



	SM-IDC5
Input Voltage	3.3-32 VDC
Logic Voltage	5 VDC
Max. On-State Current	50 mA
Isolation Voltage	4000 VAC

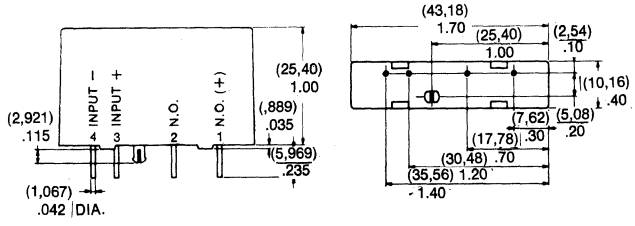


OUTPUT MODULES



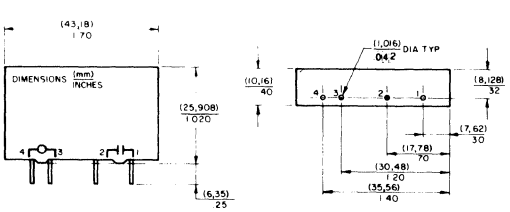
	SM-OAC5	SM-OAC5A
Input Voltage	5 VDC	5 VDC
Output Voltage Rating	12-140 VAC	24-280 VAC
Max. On-State Current	3.5A *	3.5A *
Isolation Voltage	4000 VAC	4000 VAC

	SM-ODC5
Input Voltage	5 VDC
Output Voltage Rating	3.0-60 VDC
Max. On-State Current	3A
Isolation Voltage	4000 VAC



* UL rating 3.5A, CSA rating 3A

- Zero AC Turn-on Output Modules



INPUT MODULES

Model	DC Logic Voltage	Input Voltage
M-IAC5	5	90-140 VAC/VDC
M-IAC5A	5	90-280 VAC/VDC
M-IDC5	5	3.3-32 VDC

OUTPUT MODULES

Model	DC Logic Voltage	Output Voltage Rating	Current Rating (AMPS)
M-OAC5	5	12-140 VAC	3.5 *
M-OAC5A	5	24-280 VAC	3.5 *
M-ODC5	5	3-60 VDC	3
M-ODC5A	5	5-200 VDC	1

Products and specifications subject to change without notice.

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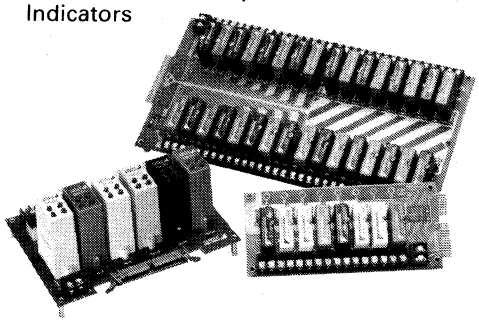
GORDOS

I/O INTERFACES

MOUNTING RACKS

Features Include:

- Models Available for Mounting Quad-Packs and Single Point I/O's
- UL Recognized/CSA Certified
- All Module/Board Systems Include LED Indicators

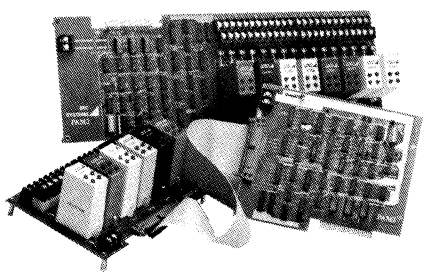


SINGLE SCREW BARRIER STRIP POWER CONNECTION
50 LINE EDGE CARD LOGIC CONNECTION

Single Point	Single Point Sub-Miniature	Quad Pack	Description
PB-8	PB-8SM	—	8 Points
PB-16	PB-16SM	PB-16Q	16 Points
PB-24	PB-24SM	PB-24Q	24 Points
PB-32D	PB-32SM	PB-32Q	32 Points

SINGLE SCREW BARRIER STRIP CONNECTIONS

PB-4	4 Module Positions
PB-4R	4 Module Positions — Separate ± Logic I/O
PB-16S	16 Module Positions — Separate ± Logic I/O
PG-16T	16 Module Positions

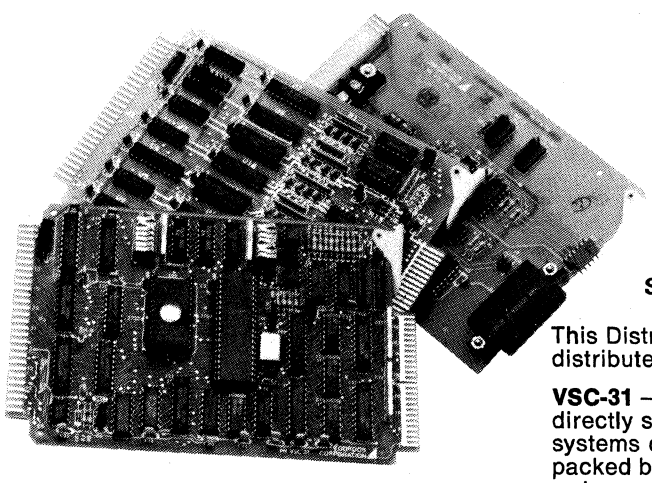


PARALLEL MULTIPLEXERS FOR POWER I/O CONTROL

This series of boards permits the control of up to 512 I/O modules with as few as 16 I/O lines. Each board can support 32 I/O modules. A full complement of 512 I/O modules requires only 16 PAM boards. Each PAM incorporates a watch dog timer function available for use in default conditions.

The PAM 2 board includes both the parallel control logic as well as the mounting space for 8 Quad Packs. Options include a 16.25″ version for a 19″ rack, AGA-7 fusing and removable terminators.

The PAM 3 is a logic only board for use with the PB-32D, PB-32Q or PB32SM I/O mounting racks.



SERIAL MULTIPLEXERS FOR POWER I/O CONTROL

This Distributed Serial System allows the user to construct distributed control and monitoring systems on a RS422 Data Link.

VSC-31 — An STD based RS-422 serial controller card that directly supports the control of 16 I/O lines. Up to 127 VSC-31 systems can be supported on one serial link. Both ASCII and packed binary formats can be used. The VSC-31 can stand alone or be mounted in an STD card cage. It can also source the PAM multiplexers.

G7507 I/O — An STD-based 24 line parallel I/O card which enables expansion of the VSC-31 system to 512 I/O lines.

VSC-TR — A bi-directional RS-232C to RS-422 translator card.

Consult factory for technical data sheet, dimensional tolerances and application assistance.

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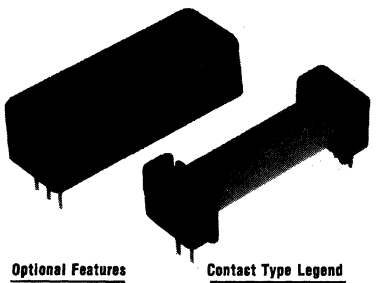
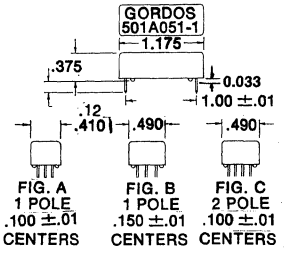
GORDOS

"VALULINE" REED RELAYS

50 SERIES .100" x 1.00" / 55 SERIES .150" x 1.000"





NOTE: All dim's max. unless otherwise specified

Optional Features

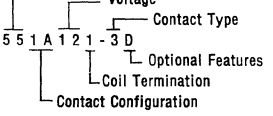
D—Diode
M—Magnetic Shield
S—Electrostatic Shield
C—Cover
CE—Cover and encapsulant
R—Insulation Resistance >10^{13} Ohms

Contact Type Legend

1A { -1 Standard, -2 High Voltage, -3 High Power, -4 High Voltage, -5 Mercury Wetted
1C { -1 & -2 Standard, -5 Mercury Wetted

Nominal Coil Voltage DC	5	12	24
Must Operate Voltage DC	3.8	9.0	18.0
Must Release Voltage DC	0.5	1.2	2.4
Maximum Voltage DC	10	20	35

Ordering Guide



- Highest Quality — Competitively Priced
- Contact types 2 and 4 are suited for Telecommunication Applications
- 1A, 2A, 1B, 1C Contact configurations with General Purpose, High Voltage, High Power & Mercury Wetted Switching Options

Contact Configuration		Form-A					Form C	
Contact Type (ref. legend)		-1	-2	-3	-4	-5	-1 & -2	-5
Max. Switching DC[2]	Watts	10	25	50	15	50	3	50
	Volts	200	1000	220	200	500	30	500
Max. Current DC (amps)	Switch	.500	1.0	3.0	1.0	1.0	.200	1.0
	Carry	2.0	2.0	5.0	2.5	2.0	.500	2.0
Max. Initial Contact Resistance (ohms)[1]		.200	.200	.200	.200	.050	.200	.050
Min. Breakdown Voltage DC	Accros Contacts	350	1500	400	800	1000	200	1000
	Contact to Coil	1000	1500	1000	1500	1500	1000	1500
Capacitance (typical pF)	Across Contacts	1.0	1.0	1.0	1.0	1.1	1.5	1.3
	Contact to Coil	2.0	2.0	2.0	2.0	2.0	2.0	6.0
Insulation Resistance (typical ohms)		10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{10}	10^{8}
Operate Time (typ. mSec)		0.5	0.5	3.0	0.5	2.5	1.0	2.5
Release Time (typ. mSec)		0.3	0.3	1.0	0.3	2.0	1.5	2.0

Operating temp range −20°C to 85°C
Storage temp range −20°C to 100°C

"+" Symbol designates diode polarity and Form B contact polarity
° Represents unused terminal location on Form B side termination only and Form C 50 Series only.

Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Fig.	Part Number w/o Cover	Fig.	Part Number w/o Cover	Schematics (Top View) End Termination (See Note: 3)	Contact Arrangement	Nom. Coil Volt.	Coil Res. (ohms) ±10%	Fig.	Part Number w/o Cover	Fig.	Part Number w/o Cover	Schematic (Top View) Side Termination (See Note: 3)
1A Standard SPST N.O.	5 12 24	500 1200 2400	A	501A051-1 501A121-1 501A241-1	B	551A051-1 551A121-1 551A241-1	Orientation Arrows are for Mercury Wetted Models Only	1A Standard SPST N.O.	5 12 24	500 1200 2400	A	501A052-1 501A122-1 501A242-1	B	551A052-1 551A122-1 551A242-1	Orientation Arrows are for Mercury Wetted Models Only
1A High Volt. SPST No.	5 12 24	200 1000 2150	A	501A051-2 501A121-2 501A241-2	B	551A051-2 551A121-2 551A241-2		1A High Volt. SPST N.O.	5 12 24	200 1000 2150	A	501A052-2 501A122-2 501A242-2	B	551A052-2 551A122-2 551A242-2	
1A High Power SPST N.O.	5 12 24	200 575 2150	A	501A051-3 501A121-3 501A241-3	B	551A051-3 551A121-3 551A241-3	UP STATIC SHIELD TERMINATION WHEN SPECIFIED	1A High Power SPST N.O.	5 12 24	200 575 2150	A	501A052-3 501A122-3 501A242-3	B	551A052-3 551A122-3 551A242-3	UP STATIC SHIELD TERMINATION WHEN SPECIFIED
1A High Volt. SPST N.O.	5 12 24	200 1000 2150	A	501A051-4 501A121-4 501A241-4	B	551A051-4 551A121-4 551A241-4		1A High Volt. SPST N.O.	5 12 24	200 1000 2150	A	501A052-4 501A122-4 501A242-4	B	551A052-4 551A122-4 551A242-4	
1A Mercury Wetted SPST N.O.	5 12 24	200 800 2200	A	501A051-5 501A121-5 501A241-5	B	551A051-5 551A121-5 551A241-5		1A Mercury Wetted SPST N.O.	5 12 24	200 800 2200	A	501A052-5 501A122-5 501A242-5	B	551A052-5 551A122-5 551A242-5	
2A Standard DPST N.O.	5 12 24	200 800 2150	C	502A051-1 502A121-1 502A241-1		N/A		2A Standard DPST N.O.	5 12 24	200 800 2150	C	502A052-1 502A122-1 502A242-1	B	552A052-1 552A122-1 552A242-1	
2A High Volt. DPST N.O.	5 12 24	125 350 1500	C	502A051-2 502A121-2 502A241-2		N/A	UP	2A High Volt. DPST No.	5 12 24	125 350 1500	C	502A052-2 502A122-2 502A242-2	B	552A052-2 552A122-2 552A242-2	UP
2A High Power DPST N.O.	5 12 24	75 350 1500	C	502A051-3 502A121-3 502A241-3		N/A		2A High Power DPST N.O.	5 12 24	75 350 1500	C	502A052-3 502A122-3 502A242-3	B	552A052-3 552A122-3 552A242-3	
2A Mercury Wetted DPST N.O.	5 12 24	75 300 1300	C	502A051-5 502A121-5 502A241-5		N/A		2A Mercury Wetted DPST N.O.	5 12 24	75 300 1300	C	502A052-5 502A122-5 502A242-5	B	552A052-5 552A122-5 552A242-5	STATIC SHIELD TERMINATION WHEN SPECIFIED (NOT AVAILABLE FOR 552A)
1B Standard SPST N.C.	5 12 24	200 800 2150	C	501B051-1 501B121-1 501B241-1	B	551B051-1 551B121-1 551B241-1		1B Standard SPST N.C.	5 12 24	200 800 2150	C	501B052-1 501B122-1 501B242-1	B	551B052-1 551B122-1 551B242-1	
1C Standard SPDT	5 12 24	380 1200 2400	C	501C051-1 501C121-1 501C241-1	B	551C051-1 551C121-1 551C241-1	UP	1C Standard SPDT	5 12 24	380 1200 2400	C	501C052-1 501C122-1 501C242-1	B	551C052-1 551C122-1 551C242-1	UP
1C Mercury Wetted SPDT	5 12 24	70 320 1600	C	501C051-5 501C121-5 501C241-5	B	551C051-5 551C121-5 551C241-5		1C Mercury Wetted SPDT	5 12 24	125 500 1750	C	501C052-5 501C122-5 501C242-5	B	551C052-5 551C122-5 551C242-5	
1C Alternate SPDT	5 12 24	380 1200 2400	C	501C051-2 501C121-2 501C241-2	B	551C051-2 551C121-2 551C241-2		1C Alternate SPDT	5 12 24	380 1200 2400	C	501C052-2 501C122-2 501C242-2	B	551C052-2 551C122-2 551C242-2	

Notes: All specifications are based on a 25°C ambient temperature.
1. Measured with nominal coil voltage applied (except form B).
2. Higher voltages and/or current may be switched with life expectancy reduced.
3. Mercury relays are position-sensitive and must be mounted within 30° from vertical, as indicated by the "up" arrow.
4. Excessive voltage maximum of 6.5 VDC for 5 VDC model, 15 VDC for 12 VDC model, and 28 VDC for 24 VDC model), may cause contact reclosure on Form B models.

Consult factory for technical data sheet, dimensional tolerances and application assistance.

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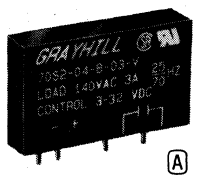
Grayhill INC. Solid State Relays

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (312) 354-1055

- CMOS and TTL Compatible
- UL Recognized and CSA Certified
- Internal Transient Protection
- High Surge Current and Blocking Voltage



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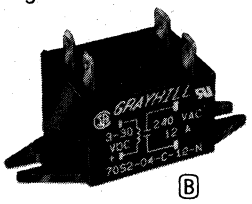
STYLE V



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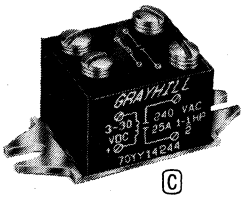
STYLE N



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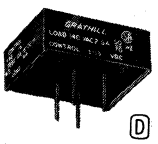
STYLE S



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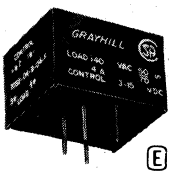
STYLE H



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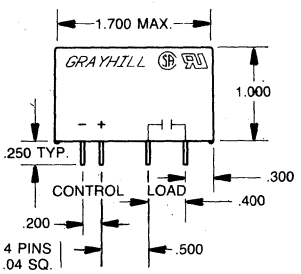
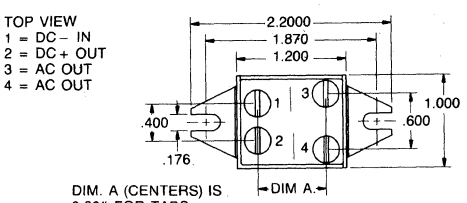
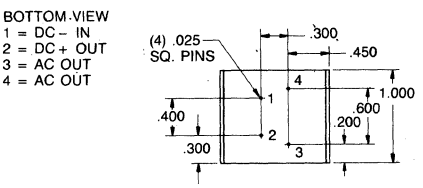
STYLE F







SPECIFICATIONS

Nominal load voltages and currents are in chart. Current is rated at 25°C and derated with increases. Mini Puck relays are rated as mounted on panel 12 x 12 x 1/8 inches.

Control current is 1-17 mA (3-30 Vdc relays), 1-19 mA (3-32 Vdc relays), and 1-6 mA (all others).

Surge current rating at 1 full cycle, non repetitive, is 60A (2.5A, 3A, 4A, and 6A relays); 110A (12A relay); 250A (25A relay).

Blocking voltages are 200V, 400V, and 600V for the 24 Vac, 120 Vac, and 240 Vac relays.

Zero voltage offset is 6V, 8V, and 18V for the 24 Vac, 120 Vac and 240 Vac relays.

Transient protection is 4000 V/μS for 6A and 15A relays, 3000 V/μS for all others.

Average input impedance is 2000 ohms (3-30 & 3-32 Vdc ranges), and 6000 ohms (6-30 & 6-32 Vdc ranges).

Isolation is 10^9 ohms; dielectric strength is 2500 Vac.

Cases are solvent resistant thermoplastic (UL94V-O) potted with high thermal conductive epoxy. Heat sinks are aluminum (copper for the 25A relay), tin plated. Terminal pins are brass, tin plated; tabs are brass, lead-tin plated; screws are steel, tin plated.

STYLE V SINGLE IN-LINE PACKAGE RELAY (FIG. A)

This PC mounted relay requires only .680 inches of board area and is form, fit, and function replacement for industry standard. It is constructed of high performance, surface mount components for high reliability. Package measures .4 inches deep, and line of pins is located .3 inches from label side.

Loads		Control Range VDC	Part Number
Load VAC	Max. Amps		
24	3	3-32	70S2-04-D-03-V
24	3	6-32	70S2-05-D-03-V
120	3	3-32	70S2-04-B-03-V
120	3	6-32	70S2-05-B-03-V
240	3	3-32	70S2-04-C-03-V
240	3	6-32	70S2-05-C-03-V

STYLES N & S MINI PUCK© SOLID STATE RELAYS (FIGS. B & C)

These heavy duty relays are fit, and function replacements for old "hockey puck" style relays, but require only one-half the space. High thermal conductive epoxy and high quality heat sinks provide superior heat transfer. Minimum panel space for heat sink effectiveness is 12 inches by 12 inches by .125 inches thick; mount with silicon grease. Body measures 1.2 inches x 1.0 inches by .85 inches high. Push tabs (Style N) add .30 inches to height. Screws (Style S) add approximately .08 inches.

120	6	3-30	70S2-04-B-06-N
120	6	6-30	70S2-05-B-06-N
240	6	3-30	70S2-04-C-06-N
240	6	6-30	70S2-05-C-06-N
120	12	3-30	70S2-04-B-12-N
120	12	6-30	70S2-05-B-12-N
240	12	3-30	70S2-04-C-12-N
240	12	6-30	70S2-05-C-12-N
120	6	3-30	70S2-04-B-06-S
120	6	6-30	70S2-05-B-06-S
120	12	3-30	70S2-04-B-12-S
120	12	6-30	70S2-05-B-12-S
120	25	3-30	70S2-03-B-25-S
240	6	3-30	70S2-04-C-06-S
240	6	6-30	70S2-05-C-06-S
240	12	3-30	70S2-04-C-12-S
240	12	6-30	70S2-05-C-12-S
240	25	3-30	70S2-03-C-25-S

STYLES H & F MICRO CUBE® AND MINI CUBE RELAYS (FIGS. D & E)

Low profile, printed circuit mounted relays allow user to stack PC boards closely together, while switching 24 Vac, 120 Vac, or even 240 Vac loads of up to 4 amperes. These relays do not require additional heat sinks. Style H is only .5 inches high; Style F is only .83 inches high. For a relay with .83 inches height and standard plug-in style termination (Style K, not shown), contact a local authorized distributor. For relays with this footprint for larger loads contact GRAYHILL.

24	2.5	3-30	70S2-04-D-02-H
24	2.5	6-30	70S2-05-D-02-H
120	2.5	3-30	70S2-04-B-02-H
120	2.5	6-30	70S2-05-B-02-H
240	2.5	3-30	70S2-04-C-02-H
240	2.5	6-30	70S2-05-C-02-H
24	4	3-30	70S2-04-D-04-F
24	4	6-30	70S2-05-D-04-F
120	4	3-30	70S2-04-B-04-F
120	4	6-30	70S2-05-B-04-F
240	4	3-30	70S2-04-C-04-F
240	4	6-30	70S2-05-C-04-F

All part numbers shown on this page are UL Recognized (file number E58632) and CSA Certified (file number LR38763).

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

Grayhill INC.
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I/O Modules

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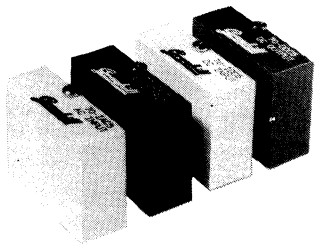
- Transient Protected
- Form, Fit, Function Replacement



GENERAL INFORMATION

I/O modules are optically isolated interfaces between microprocessors and external AC and DC power devices. They are provided in standard pinouts in two sizes. Standard modules have mounting screws and switch up to 3.5 Amps. Miniature modules are current regulated and switch up to 3.0 Amps. Other specifications are shown below; where the modules differ, the specification for the miniature has been listed in parentheses.

OUTPUT MODULES

CONTROL CIRCUIT—Nominal voltages of 5, 15, and 24 represent 2.5-9.0, 8(10)-18, and 15-30 Vdc respectively. Currents are 5-39, 5-18, and 5-14 mA (maximum current at nominal voltage for mini is 14, 9, and 9 mA). Average input impedances are 220 (300), 1k (1.8k), and 2.2k (2.7k) ohms. Turn-off voltage is 1 Vdc minimum; reverse control voltage, 5 Vdc maximum.

AC OUTPUT CIRCUIT—Nominal load voltages of 120 and 240 Vac represent 24-140 and 24-280 Vac. Minimum blocking voltages are 400 and 600V. Maximum zero voltage offsets are 12 (8) and 18 (8) volts peak; off state leakage is 2 and 4 mA rms maximum.Turn-on and turn-off times are 8.3 mS. DV/DT is 3000V per *u*S. Surge current is 80A. On state voltage drop is 1.5V peak. Typical power dissipation is 1 W/A. Minimum power factor is 0.4. Frequency range is 25-70 Hz. Thermal resistance is 20°C/W (25°C/W) typical. 1^2t for fusing is 35 A^2S minimum.

DC OUTPUT CIRCUIT—Load voltage is 3-60 Vdc. Clamping voltage maximum is 108 (80) Vdc. Typical power dissipation is 1W/A.Transient power dissipation is 400W at 1 mS nonrecurring. Turn-on time is 75 *u*S (20 *u*S) maximum. Turn-off time is 500 *u*S (40 *u*S) maximum. Off state leakage is 10 *u*A maximum. On state voltage drop is 1.2 Vdc maximum. Surge current is 5A for 1S.

INPUT MODULES

LOGIC CIRCUIT—Nominal supply voltages of 5, 15, and 24 Vac represent 3.5 (3.0)-6, 8-18, and 15-30 Vdc respectively. Current is 13 mA maximum. Breakdown voltage is 50 Vdc minimum. Off state leakage is 1.0 *u*A maximum. On state voltage drop is .45 Vdc maximum. Turn-on and turn-off times for the AC input modules are 20 mS maximum. Turn-on time for the DC module is 5 mS (220 *u*S) maximum; turn-off time is 5 mS (400 *u*S) maximum.

AC INPUT CIRCUIT—Nominal voltages of 120 and 240 Vac represent 90-140 and 180-280 Vac. Input currents at maximum input voltages are 11 (8) and 6 mA rms maximum. Drop out voltages are 25 and 50 Vac rms minimum. Average input impedances are 14k (22k) and 45k (60k) ohms.

DC INPUT CIRCUIT—Voltage is 3-32 Vdc. Current at maximum input voltage is 14 mA (18 mA). Drop out voltage is 1 Vdc minimum. Average input impedance is 2k (1.8k) ohms.

GENERAL CHARACTERISTICS

Specifications are made at 25°C; derate with higher temperatues. Minimum isolation is 10^{10} ohms. Dielectric strength is 4000 Vac rms. Input to output capacitance is 6 pF Vibration is 20 G's peak (.06″ DA). Mechanical shock is 1500 G's 0.5 mS half-sine. Operating temperature is −40 to +100°C; storage, −40 to +125°C. Weight is 40 grams (25 grams for the miniature). Terminals are copper wire, tin plated. Case is solvent resistant thermoplastic, UL94V-O. Potting is high thermal conductive epoxy.

ALSO AVAILABLE

AC output modules for random turn-on of 240 Vac from 5 Vdc or with normally closed circuitry. DC output modules for switching 200 Vdc from 5 Vdc. These part numbers provide non-polarized input: 70-IDC5NP switches 5 Vdc from 10-32 Vdc or 15-32 Vac; 70-IDC15NP switches 15 Vdc from 10-32 Vdc or 15-32 Vac; 70-IDC24NP switches 24 Vdc from 10-32 Vdc or 15-32 Vac. See Grayhill catalog for specifications.

ORDERING INFORMATION

Logic Volts	Output Volts	Part No. Standard	Part No. Miniature
AC OUTPUT MODULE—BLACKS			
5 Vdc	120 Vac	**70-OAC5**	**70M-OAC5**
15 Vdc	120 Vac	**70-OAC15**	**70M-OAC15**
24 Vdc	120 Vac	**70-OAC24**	**70M-OAC24**
5 Vdc	240 Vac	**70-OAC5A**	**70M-OAC5A**
15 Vdc	240 Vac	**70-OAC15A**	**70M-OAC15A**
24 Vdc	240 Vac	**70-OAC24A**	**70M-OAC24A**
DC OUTPUT MODULES—RED			
5 Vdc	60 Vdc	**70-ODC5**	**70M-ODC5**
15 Vdc	60 Vdc	**70-ODC15**	**70M-ODC15**
24 Vdc	60 Vdc	**70-ODC24**	**70M-ODC24**

Logic Volts	Input Volts	Part No. Standard	Part No. Miniature
AC INPUT MODULES—YELLOW			
5 Vdc	120 Vac	**70-IAC5**	**70M-IAC5**
15 Vdc	120 Vac	**70-IAC15**	**70M-IAC15**
24 Vdc	120 Vac	**70-IAC24**	**70M-IAC24**
5 Vdc	240 Vac	**70-IAC5A**	**70M-IAC5A**
15 Vdc	240 Vac	**70-IAC15A**	**70M-IAC15A**
24 Vdc	240 Vac	**70-IAC24A**	**70M-IAC24A**
DC INPUT MODULES—WHITE			
5 Vdc	3-32 Vdc	**70-IDC5**	**70M-IDC5**
15 Vdc	3-32 Vdc	**70-IDC15**	**70M-IDC15**
24 Vdc	3-32 Vdc	**70-IDC24**	**70M-IDC24**

Module Limit	Type of Connector	Part Number
STANDARD MODULE MOUNTING RACKS		
4	Edge Connector	**70RCK4**
8	Edge Connector	**70RCK8**
16	Edge Connector	**70RCK16**
24	Edge Connector	**70RCK24**
MINIATURE MODULE MOUNTING RACKS		
16	Edgen Connector	**70MRCK16**
16	Header Connector	**70MRCK16H**
16	Right Angle Header	**70MRCK16R**

For prices and discounts, contact a local Sales Office, an authorized Distributor, or GRAYHILL.
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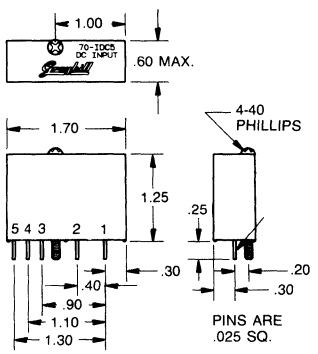
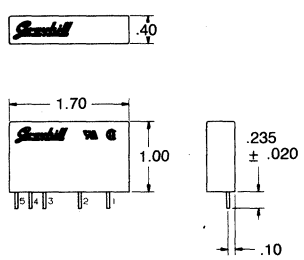
STANDARD PACKAGE



MINIATURE PACKAGE

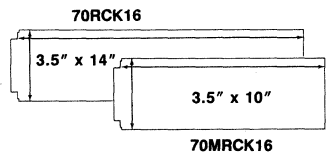


TERMINAL CONNECTIONS

Modules	#5	#4	#3	#2	#1
AC Output	N/A	DC − In	DC + In	AC Out	AC Out
DC Output	N/A	DC − In	DC + In	DC − Out	DC + Out
AC Input	Ground	Output	$+V_{CC}$	AC In	AC In
DC Input	Ground	Output	$+V_{CC}$	DC − In	DC + In

ONLY INPUT MODULES HAVE TERMINAL #5.

MOUNTING RACKS



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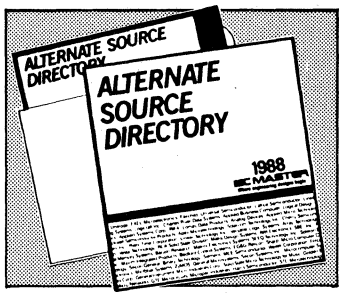

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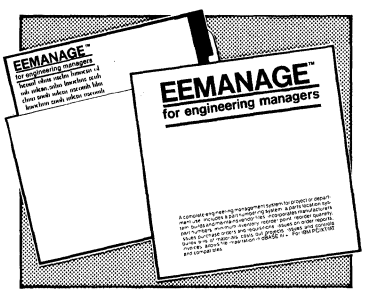

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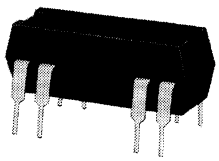

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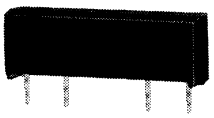

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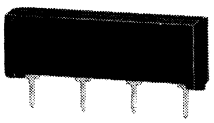

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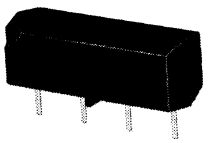
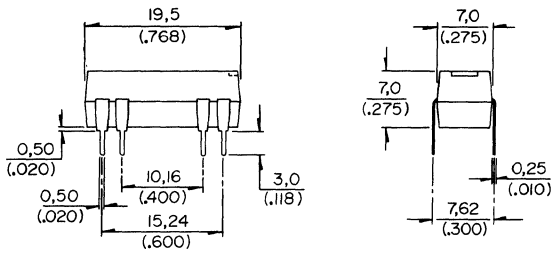


3700 SERIES

DIMENSIONS

Dimensions in millimeters
Inches in parenthesis

700 SERIES DIP



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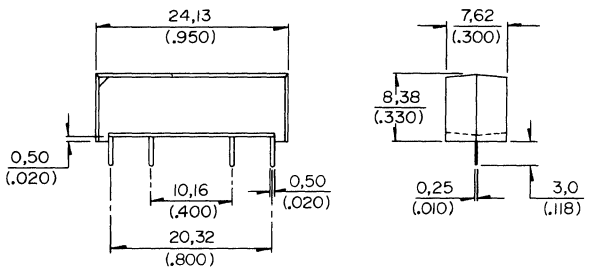

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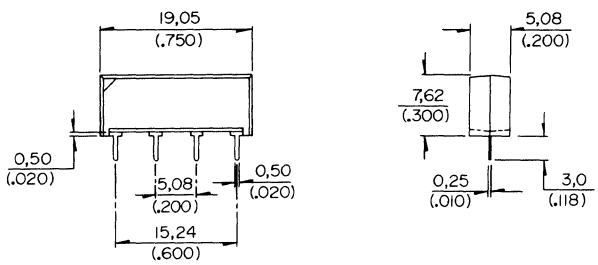

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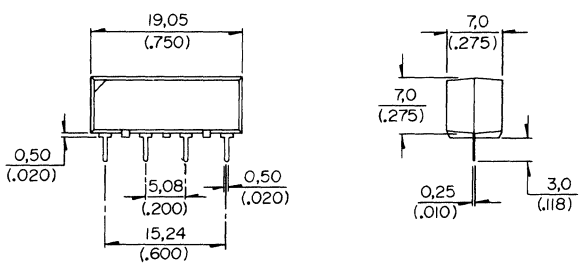


700 SERIES DIP

Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A DRY SPST - NO	10W 0.5A 200V	721A0500	-	5	500	$3.38
		721A0510	Yes	5	500	3.85
		721A1200	-	12	1000	3.60
		721A1210	Yes	12	1000	4.05
		721A2400	-	24	2150	4.28
		721A2410	Yes	24	2150	4.73
1C DRY SPST - CO	3W 0.25A 175V	721C0500	-	5	200	5.85
		721C0510	Yes	5	200	6.08
		721C1200	-	12	500	6.08
		721C1210	Yes	12	200	6.30
		721C2400	-	24	2000	6.53
		721C2410	Yes	24	2000	6.75
2A DRY DPST - NO	10W 0.5A 200V	722A0500	-	5	200	4.95
		722A0510	Yes	5	200	5.18
		722A1200	-	12	500	5.63
		722A1210	Yes	12	500	6.08
		722A2400	-	24	2150	6.08
		722A2410	Yes	24	2150	6.58
1A MERCURY SPST - NO	50W 2.0A 500V	731A0500	-	5	55	7.88
		731A0510	Yes	5	55	8.10
		731A1200	-	12	300	8.10
		731A1210	Yes	12	300	8.33
		731A2400	-	24	1100	8.33
		731A2410	Yes	24	1100	8.55
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	751A0500	-	5	500	4.50
		751A0510	Yes	5	500	4.95
		751A1200	-	12	1000	4.95
		751A1210	Yes	12	1000	5.40
		751A2400	-	24	2150	5.40
		751A2410	Yes	24	2150	5.85

3300 SERIES SIP

Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3321A0400	-	5	500	$2.70
		3321A1200	-	12	500	2.70
		3321A2400	-	24	2000	3.15
1C SPDT - CO DRY	3W 0.25A 175V	3321C0500	-	5	125	4.73
		3321C1200	-	12	500	4.95
		3321C2400	-	24	2000	5.40
1A SPST - NO MERCURY	50W 2A 500V	3331A0500	-	5	125	7.20
		3331A1200	-	12	500	7.43
		3331A2400	-	24	2000	7.88
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	3351A0500	-	5	125	3.60
		3351A1200	-	12	500	3.60
		3351A2400	-	24	200	4.05

3600 SERIES SIP

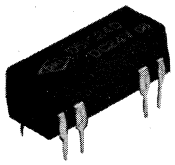
Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3621A0500	-	5	500	$4.28
		3621A1200	-	12	1000	4.73
		3621A2400	-	24	2150	5.18
1A SPST - NO COAX SCREEN	10W 0.5A 200V	3621A0520	-	5	200	5.63
		3621A1220	-	12	500	6.08
		3621A2420	-	24	1500	6.53

3700 SERIES SIP

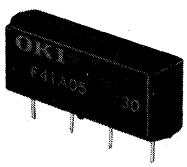
Contact Form	Contact Rating	Model Number	Diode	Coil Vdc Nom.	Coil Ohms ±10%	List Price 1-24
1A SPST - NO DRY	10W 0.5A 200V	3721A0500	-	5	500	$3.15
		3721A0510	Yes	5	500	3.60
		3721A1200	-	12	1000	3.38
		3721A1210	Yes	12	1000	3.83
		3721A2400	-	24	2150	4.05
		3721A2410	Yes	24	2150	4.50
1A SPST - NO MERCURY	50W 2.0A 500V	3731A0500	-	5	100	7.43
		3731A0510	Yes	5	100	7.65
		3731A1200	-	12	500	7.88
		3731A1210	Yes	12	500	8.10
		3731A2400	-	24	1500	8.33
		3731A2410	Yes	24	1500	8.55
1A SPST - NO HIGH VOLTAGE	10W 0.5A 300V	3751A0500	-	5	125	3.83
		3751A0510	Yes	5	125	4.05
		3751A1200	-	12	500	4.05
		3751A1210	Yes	12	500	4.28
		3751A2400	-	24	2000	4.50
		3751A2410	Yes	24	2000	4.73

HASCO COMPONENTS INC. / REED RELAYS

SINCE 1976



DIP SERIES



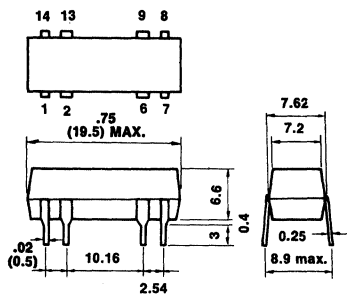
SIP SERIES

FEATURES

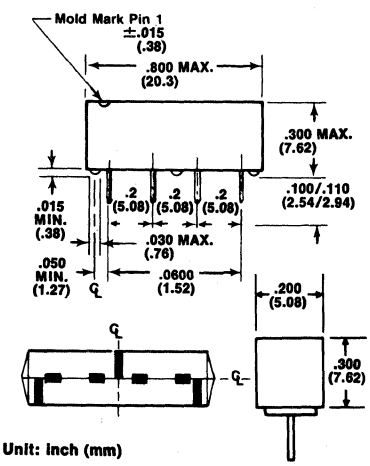
- De-activated rhodium contacts. for stable contact resistance.
- Standard TO-116 Terminal Grid fits all standard DIP sockets.
- Interface directly with RTL, DTL, TTL, HTL logic.
- Molded epoxy package for environmental immunity.
- Automatic insertion compatible.
- Relay testing services test report available.

DIMENSIONS

DIP STYLE



SIP STYLE

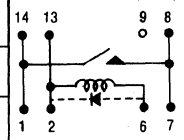
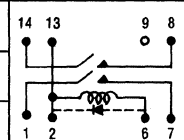
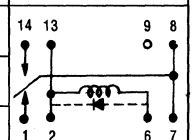


Unit: inch (mm)

DIP AND MINI SIP SERIES

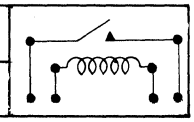
OKI electric industry company, ltd.

DIP CHARACTERISTICS

Contact Form	Part Number	Nominal Voltage (V)	Must Operate (V)	Must Release (V)	Coil Resistance (Ω)	Circuit Schematic (Top view)
1A	D51A05(D)*	5	3.75	0.5	500	
	D51A12(D)	12	9.0	1.2	800	
	D51A24 (D)	24	18.0	2.4	2000	
2A	D52A05 (D)	5	3.75	0.5	140	
	D52A12 (D)	12	9.0	1.2	400	
	D52A24 (D)	24	18.0	2.4	1300	
1C	D51C05 (D)	5	3.75	0.5	200	
	D51C12 (D)	12	9.0	1.2	500	
	D51C24 (D)	24	18.0	2.4	1500	

* (D) optional clamp diode

SIP CHARACTERISTICS

1A	F41A05	5	3.75	0.5	500	
	F41A12	12	9.0	1.2	800	

ENGINEERING DATA

	1A, 2A	1C
Operate time	0.5msec max.	0.5msec. max.
Release time	0.2msec max.	0.2msec max.
Bounce time	0.5msec max.	2.0msec max.
Contact resistance	Dip: 150mΩ max. (initial)	150mΩ max. (initial)
	Sip: 0.10Ω max.	150mΩ max. (initial)
Contact ratings	DC10VA max.	DC3VA max.
	DC100V max.	DC30V max.
	DC1.0A max. (carry only)	DC0.5A max. (carry only)
	DC0.5A max. (switched)	DC0.25A max. (switched)
Life expectancy	50 x 10^6 operations at signal level	30 x 10^6 operations at signal level
	3 x 10^6 full rated load	1 x 10^6 at full rated load
Breakdown voltage	DC250V across open contacts	DC200V across open contacts
	DC500V between coil and contact	DC500V between coil and contact
Insulation resistance	10^9Ω min.	10^9Ω min.
Vibration	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)
Thermal shock	−55 ~ 105°C	−55 ~ 105°C
Moisture resistance	60°C-90% 240 hours	60°C-90% 240 hours
Terminal strength	225g	225g
Operating temperature	−40 ~ 85°C	−40 ~ 85°C
Storage temperature	−55 ~ 105°C	−55 ~ 105C°
Operations	200 x 10^6 low level	

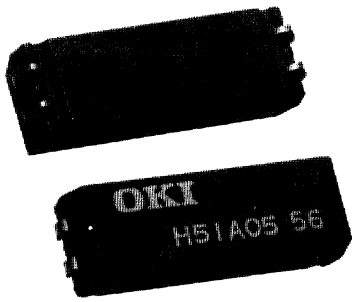
EXCLUSIVE AGENT FOR OKI REED RELAYS IN USA AND CANADA

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

HASCO COMPONENTS INC. SINCE 1976 / SMR

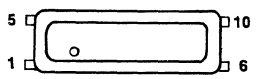
SURFACE MOUNT REED RELAY SMR

OKI electric industry company, ltd.

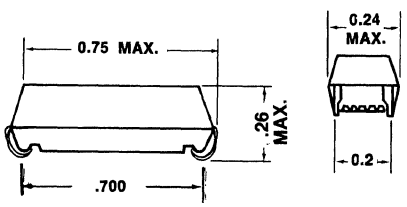


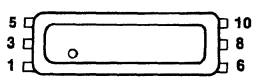
SMR REED RELAYS

STRUCTURE (External Dimensions)

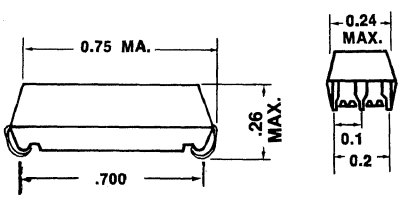


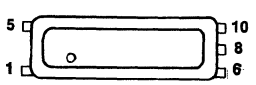
FORM 1A



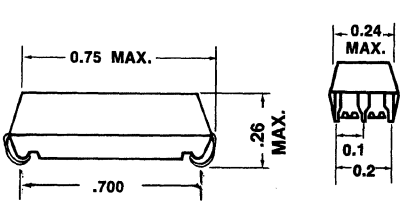


FORM 2A

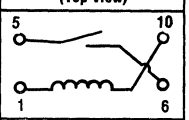
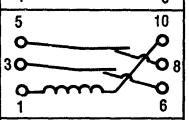
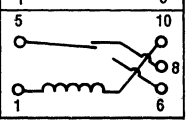




FORM 1C



CHARACTERISTICS

Contact Form	Part Number	Nominal Voltage (V)	Must Operate (V) (at 20°C)	Continuous Voltage (Max V)	Must Release (V)	Coil Resistance (Ω) ±10% (at 20°C)	Circuit Schematic (Top view)
1A	**RRH51A05 (D)**	5	3.75	10	0.8	500	
	RRH51A12 (D)	12	9.0	20	1.2	800	
2A	**RRH52A05 (D)**	5	3.75	10	0.8	140	
	RRH52A12 (D)	12	9.0	20	1.2	400	
1C	**RRH51C05 (D)**	5	3.75	10	0.8	200	
	RRH51C12 (D)	12	9.0	20	1.2	500	

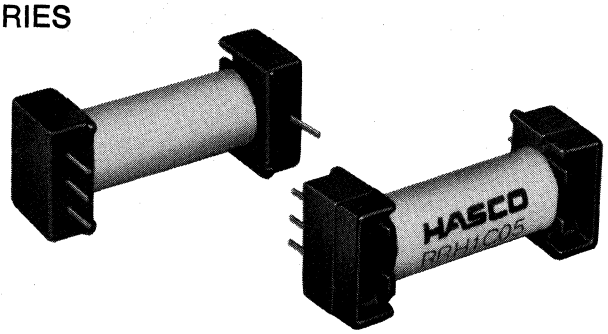
ENGINEERING DATA

	1A	2A	1C
Operate time	0.5msec max.	0.5msec max.	0.5msec max.
Release time	0.2msec max.	0.2msec max.	0.2 0.2msec max.
Bounce time	0.5msec max.	0.5msec max.	2.0msec max.
Contact resistance	150mΩ max. (initial)	150mΩ max. (initial)	150mΩ max. (initial)
Contact ratings	DC10VA max.	DC1VA max.	DC3VA max.
	DC100V max.	DC24V max.	DC30V max.
	DC1.0A max. (carry only)	DC0.3A max. (carry only)	DC0.5A max. (carry only)
	DC0.4A max. (switched)	DC0.1A max. (switched)	DC0.2A max. (switched)
Life expectancy	50 x 10^6 operations at signal level	50 x 10^6 operations at signal level	30 x 10^6 operations at signal level
	3 x 10^6 at full rated load	1 x 10^6 at full rated load	1 x 10^6 at full rated load
Breakdown voltage	DC250V across open contacts	DC250V across open contacts	DC200V across open contacts
	DC500V between coil and contact	DC500V between coil and contact	DC500V between coil and contact
Insulation resistance	10^9Ωmin.	10^9Ωmin.	10^9Ωmin.
Vibration	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)	20G (10 ~ 2000Hz)
Thermal shock	−55 ~ 105°C	−55 ~ 105°C	−55 ~ 105°C
Moisture resistance	60°C-90% 240 hours	60°C-90% 240 hours	60°C-90% 240 hours
Terminal strength	225g	225g	225g
Operating temperature	−40 ~ 85°C	−40 ~ 85°C	−40 ~ 85°C
Storage temperature	−55 ~ 105°C	−55 ~ 105°C	−55 ~ 105°C

HASCO COMPONENTS INC. / REED RELAYS

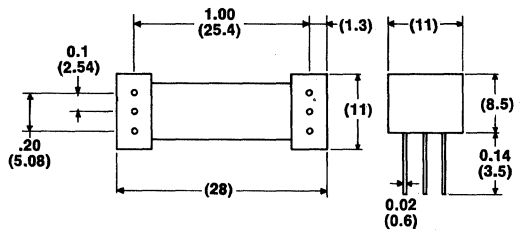
SINCE 1976

STANDARD FORM 1A 1 INCH X .1 INCH REED RELAY RRH SERIES

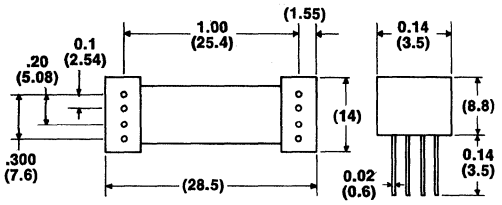


.74¢ @ 2.5k

SAME DAY SAMPLES



FORM 1A, 1C

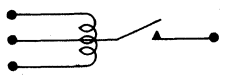
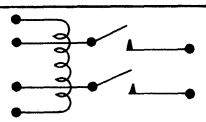
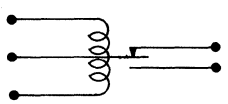


FORM 2A

Unit: Inch(mm)

METAL COVER AVAILABLE

SPECIFICATIONS COIL RATINGS

Contact Form	Part Number	Nominal Voltage (V)	Coil Resistance (Ω) ±10%	Rated Current (mA)	Continuous Voltage (Max V)	Circuit Schematic
1A	RRH1A05	5	500	20	10	
	RRH1A12	12	1000	15	20	
	RRH1A24	24	2200	10.90	28	
2A	RRH2A05	5	140	14	10	
	RRH2A12	12	500	15	20	
	RRH2A24	24	2150	12	28	
1C	RRH1C05	5	250	20	10	
	RRH1C12	12	500	15	20	
	RRH1C24	24	2200	10.90	28	

CHARACTERISTICS

Item		1A, 2A	1C
Contact resistance		150mΩ max.	150mΩ max.
Operate time		0.5msec max.	1.0msec max.
Bounce time		0.5msec max.	2.0msec max.
Release time		0.2msec max.	0.2msec max.
Operating frequency	Mechanically	100 operations/sec.	50 operations/sec.
	Electrically	10 operations/sec (under rated load)	
Insulation resistance		100MΩ min. (at 250 VDC)	50MΩ min. (at 100 VDC)
Service life	Mechanically	100,000,000 operations min.	50,000,000 operations min.
	Electrically	10,000,000 operations min.	2,000,000 operations min.
Carry current		0.5A max.	0.25 max.
Breakdown voltage		DC 250V across open contacts	DC 200V across open cotnacts
		DC 500V between coil and contract	DC 500V between coil and contract
Ambient temperature		−20 ~ 60°C	
Minimum per-missible load		100m VDC 10μA	

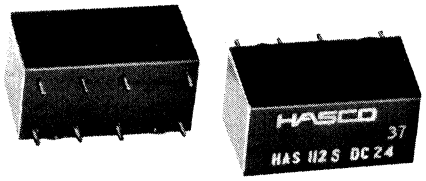
CUSTOM PACKAGING WITH SPECIAL REEDS AVAILABLE

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

HASCO COMPONENTS INC.
SINCE 1976

RELAYS

DPDT — DIP or PC STANDARD or SENSITIVE HAS 112/HS 212 RELAY

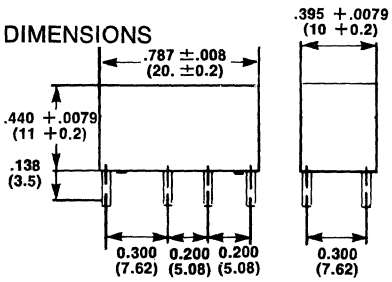


FEATURES

- Available fully sealed or "semi" sealed.
- Employing 16 pin, IC spacing.
- Low profile for tight spacing.
- Coil voltages: 5, 6, 9, 12, 24 & 48 from stock.
- Compatible and competitive!
- FCC Pt 68 available.
- Sensitive available.
- Thinner option available.
- Bifurcated contacts.
- Nitrogen sealing available.
- In stock!

SAMPLES SENT SAME DAY!

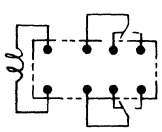
DIMENSIONS



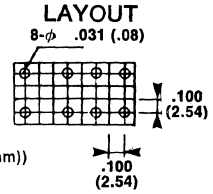
For sealed unit specify "S"
For Pt 68 specify (2)

(Unit: inch (mm))

SCHEMATICS



MOUNTING HOLE LAYOUT



COIL RATINGS FOR **STANDARD** HAS 112

Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HAS-112-5	DPDT (2 Form C)	5	45	111.0	3.5	0.5	7.0	Approx. 0.56
HAS-112-6		6	66	90.9	4.2	0.6	8.4	
HAS-112-9		9	140	64.3	6.3	0.9	12.6	
HAS-112-12		12	280	42.9	8.4	1.2	16.8	
HAS-112-24		24	1070	22.4	16.8	2.4	33.6	
HAS-112-48		48	3900	12.3	33.6	4.8	67.2	

Data Measured at 20°C.

COIL RATINGS FOR **SENSITIVE** HS 212

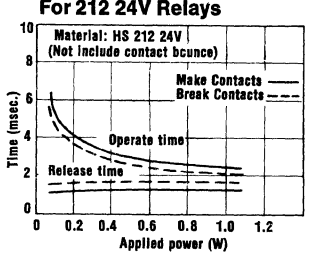
Relay Code (V)	Contact Arrangement	Nom. Volt. (VDC)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (VDC)	Drop-Out Volt. (VDC)	Max. Volt. (VDC)	Nom. Pwr (W) Cons'p-tion
HS-212-5	DPDT (2 Form C)	5	167	29.9	3.5	—	12.5	0.15
HS-212-6		6	240	25.0	4.2	—	15.0	0.15
HS-212-9		9	540	16.7	6.3	—	22.5	0.15
HS-212-12		12	960	12.5	8.4	—	30.0	0.15
HS-212-24		24	2880	8.3	16.8	—	51.6	0.2
HS-212-48		48	7680	6.3	32.6	—	84.0	0.3

As for the resistance value, pull-in voltage and drop-out voltage, they show the value at ambient temperature, 20°C, and the tolerance is ±10%.

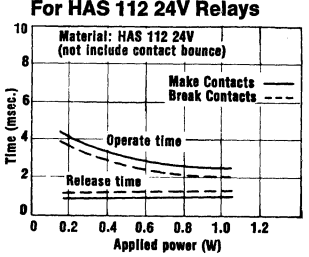
RATING PERFORMANCE

Specifications			Note
Coil	Nominal Voltage	5, 6, 9, 12, 24, 48 VDC	
	Nominal Power Consumption	0.56W	
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	DPDT, 2 Form C	
	Contact Material	Gold-clad, Ag-Pd alloy	
	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 30W/AC 60 VA	at resistive load
	Max. Switching Voltage	125 VDC/AC	
	Max. Switching Current	1.25 ADC/AC	
Time	Operate Time	Approx. 3 mS	at nominal
	Release Time	Approx. 2 mS	voltage
	Bounce Time (Operating)	0.5 to 2.0 mS	no bounce in break contact
	Bounce Time (Releasing)	1.5 to 3.5 mS	no bounce in make contcat
Insulation Resistance		1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength		500 VAC	1 minute is at 25°C, 50% relative humidity
Vibration Resistance		1.55 mm DA, 10 ~ 55 Hz	
Temperature Range		−40° C ~ +85°C	
Life	Mechanical Life	10 x 10^6 times	
	Electrical Life	5 x 10^5 times	at 24 VDC, 1A, resistive load
Weight		5 g	

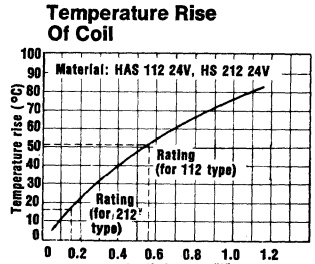
Operate and Release Time For 212 24V Relays



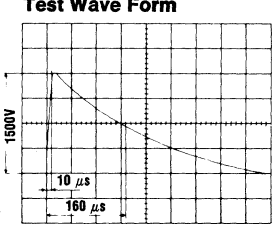
Operate and Release Time For HAS 112 24V Relays



Temperature Rise Of Coil



FCC 1500V Surge Test Wave Form



HASCO COMPONENTS INC. RELAYS

SINCE 1976

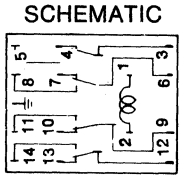
4PDT — HAS 124 FLATPACK

SAMPLES SENT SAME DAY!

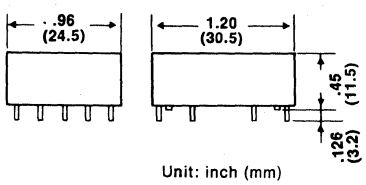
FEATURES

- Voltages — 5, 6, 12, 24 and 48.
- Bifurcated contacts.
- Fully sealed versions are in stock.
- Form D available.
- Nitrogen filled.
- FCC Part 68.
- In stock!

SCHEMATIC

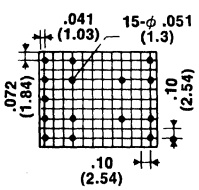


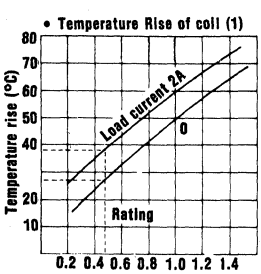
DIMENSIONS

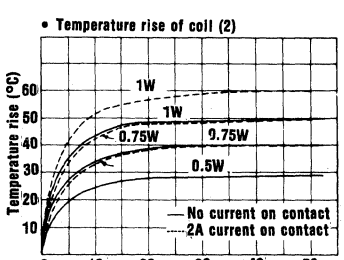


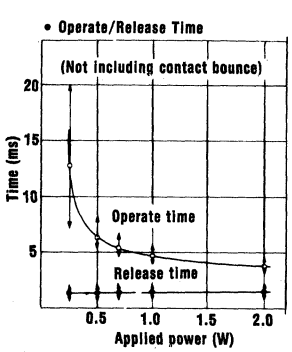
Unit: inch (mm)

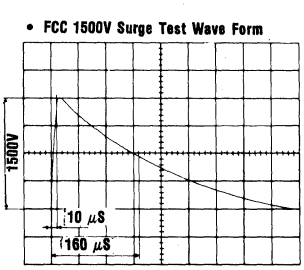
MOUNTING HOLE LAYOUT











COIL RATING

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HAS-124-5	4 PDT	5	52	96.2	3.5	0.5	7.0	
HAS-124-6	4	6	85	70.6	4.2	0.6	8.4	
HAS-124-9	Form C	9	170	52.9	6.3	0.9	12.6	0.48
HAS-124-12	S:	12	330	36.4	8.4	1.2	16.8	
HAS-124-24	Sealed	24	1200	20.0	16.8	2.4	33.6	
HAS-124-48		48	4200	11.4	33.6	4.8	67.2	

Data measured at 20°C, *measured at 40°C.

RATING PERFORMANCE

	Specifications		Note
Coil	Nominal Voltage	5, 6, 9, 12, 24, 48 VDC	nominal voltage
	Nominal Power Consumption	0.48W	48V
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	4 PDT, 4 Form C	crossbar type, bifurcated contact
	Contact Material	Gold-Clad, Ag-Pd Alloy	
	Contact Resistance	100 mΩ	at initial value
	Max. Switching Power	DC 60W, AC 60 VA	at resistive load
	Max. Switching Voltage	110 VDC/AC	
	Max. Switching Current	2A DC/DC	
Time	Operate Time	Approx. 10 mS	at nominal voltage
	Release Time	Approx. 5 mS	
	Bounce Time (Operating)	0 to 3.5 mS on Operate	no bounce in break contact
	Bounce Time (Releasing)	1 to 5 mS on Release	no bounce in make contact
Insulation Resistance		1000 MΩ	at 500 VAC, 25°C, 50% relative humidity
Dielectric Strength		750 VAC	1 minute at 25°C, 50% relative humidity
Vibration Resistance		1.5 mm DA 10 ~ 55 Hz	
Temperature Range		−40°C ~ +70°C	
Life	Mechanical Life	100 x 10^6 times	
	Electrical Life	3 x 10^6 times	at 30 VDC, 1A, resistive load
Weight		15.5 g	

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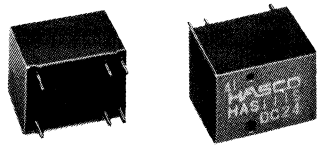
HASCO COMPONENTS INC. SINCE 1976 — RELAYS

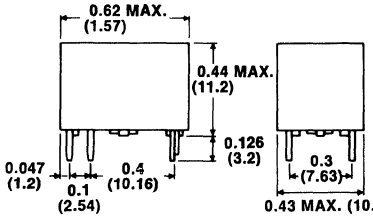
SPDT — 1 AMP DIP OR PC RELAY — STANDARD or SENSITIVE HAS 111/211



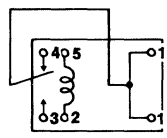
FEATURES

- Small size 1A switching capacity.
- Available semi or fully sealed.
- Voltages 1.5-48 volts available.
- Hi-quality, yet inexpensive.
- FCC Pt 68 available.
- Nitrogen seal option.
- In stock!

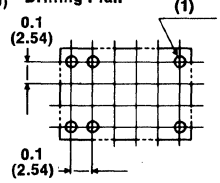
SAMPLES SENT SAME DAY!



Internal Connections (Bottom View)

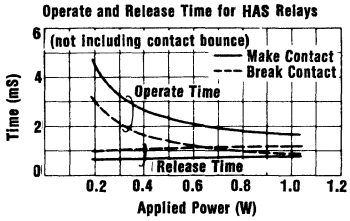


Drilling Plan 6-⌀ 0.039 hole (1)

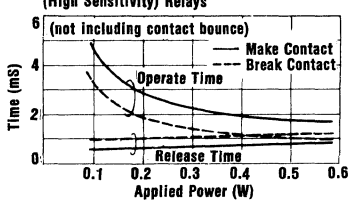


Specifications subject to change without notice.
Unit: inch (mm)
For sealed unit specify "S"

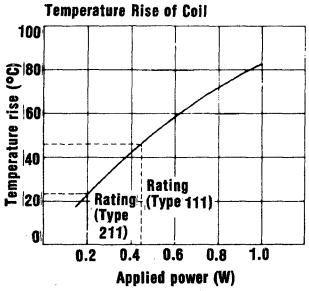
Operate and Release Time for HAS Relays



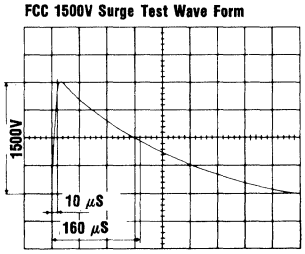
Operate and Release Time for HS (High Sensitivity) Relays



Temperature Rise of Coil



FCC 1500V Surge Test Wave Form



COIL RATINGS FOR **STANDARD** MODEL HAS 111

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HAS-111-3	SPDT (1 Form C)	3	20	150	2.1	0.3	3.3	Approx. 0.45
HAS-111-5		5	56	89.3	3.5	0.5	5.5	
HAS-111-6		6	80	75	4.2	0.6	6.6	
HAS-111-9		9	180	50	6.3	0.9	9.9	
HAS-111-12		12	320	37.5	8.4	1.2	13.2	
HAS-111-24		24	1280	18.8	16.8	2.4	26.4	
HAS-111-48		48	5120	9.4	33.6	4.8	52.8	

COIL RATINGS FOR **SENSITIVE** MODEL HS 211

Relay Code	Contact Arrangement	Nom. Volt. (V)	Coil Resist. (Ω ±10%)	Nom. Curr. (mA)	Pick-Up Volt. (V)	Drop-Out Volt. (V)	Max. Volt. (V)*	Nom. Pwr (W) Cons'p-tion
HS-211-3	SPDT (1 Form C)	3	45	66.7	2.1	0.3	4.8	Approx. 0.20
HS-211-5		5	120	41.7	3.5	0.5	8.0	
HS-211-6		6	180	33.3	4.2	0.6	9.6	
HS-211-9		9	400	22.5	6.3	0.9	14.4	
HS-211-12		12	700	17.1	8.4	1.2	19.2	
HS-211-24		24	2800	8.6	16.8	2.4	38.4	

Data measured at 20°C, *measured at 40°C.

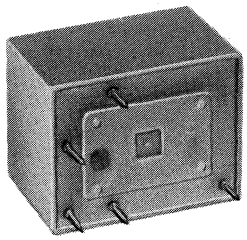
RATING PERFORMANCE

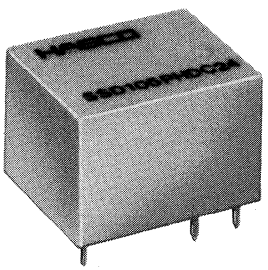
	Specifications		Note
Coil	Nominal Voltage	1.5, 3, 5, 6, 9, 12, 24, 48 VDC	
	Nominal Power Consumption	0.45W	
	Pick-up Voltage	70% of nominal voltage	
	Drop-out Voltage	10% of nominal voltage	
Contact	Contact Arrangement	SPDT, 1 Form C	
	Contact Material	Silver-Palladium (Gold overlay)	
	Contact Resistance	Max. 100 mΩ	at initial value
	Max. Switching Power	DC 30W/AC 60 VA	at resistive load
	Max. Switching Voltage	60 VDC/120 VAC	
	Max. Switching Current	1A DC/AC	
Time	Operate Time	Approx. 2 mS	at nominal voltage
	Release Time	Approx. 1 mS	
	Bounce Time (Operating)	Max. 2 mS	no bounce in break contact
	Bounce Time (Releasing)	Max. 7 mS	no bounce in make contact
Insulation Resistance		Min. 100 MΩ	at 500 VDC
Dielectric Strength		500 VAC	1 minute
Vibration Resistance		1.5 mm DA 10 ~ 55 Hz	
Temperature Range		−25°C ~ +55°C	
Life	Mechanical Life	500 x 10^4 times	
	Electrical Life	50 x 10^4 times	at 24 VDC, 1A resistive load
		10 x 10^4 times	at 120 VAC, 0.5A, resistive load
Weight		Approx. 4 g	

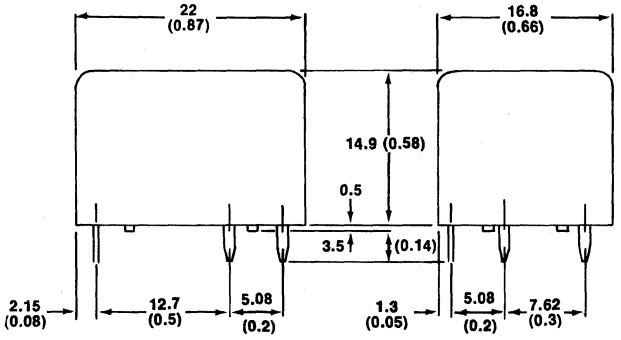
HASCO COMPONENTS INC.
SINCE 1976

RELAYS

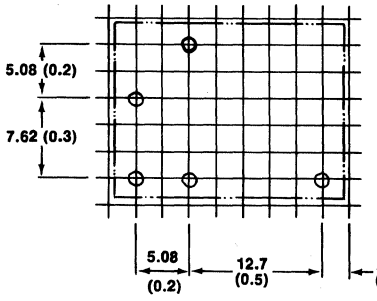
SPDT 3, 6 OR 10 AMP RELAY
SSD106P RELAY SERIES



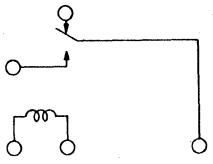




MOUNTING HOLES
(BOTTOM VIEW)



TERMINAL ARRANGEMENT
(BOTTOM VIEW)



*Hole Dia to be 1.0 — 1.2 (0.039 — 0.047)

Unit: Inch(mm)

MAXIMUM LOAD RATINGS (Resistive)

Type \ Voltage	AC 125V	AC 250V	DC 30V
SSD 103PH	3A	2.5A	3A
SSD 105PH06	5A6	3A	5A
SSD 110PH	10A	5A	10A

FEATURES

- Highly reliable, low cost
- Miniature size (16.8 x 22 x 14.8mm) & large switch capacity up to 10A
- High dielectric strength type
- Printed circuit terminals, fits grid with 2.54mm
- In stock

.74¢ @ 2.5k

SAME DAY SAMPLES

SPECIFICATIONS

CONTACT DATA

Arrangement: 1 Form C (SPDT)
Material & Rating: Silver, gold flash: 3A at 24VDC or 120VAC, 1.5A at 240VAC, resistive
Silver Cadmium oxide, silver flash: 6A at 24VDC or 120VAC, 3A at 240VAC, resistive
Special alloy, silver flash: 10A at 24VDC or 120VAC, 5A at 240VAC, resistive
Max. operating Voltage: 250VAC & 125VDC
Min. permissible load (reference value): Silver contact: 5VDC, 1mA
Other contact: 5VDC, 100mA
Service life: Mechanical: 20 Million operations
Electrical: 100,000 operations min. at rated load

COIL DATA

(See coil data chart)
Voltages: From 3V to 24V
Power (at 20°C): Nominal: 0.45 watt

GENERAL DATA

Contact resistive: 50 m ohm Max.
Operate time: Approx. 6 ms (at nominal voltage)
Operate bounce time: Approx. 2 ms
Release time: Approx. 2 ms
Release bounce time: Approx. 4 ms
Insulation resistance: More than 100 M ohm at DC 500V
Dielectric strength: 750VAC (50/60 Hz), between open contact; 2000VAC (50/60 Hz), between coil & contact
Vibration: 1.5mm double amplitude, 10 to 50 Hz
Shock: 100m/sec² (approx. 10 G's)
Operation frequency: Mechanical: 18,000 operations/hour
Electrical: 1,800 operations/hour (under rated load)
Temperature range: −30°C to +85°C.
Temperature rise: Less than 35 deg.
Humidity: 45° −85% RH
Approximate weight: 10 gr.

COIL RATINGS

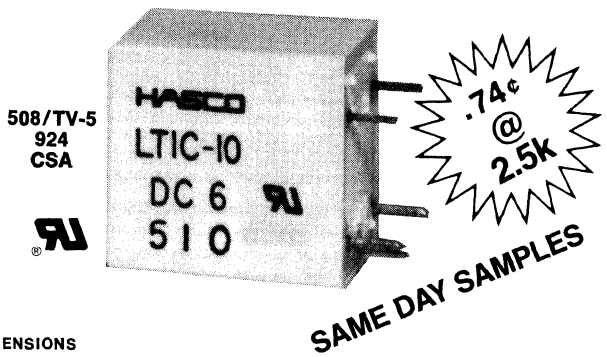
Nominal Coil Voltage	Coil Resistance in Ohms, ±10% at 20°C	Must Operate Voltage at 20°C	Must Release Voltage at 20°C	Maximum Voltage
3VDC	20	less than 75% of nominal voltage	More than 10% of nominal voltage	130% of nominal voltage
5VDC	56			
6VDC	80			
9VDC	180			
12VDC	320			
24VDC	1150			

TO ORDER:

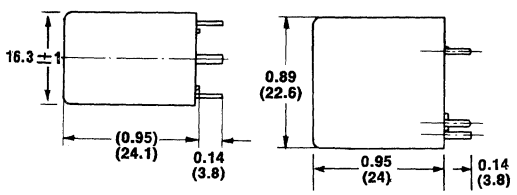
FULLY SEALED
SSD103PH: 3 AMP
SSD106PH: 6 AMP
SSD110PH: 10 AMP

HASCO COMPONENTS INC. SINCE 1976 — RELAYS

LT MINIATURE POWER RELAYS SPDT 3, 5 & 10 AMP



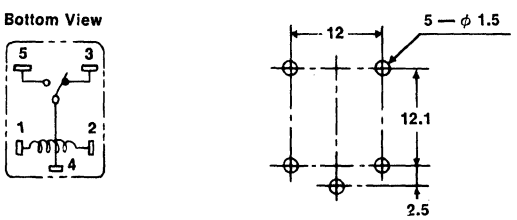
LT DIMENSIONS



Unit: inch (mm)

(Shorter height available)

CIRCUIT DIAGRAM AND MOUNTING



ORDERING INFORMATION

LT	IC	5	XXV
	C: SPDT	3 = 3 amp	5 = 5V
	B: SPNC	5 = 5 amp	6 = 6V
	A: SPNO	10 = 10 amp	9 = 9V
			12 = 12V
			24 = 24V
			48 = 48V

For lower height model use SLT

FEATURES

- Miniature, lightweight relay which requires less mounting space.
- UL 508/TV-5 available.
- High reliable relay with dielectric strength, 2000V which employs the specific construction.
- Economical and favorable price for simple construction.
- Fully sealed.
- In stock for most voltages and amps!

GENERAL CHARACTERISTICS

Ambient Temperature: −20 to +60°C (not to freeze).
Ambient Humidity: 45 to 85% (not to be dewy).
Operating Time: Less than 20 mS.
Release Time: Less than 20 mS.
Contact Resistance (at initial): Less than 100 milliohms at 6V DC, 1A.
Insulation Resistance: 500V DC, more than 100M Ohms.
Dielectric Strength: Between contacts: 500V AC (50/60 Hz) 1 minute — Between coil and contact; 2,000V AC (50/60 Hz) 1 minute.
Vibration: 6G (10 to 55 Hz).
Shock: 10G.
(The above mentioned values are at normal temperature and humidity.)

CHARACTERISTICS

Power Consumption: Approx. 0.36W to approx. 0.5W.
Temperature Rise: Less than 40 deg. after applied max. continuous voltage.

COIL RATINGS

Rated Voltage (V)	DC6	DC9	DC12	DC24
Rated Current (mA)	60	40	30	15
Coil Resistance (Ω)	100	225	400	1600

* Coil rated current tolerance is +15%, −20% at ambient temp. of 20°C.
* DC 5V coil rating also in stock.

MAXIMUM LOAD RATINGS

Type	Load	Voltage	AC 125V	DC 24V
3A	Resistive	(cos ϕ = 1)	3A	3A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	1.2A	1.2A
5A	Resistive	(cos ϕ = 1)	5A	5A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	2A	2A
10A	Resistive	(cos ϕ = 1)	10A	10A
	Inductive	(cos ϕ = 0.4 T = 7 ms)	4A	4A

SPECIFICATIONS

Maximum Continuous Voltage: 115% of rated voltage at 20°C.
Operating Voltage: Less than 80% of rated voltage at 20°C.
Opening Voltage: More than 10% of rated voltage at 20°C.
Coil Temperature Rise: LT 1C 3/LT 1C 5—Less than 50°C at rated voltage. LT 1C 10—Less than 60°C at rated voltage.
Initial Contact Resistance: Less than 100 mΩ (1A 6V DC).
Insulation Resistance: More than 100 MΩ (500V DC).
Dielectric Strength: Between coil and contact — AC 1500V for 1 minute. Between contacts — AC 750V for 1 minute
Electrical Life: More than 100,000 operations at rated voltage.
Mechanical Life: More than 5,000,000 operations.
Contact Material: LT 1C 3 — Gold plated over silver LT 1C 5 and LT 1C 10 — Silver alloy.
Operating Temperature: LT 1C 3/LT 1C 5 — 30°C ~ +20°C. LT 1C 10 — 30°C ~ +50°C.

*** Available up to 4000V DC.**

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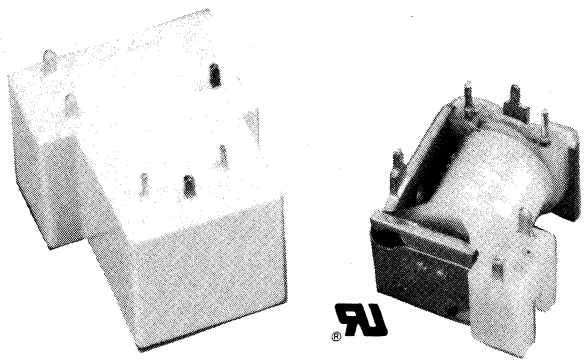
HASCO COMPONENTS INC.
SINCE 1976

RELAYS

HAT-901 SERIES HEAVY DUTY



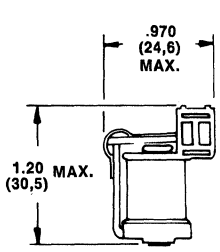
GENERAL SPECIFICATIONS

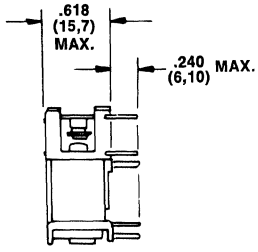
Max. continuous rated voltage: 110% of nominal voltage.
Pull-In voltage: 75% of nominal voltage. Max @ 25°C.
Drop-Out voltage: 10% of nominal voltage. Min @ 25°C.
Contact Resistance: 20 mΩ max. (Initial value)
Operating Temp: −55°C to +85°C.
Insulation Resist: DC 500V 10 MΩ min.
Dielectric Strength: AC 1500V between contact and coil, frame and contact, coil and frame one minute. AC 1500V between contacts one minute.
Operate Time: approx 15 ms.
Release Time: approx. 10 ms.
Electrical Life: 10 x 10^3 operation min.
Mechanical Life: 10 x 10^6 operation min.

COIL SPECIFICATIONS

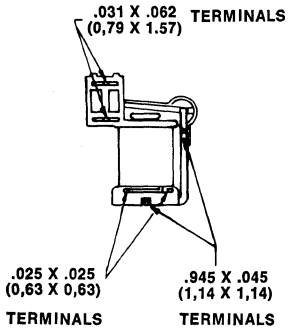
Nominal Voltage (VDC)	Resistance 10% @ 25°C (Ohms)	Coil Power 10% @ 25°C (Watts)
5	27	.93
6	40	.90
9	97	.84
12	155	.93
15	256	.88
18	380	.85
24	660	.87

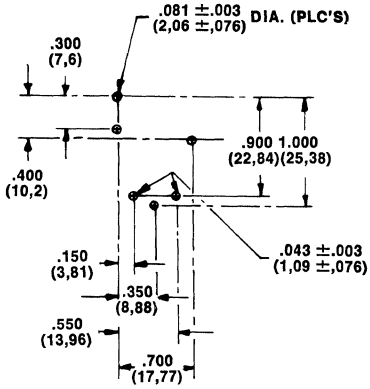
MECHANICAL SPECIFICATIONS





PC BOARD LAYOUT
VIEWED TOWARD TERMINALS





MAXIMUM LOAD SPECIFICATIONS

Voltage	Load Type	SPNC	SPDT	SPNO
AC	Resistive Motor	20A 120 VAC 15A 240 VAC 1HP 120/240 VAC		30A 240 VAC
DC	Resistive	15A 28 VDC		30A 28 VDC

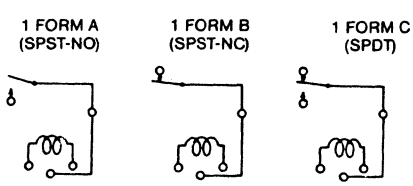
ORDERING INFORMATION

Part Number	Form	Style
HAT 901	**A**	Sealed Type = S
	B	Cover Only = C
	C	Open Style is Standard

(I.e.: HAT-901C-S 12
is an SPDT fully
sealed version with 12V coil.)

WIRING DIAGRAMS

PIN VIEW



MINIGLOSSARY ELECTROMECHANICAL RELAYS

RELAYS

Hybrid: Isolated input and output either with a solid-state input and an electromechanical output or vice versa. Typically a reed switch is used to trigger a solid-state output or a solid-state amplifier is used to trigger an electromechanical relay.

Differential: Have multiple windings to function when voltage, current and/or power difference reaches a specific level or value.

Close-differential: The dropout value is specified close to the pickup value.

Frequency sensitive: Operates at a set frequency or within specific frequency bands. A resonant reed, for example.

Hermetically sealed: Totally sealed by glass-to-metal or metal-to-metal seals to ensure very low rates of gas leakage over long time periods.

Encapsulated: Imbedded in a suitable potting compound.

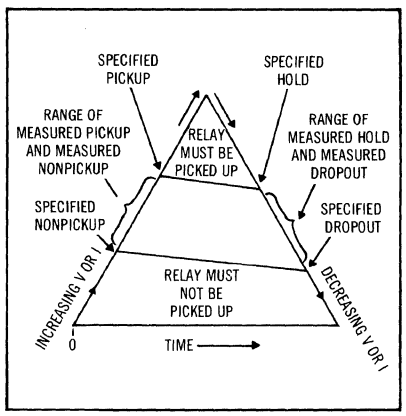
Sealed: Enclosed in a relatively airtight cover. (Not the same as hermetically sealed.)

Covered: Unsealed metal or plastic enclosure or housing.

CONTACTS

Dry circuit: contacts that carry current but do not open or close during energizing of the load circuit. Often wrongly used in reference to low level contacts.

Low Level: Contacts controlling relatively low voltages and low currents. Generally below 5 Vdc and 10mA.



OPERATING CHARACTERISTICS

Measured dropout: The value at which all contacts restore to their unoperated position as current or voltage decreases.

Specified dropout: The value at or *above* which all contacts *must* restore to their unoperated position as voltage or current is decreased.

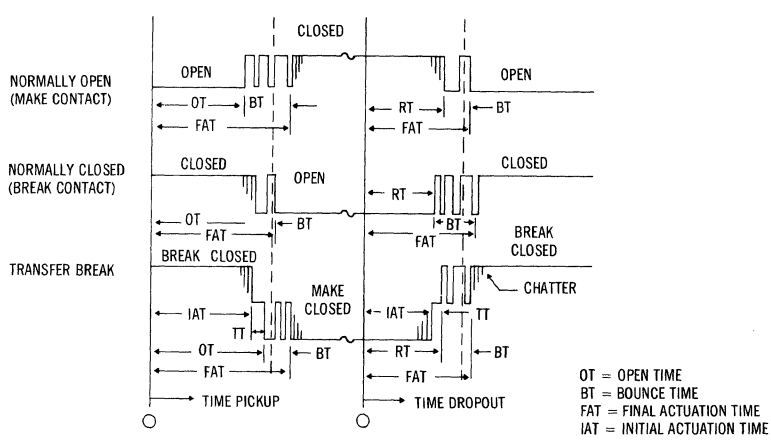


Fig. 2. Typical time vs. current (non-inductive load)

Specified hold: The value that *must* be reached before any contact change occurs as voltage or current is decreased on an operated relay.

Specified nonpickup: The value that *must* be reached before any contact change occurs as voltage or current decreases on an unoperated relay.

Measured pickup: The value at which all contacts function as voltage or current increases on an unoperated relay.

Specified pickup. The value at or *below* which all contacts *must* function as voltage or current increases on an unoperated relay.

Sensitivity: Specified pickup expressed in watts.

Normal bridging: The make-before-break action between adjacent contacts on relays designed for this purpose.

Abnormal bridging: The undesired closing of contacts caused by a metal bridge or protrusion developed by arcing.

Magnetic freezing: Sticking of the armature to the core as a result of residual magnetism.

TIME

Actuation: The interval from coil energization or de-energization to the functioning of a specified contact.

Initial actuation: The interval from coil energization or de-energization to the *first* closing or opening of a previously open or closed contact.

Final actuation: Sum of initial actuation *and* bounce intervals following an actuation.

Contact bounce: The interval from close or opening of a contact to the end of the bounce of "chatter."

Chatter: See bounce.

Operate: Normally taken as the interval between energization and the opening or closing of the last contact to function not including bounce.

Release: Normally taken as the interval between de-energization and the opening or closing of the last contact to function excluding bounce.

Transfer: The interval between opening a closed contact and closing an open contact of a break-before-make relay.

High Performance Miniature Relays

Hi-G Company is the leading supplier of rugged, hermetically-sealed, military-qualified relays, rated 10 amperes and under. Because all Hi-G Military Qualified relays are designed for extreme environmental conditions, they are also suited for critical commercial and computer applications.

Hi-G Relay Guide

MILITARY QUALIFIED RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
1	DPDT	TO-5	130	(J) MA	ii
1	SPDT	TO-5	100	(J) 1MA	iii
1	DPDT	TO-5	60	(J) MS	iv
1	SPDT	TO-5	40	(J) 1MS	v
1	DPDT	Square/.100 Grid	130	(J) MGA	vi
1	DPDT	Square/.100 Grid	60	(J) MGS	vii
2	DPDT	1/5 Xtal Can	135	(J) G	vii
2	DPDT	1/2 Xtal Can	250	(J) 2K-4730	vii
2	DPDT	1/2 Xtal Can	250	(J) 2K-4940	viii
2	DPDT	Xtal Can	250	2B-1506	viii
2	DPDT	Tall Xtal Can	40	2BC-1510	viii
10	DPDT	Xtal Can	500	2T-2911/2994	viii

SOLID STATE RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
50mA 40Vac or dc	SPST (N.O.)	TO-5	5.0Vdc	JTS-5	xv
250mA 40Vdc	SPST (N.O.)	TO-5	5.0Vdc	JTS-6	xv
100mA 250Vdc	SPST (N.O.)	TO-5	5.0Vdc	JTS-7	xv
600mA 50Vdc	SPST (N.O.)	Dip .300	3-16Vdc	JDS8	xv
1 amp 250Vac	SPST (N.O.)	Dip .300	3.8-32Vdc	JDS9	xv
25 amp 220Vac	SPST (N.O.)	Heat Sink	4-32Vdc	JPS10	xv

MILITARY, COMMERCIAL, AND COMPUTER GRADE RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
1	DPDT	TO-5	185	CA	x
1	DPDT	TO-5	90	CS	x
2	DPDT	1/2 Xtal Can	250	K	**
2	DPDT	Xtal Can	250	B, BR	**
2	4PDT	Xtal Can	400	4B	**
2	2PDT	1/2 Xtal Can	100	KA	**
2	SPDT/DPDT	Xtal Can	25/40	BK	**
2	SPDT/DPDT	Tall Xtal Can	25/40	BC	**
2	DPDT	Xtal Can	100	BA	**
4	DPDT	1/2 Xtal Can	300	HA	**
5	DPDT	Xtal Can	280	BN	**
5	DPDT	Tall Xtal Can	80	BCN	**
10	DPDT	Xtal Can	500	T	**
2	DPDT	1/2 Xtal Can	350	FS2	ix
2	DPDT	1/2 Xtal Can	150	FS3	ix
5	DPDT	1/2 Xtal Can	725	FS5	ix

RF RELAYS

Contact Rating (AMP)	Contact Arrangement	Enclosure	Sensitivity (mW)	Hi-G Series	Page Number
*	SPDT	Cube	150	RFC	**
*	DPDT	1/2 Xtal Can	250	RFK	x
*	DPDT	Xtal Can	250	RFB	**
*	DPDT	Tall Xtal Can	40	RFBC	**

*Contacts rated 75 Watts switching, 200 Watts carry.

**Descriptions of these relays are not listed here. For additional information, please contact Hi-G Company, 101 Locust St., Hartford, CT 06114 for complete miniature relay catalog. Telephone: (203) 522-8600.

HI-G RELAYS

Hi-G offers the most complete selection of qualified relays, rated 10 amperes and under, of any manufacturer in the world. The following charts list the appropriate military specification, relay configuration, relay contact operating parameters, and the corresponding Hi-G part number. A (J) prefix to the Hi-G part number denotes Qualified Relay; L, M, and P suffixes denote applicable failure rate.

Series (J)MA:
TO-5 Case Relay, DPDT

QUALIFIED:
MIL-R-39016/9
MIL-R-39016/15
MIL-R-39016/20
MIL-R-28776/1

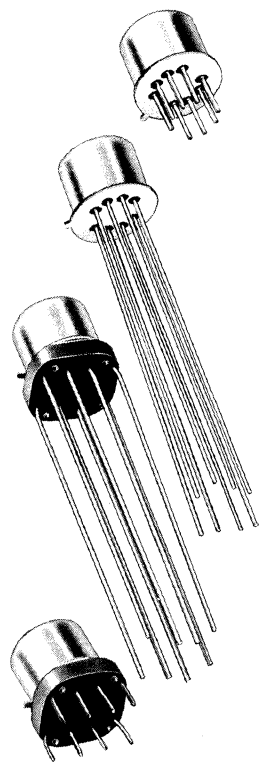
Failure Rate Levels
L, M, P.

These ultra-miniature DPDT relays in transistor-style case are available in **4 types:** basic relay; with diode coil suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 130 mW

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/9	
	M39016/9-013L, M, P	JMAW-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	JMAP-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-051L	JMAW-30XL
	-052L	JMAP-30XL
	-057L	JMAC-5XL
	-058L	-6XL
	-059L	-9XL
	-060L	-12XL
	-061L	-18XL
	-062L	-26XL
	-063L	-30XL
	-071L	JMAC-5XLS
	-072L	-6XLS
	-073L	-9XLS
	-074L	-12XLS
	-075L	-18XLS
	-076L	-26XLS
	-077L	-30XLS
	M39016/15	
	M39016/15-029L, M, P	JMAWD-6XL, M, P
	-030L	-9XL
	-031L	-12XL
	-032L	-18XL
	-033L	-26XL
	-034L	-5XL
	-035L	JMAPD-6XL
	-036L	-9XL
	-037L	-12XL
	-038L	-18XL
	-039L	-26XL
	-040L	-5XL
	-065L	JMAWDG-6XL
	-066L	-9XL
	-067L	-12XL
	-068L	-18XL
	-069L	-26XL
	-070L	-5XL
	-077L	JMACD-6XL
	-078L	-9XL
	-079L	-12XL
	-080L	-18XL
	-081L	-26XL
	-082L	-5XL
	-089L	JMACDG-6XL
	-090L	-9XL
	-091L	-12XL
	-092L	-18XL
	-093L	-26XL
	-094L	-5XL
	-101L	JMACD-6XLS
	-102L	-9XLS
	-103L	-12XLS
	-104L	-18XLS

Series (J)MA
Cont'd.



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/15 (cont'd.)	
	-105L	-26XLS
	-106L	-5XLS
	-113L	JMACDG-6XLS
	-114L	-9XLS
	-115L	-12XLS
	-116L	-18XLS
	-117L	-26XLS
	-118L	-5XLS
	M39016/20	
	M39016/20-007L, M, P	JMAWDD-5XL, M, P
	-008L	-6XL
	-009L	-9XL
	-010L	-12XL
	-011L	-18XL
	-012L	-26XL
	-037L	JMAPDD-5XL
	-038L	-6XL
	-039L	-9XL
	-040L	-12XL
	-041L	-18XL
	-042L	-26XL
	-049L	JMACDD-5XL
	-050L	-6XL
	-051L	-9XL
	-052L	-12XL
	-053L	-18XL
	-054L	-26XL
	-061L	JMACDD-5XLS
	-062L	-6XLS
	-063L	-9XLS
	-064L	-12XLS
	-065L	-18XLS
	-066L	-26XLS
	M28776/1	
	M28776/1-013L, M, P	JMAWT-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	JMAPT-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	JMACT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	JMACT-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS

Hi-G Military Relays

Series (J)1MA:

TO-5 Case Relay, SPDT

QUALIFIED:
MIL-R-39016/7
MIL-R-39016/23
MIL-R-39016/24
MIL-R-28776/5

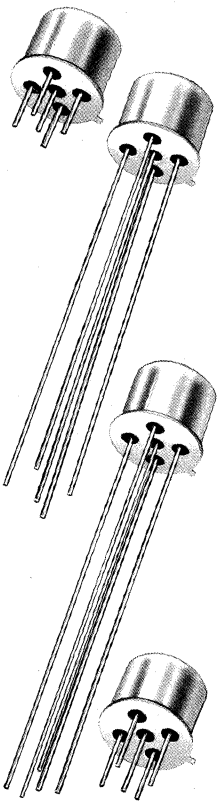
Failure Rate Levels L, M, P.

These ultra-miniature SPDT relays in transistor-style case are available in **4 types:** basic relay; with diode suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 1 Form C
Rating: 1 Amp
Sensitivity: 100 mW

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/7	
	M39016/7-013L, M, P	J1MAW-5XL, M, P
	-014L	J1MAP-5XL
	-015L	J1MAW-6XL
	-016L	J1MAP-6XL
	-017L	J1MAW-9XL
	-018L	J1MAP-9XL
	-019L	J1MAW-12XL
	-020L	J1MAP-12XL
	-021L	J1MAW-18XL
	-022L	J1MAP-18XL
	-023L	J1MAW-26XL
	-024L	J1MAP-26XL
	-025L	J1MAC-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MAC-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS
	M39016/23	
	M39016/23-013L, M, P	J1MAWD-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPD-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACD-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACD-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS

Series (J)1MA Cont'd.



RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/24	
	M39016/24-013L, M, P	J1MAWDD-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPDD-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACDD-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACDD-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS
	M28776/5	
	M28776/5-013L, M, P	J1MAWT-5XL, M, P
	-014L	-6XL
	-015L	-9XL
	-016L	-12XL
	-017L	-18XL
	-018L	-26XL
	-019L	J1MAPT-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-025L	J1MACT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	J1MACT-5XLS
	-032L	-6XLS
	-033L	-9XLS
	-034L	-12XLS
	-035L	-18XLS
	-036L	-26XLS

Hi-G Military Relays

Series (J)MS:
Sensitive TO-5 Case Relay, DPDT

QUALIFIED:
MIL-R-39016/11
MIL-R-39016/16
MIL-R-39016/21
MIL-R-28776/3

Failure Rate Levels L, M, P.

These sensitive ultra-miniature DPDT relays in transistor-style case are available in **4 types:** basic relay; with diode suppression (D); with two diodes for coil suppression and polarity-reversal protection (DD); and with integral transistor driver and diode coil suppression (T).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 60 mW

Hi-G Military Relays

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/11	
Series (J)MS: Sensitive TO-5 Case Relay, DPDT	M39016/11-017L, M, P	JMSW-5XL, M, P
	-018L	JMSP-5XL
	-019L	JMSW-6XL
	-020L	JMSP-6XL
	-021L	JMSW-12XL
	-022L	JMSP-12XL
	-023L	JMSW-26XL
	-024L	JMSP-26XL
	-025L	JMSW-36XL
	-026L	JMSP-36XL
	-027L	JMSW-48XL
	-028L	JMSP-48XL
	-029L	JMSW-9XL
	-030L	JMSP-9XL
	-031L	JMSW-18XL
	-032L	JMSP-18XL
	-033L	JMSC-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-36XL
	-038L	-48XL
	-039L	-9XL
	-040L	-18XL
	-041L	JMSC-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-36XLS
	-046L	-48XLS
	-047L	-9XLS
	-048L	-18XLS
	M39016/16	
	M39016/16-017L, M, P	JMSWD-5XL, M, P
	-018L	-6XL
	-019L	-12XL
	-020L	-26XL
	-021L	-36XL
	-022L	-48XL
	-023L	-9XL
	-024L	-18XL
	-025L	JMSPD-5XL
	-026L	-6XL
	-027L	-12XL
	-028L	-26XL
	-029L	-36XL
	-030L	-48XL
	-031L	-9XL
	-032L	-18XL
	-033L	JMSCD-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-36XL
	-038L	-48XL
	-039L	-9XL
	-040L	-18XL
	-041L	JMSCD-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-36XLS
	-046L	-48XLS
	-047L	-9XLS
	-048L	-18XLS

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
Series (J)MS Cont'd.	M39016/21	
	M39016/21-007L, M, P	JMSWDD-5XL, M, P
	-008L	-6XL
	-009L	-9XL
	-010L	-12XL
	-011L	-18XL
	-012L	-26XL
	-019L	JMSPDD-5XL
	-020L	-6XL
	-021L	-9XL
	-022L	-12XL
	-023L	-18XL
	-024L	-26XL
	-029L	JMSWDD-36XL
	-030L	-48XL
	-031L	JMSPDD-36XL
	-032L	-48XL
	-033L	JMSCDD-5XL
	-034L	-6XL
	-035L	-9XL
	-036L	-12XL
	-037L	-18XL
	-038L	-26XL
	-039L	-36XL
	-040L	-48XL
	-041L	JMSCDD-5XLS
	-042L	-6XLS
	-043L	-9XLS
	-044L	-12XLS
	-045L	-18XLS
	-046L	-26XLS
	-047L	-36XLS
	-048L	-48XLS
	M28776/3	
	M28776/3-017L, M, P	JMSWT-5XL, M, P
	-018L	-6XL
	-019L	-9XL
	-020L	-12XL
	-021L	-18XL
	-022L	-26XL
	-023L	-36XL
	-024L	-48XL
	-025L	JMSPT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	-36XL
	-032L	-48XL
	-033L	JMSCT-5XL
	-034L	-6XL
	-035L	-9XL
	-036L	-12XL
	-037L	-18XL
	-038L	-26XL
	-039L	-36XL
	-040L	-48XL
	-041L	JMSCT-5XLS
	-042L	-6XLS
	-043L	-9XLS
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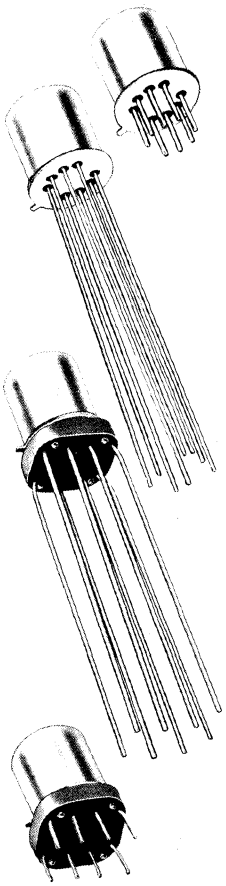
	-048L	-48XLS



Series (J)1MS:
Sensitive TO-5 Case Relay, SPDT

QUALIFIED:
MIL-R-39016/10
MIL-R-39016/25
MIL-R-39016/26
MIL-R-28776/4

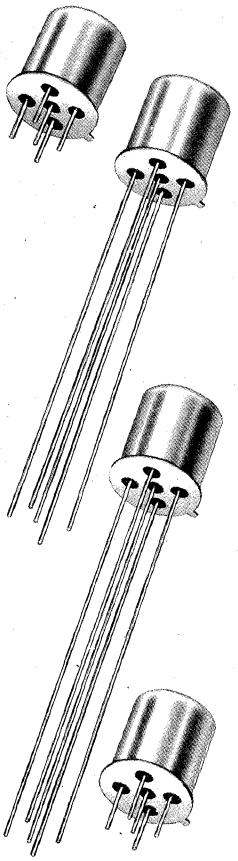
Failure Rate Levels
L, M, P.

These sensitive ultra-miniature SPDT relays in transistor-style case are available in **4 types:** basic relay; with diode coil suppression (D); with two diodes for coil suppression and polarity reversal protection (DD); with integral transistor driver and coil suppression (T).

Contacts: 1 Form C
Rating: 1 Amp
Sensitivity: 40 mW

Hi-G Military Relays

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/10	
Series (J)1MS: Sensitive TO-5 Case Relay, SPDT	M39016/10-017L, M, P	J1MSW-5XL, M, P
	-018L	J1MSP-5XL
	-019L	J1MSW-6XL
	-020L	J1MSP-6XL
	-021L	J1MSW-12XL
	-022L	J1MSP-12XL
	-023L	J1MSW-26XL
	-024L	J1MSP-26XL
	-025L	J1MSW-32XL
	-026L	J1MSP-32XL
	-027L	J1MSW-40XL
	-028L	J1MSP-40XL
	-029L	J1MSW-9XL
	-030L	J1MSP-9XL
	-031L	J1MSW-18XL
	-032L	J1MSP-18XL
	-033L	J1MSC-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSC-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS
	M39016/25	
	M39016/25-017L, M, P	J1MSWD-5XL, M, P
	-018L	-6XL
	-019L	-12XL
	-020L	-26XL
	-021L	-32XL
	-022L	-40XL
	-023L	-9XL
	-024L	-18XL
	-025L	J1MSPD-5XL
	-026L	-6XL
	-027L	-12XL
	-028L	-26XL
	-029L	-32XL
	-030L	-40XL
	-031L	-9XL
	-032L	-18XL
	-033L	J1MSCD-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSCD-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS

RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
Series (J)1MS Cont'd.	**M39016/26**	
	M39016/26-017L, M, P	J1MSWDD-5XL, M, P
	-018L	-6XL
	-019L	-12XL
	-020L	-26XL
	-021L	-32XL
	-022L	-40XL
	-023L	-9XL
	-024L	-18XL
	-025L	J1MSPDD-5XL
	-026L	-6XL
	-027L	-12XL
	-028L	-26XL
	-029L	-32XL
	-030L	-40XL
	-031L	-9XL
	-032L	-18XL
	-033L	J1MSCDD-5XL
	-034L	-6XL
	-035L	-12XL
	-036L	-26XL
	-037L	-32XL
	-038L	-40XL
	-039L	-9XL
	-040L	-18XL
	-041L	J1MSCDD-5XLS
	-042L	-6XLS
	-043L	-12XLS
	-044L	-26XLS
	-045L	-32XLS
	-046L	-40XLS
	-047L	-9XLS
	-048L	-18XLS
	M28776/4	
	M28776/4-017L, M, P	J1MSWT-5XL, M, P
	-018L	-6XL
	-019L	-9XL
	-020L	-12XL
	-021L	-18XL
	-022L	-26XL
	-023L	-32XL
	-024L	-40XL
	-025L	J1MSPT-5XL
	-026L	-6XL
	-027L	-9XL
	-028L	-12XL
	-029L	-18XL
	-030L	-26XL
	-031L	-32XL
	-032L	-40XL
	-033L	J1MSCT-5XL
	-034L	-6XL
	-035L	-9XL
	-036L	-12XL
	-037L	-18XL
	-038L	-26XL
	-039L	-32XL
	-040L	-40XL
	-041L	J1MSCT-5XLS
	-042L	-6XLS
	-043L	-9XLS
	-044L	-12XLS
	-045L	-18XLS
	-046L	-26XLS
	-047L	-32XLS
	-048L	-40XLS

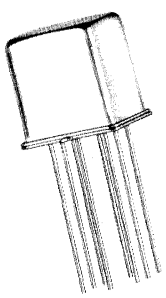
Series (J)MGA:
MINIGRID™ Relay, DPDT

QUALIFIED:
MIL-R-39016/17
MIL-R-39016/18
MIL-R-39016/19

Failure Rate Levels
L, M, P.

These ultra-miniature DPDT relays are hermetically sealed with .100 inch grid space terminals. These relays are available in **3 types:** basic relay; with diode suppression (D); and with two diodes for coil suppression and polarity reversal protection (DD).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 130 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/17	
M39016/17-025L, M, P	JMGAP-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGAC-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGAC-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW
M39016/18	
M39016/18-025L, M, P	JMGAPD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGACD-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW
M39016/19	
M39016/19-025L, M, P	JMGAPDD-5L, M, P
-026L	-6L
-027L	-9L
-028L	-12L
-029L	-18L
-030L	-26L
-031L	JMGACDD-5L
-032L	-6L
-033L	-9L
-034L	-12L
-035L	-18L
-036L	-26L
-037L	JMGACDD-5LW
-038L	-6LW
-039L	-9LW
-040L	-12LW
-041L	-18LW
-042L	-26LW

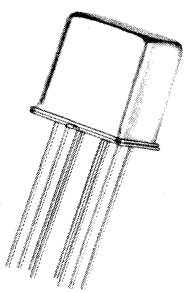
Series (J)MGS:
Sensitive MINIGRID™ Relay, DPDT

QUALIFIED:
MIL-R-39016/41
MIL-R-39016/42
MIL-R-39016/43

Failure Rate Levels
L, M, P.

These sensitive ultra-miniature DPDT relays, in hermetically-sealed cans with .100 inch grid spaced terminals, are available in **3 types:** basic relay; single-diode suppression (D); and with two diodes for coil suppression and polarity reversal protection (DD).

Contacts: 2 Form C
Rating: 1 Amp
Sensitivity: 60 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/41	
M39016/41-033L, M, P	JMGSC-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSP-5L
-042L	-6L
-043L	-12L
-044L	-26L
-045L	-36L
-046L	-48L
-047L	-9L
-048L	-18L
-049L	JMGSC-5LW
-050L	-6LW
-051L	-12LW
-052L	-26LW
-053L	-36LW
-054L	-48LW
-055L	-9LW
-056L	-18LW
M39016/42	
M39016/42-033L, M, P	JMGSCD-5L, M, P
-034L	-6L
-035L	-12L
-036L	-26L
-037L	-36L
-038L	-48L
-039L	-9L
-040L	-18L
-041L	JMGSPD-5L
-042L	-6L
-043L	-12L
-044L	-26L
-045L	-36L
-046L	-48L
-047L	-9L
-048L	-18L
-049L	JMGSCD-5LW
-050L	-6LW
-051L	-12LW
-052L	-26LW
-053L	-36LW
-054L	-48LW
-055L	-9LW
-056L	-18LW
M39016/43	
M39016/43-033L, M, P	JMGSCDD-5L, M, P
-034L	-6L
-035L	-9L
-036L	-12L
-037L	-18L
-038L	-26L
-039L	-36L
-040L	-48L
-041L	JMGSPDD-5L
-042L	-6L
-043L	-9L
-044L	-12L
-045L	-18L
-046L	-26L
-047L	-36L
-048L	-48L
-049L	JMGSCDD-5LW
-050L	-6LW
-051L	-9LW
-052L	-12LW
-053L	-18LW
-054L	-26LW
-055L	-36LW
-056L	-48LW

Hi-G Military Relays

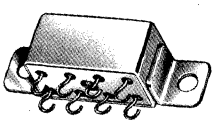
Series G:
1/5 Crystal Can Relay

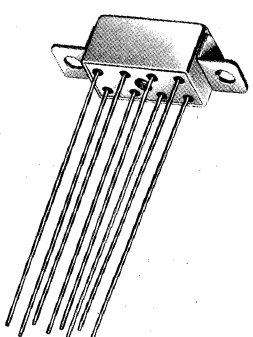
QUALIFIED:
MIL-R-39016/13

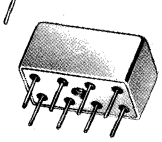
Failure Rate Levels
L, M, P.

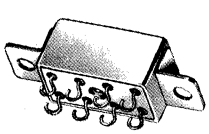
These 2-ampere, .150 grid, low-profile DPDT relays allow maximum packaging density under extreme environmental conditions. Relays are available in three terminal styles and in three enclosures.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 135 mW









RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/13	
Series G: 1/5 Crystal Can Relay	M39016/13-055L, M, P	J2G-4650-55L, M, P
	-056L	-56L
	-057L	-57L
	-058L	-58L
	-059L	-59L
	-060L	-60L
	-061L	-61L
	-062L	-62L
	-063L	-63L
	-064L	-64L
	-065L	-65L
	-066L	-66L
	-067L	-67L
	-068L	-68L
	-069L	-69L
	-070L	-70L
	-071L	-71L
	-072L	-72L
	-073L	-73L
	-074L	-74L
	-075L	-75L
	-076L	-76L
	-077L	-77L
	-078L	-78L
	-079L	-79L
	-080L	-80L
	-081L	-81L
	-082L	-82L
	-083L	-83L
	-084L	-84L
	-085L	-85L
	-086L	-86L
	-087L	-87L
	-088L	-88L
	-089L	-89L
	-090L	-90L
	-091L	-91L
	-092L	-92L
	-093L	-93L
	-094L	-94L
	-095L	-95L
	-096L	-96L
	-097L	-97L
	-098L	-98L
	-099L	-99L
	-100L	-100L
	-101L	-101L
	-102L	-102L
	-103L	-103L
	-104L	-104L
	-105L	-105L
	-106L	-106L
	-107L	-107L
	-108L	-108L
	-109L	-109L
	-110L	-110L
	-111L	-111L
	-112L	-112L
	-113L	-113L
	-114L	-114L
	-115L	-115L
	-116L	-116L
	-117L	-117L

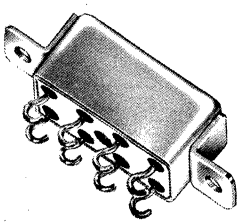
Series (J)2K-4730:
1/2 Crystal Can Relay

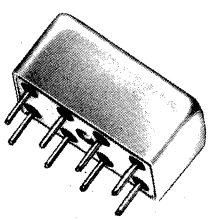
QUALIFIED:
MIL-R-39016/6

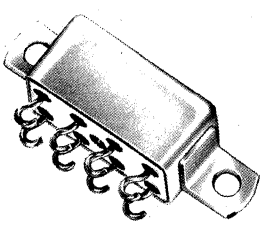
Failure Rate Levels
L, M, P.

This 1/2 size crystal can DPDT relay is available with solder lug, wire leads and pins for printed circuit board mounting. Four mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW







RELAY TYPE	MILITARY DESIGNATION	HI-G PART NO.
	M39016/6	
Series (J)2K-4730: 1/2 Crystal Can Relay	M39016/6-104L, M, P	J2K-4730-104L, M, P
	-105L	-105L
	-106L	-106L
	-107L	-107L
	-108L	-108L
	-109L	-109L
	-110L	-110L
	-111L	-111L
	-112L	-112L
	-113L	-113L
	-114L	-114L
	-115L	-115L
	-116L	-116L
	-117L	-117L
	-118L	-118L
	-119L	-119L
	-120L	-120L
	-121L	-121L
	-122L	-122L
	-123L	-123L
	-124L	-124L
	-125L	-125L
	-126L	-126L
	-127L	-127L

MILITARY DESIGNATION	HI-G PART NO.
M39016/6 (cont'd.)	
M39016/6-128L, M, P	J2K-4730-128L, M, P
-129L	-129L
-130L	-130L
-131L	-131L
-132L	-132L
-133L	-133L
-134L	-134L
-135L	-135L
-136L	-136L
-137L	-137L
-138L	-138L
-139L	-139L
-140L	-140L
-141L	-141L
-142L	-142L
-143L	-143L
-144L	-144L
-145L	-145L
-146L	-146L
-147L	-147L
-148L	-148L
-149L	-149L
-150L	-150L
-151L	-151L
-152L	-152L
-204L	-204L
-205L	-205L
-206L	-206L
-207L	-207L
-208L	-208L
-209L	-209L
-210L	-210L
-211L	-211L
-212L	-212L
-213L	-213L
-214L	-214L
-215L	-215L
-216L	-216L
-217L	-217L
-218L	-218L
-219L	-219L
-220L	-220L
-221L	-221L
-222L	-222L
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-224L	-224L
-225L	-225L
-226L	-226L
-227L	-227L
-228L	-228L
-229L	-229L
-230L	-230L
-231L	-231L
-232L	-232L
-233L	-233L
-234L	-234L
-235L	-235L
-236L	-236L
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-238L	-238L
-239L	-239L
-240L	-240L
-241L	-241L
-242L	-242L
-243L	-243L
-244L	-244L
-245L	-245L
-246L	-246L
-247L	-247L
-248L	-248L
-249L	-249L
-250L	-250L
-251L	-251L
-252L	-252L

Hi-G Military Relays

Series (J)2K-4940:

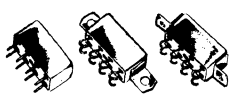
1/2 Crystal Can Relay Coil Transient Suppressed

QUALIFIED:
MIL-R-39016/22

Failure Rate Levels
L, M, P.

These DPDT transient suppressed relays are available with solder lugs, wire leads or pins for printed circuit board mounting. Three mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW



MILITARY DESIGNATION	HI-G PART NO.
M39016/22	
M39016/22-004L, M, P	J2K-4940-004L, M, P
-005L	-005L
-006L	-006L
-007L	-007L
-008L	-008L
-009L	-009L
-010L	-010L
-011L	-011L
-012L	-012L
-013L	-013L
-014L	-014L
-015L	-015L
-016L	-016L
-017L	-017L
-018L	-018L
-019L	-019L
-020L	-020L
-021L	-021L
-022L	-022L
-023L	-023L
-024L	-024L

Series 2B-1506:

Crystal Can Relay

QUALIFIED:
MIL-R-5757/10

These full size crystal can DPDT relays are available with solder lugs, wire leads or pins for printed circuit board mounting. Five mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 250 mW

MILITARY DESIGNATION	HI-G PART NO.
M5757/10	
M5757/10-015	2B-1506-15
-016	-16
-022	-22
-035	-35
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-043	-43
-044	-44
-052	-52
-053	-53
-054	-54
-056	-56

Series 2BC-1510:

Sensitive Crystal Can Relay

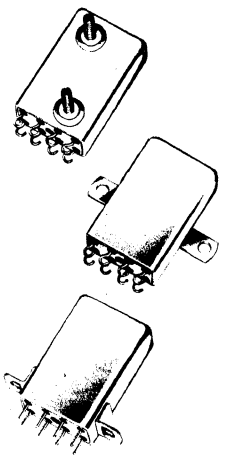
QUALIFIED:
MIL-R-5757/13

These sensitive full size crystal can DPDT relays are available with solder lugs, wire leads and pins for printed circuit board mounting. Four mounting styles are available.

Contacts: 2 Form C
Rating: 2 Amp
Sensitivity: 40 mW

MILITARY DESIGNATION	HI-G PART NO.
M5757/13	
M5757/13-011	2BC-1510-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-031	-31
-032	-32
-033	-33
-034	-34
-035	-35
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-041	-41
-042	-42
-043	-43
-044	-44
-045	-45

Series 2BC-1510
Cont'd.



MILITARY DESIGNATION	HI-G PART NO.
M5757/13 (cont'd.)	
-046	-46
-047	-47
-048	-48
-049	-49
-050	-50
-051	-51
-052	-52
-053	-53
-054	-54
-055	-55
-056	-56
-057	-57
-058	-58
-059	-59
-060	-60
-061	-61
-062	-62
-063	-63
-064	-64
-065	-65
-066	-66
-067	-67
-068	-68
-069	-69
-070	-70
-072	-72
-073	-73
-074	-74
-075	-75
-076	-76
-077	-77
-078	-78
-079	-79
-080	-80
-081	-81

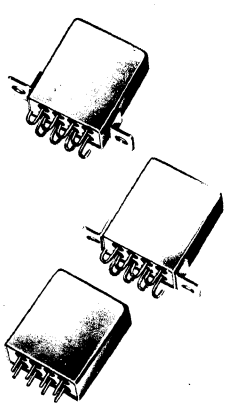
Series 2T-2911 and 2T-2994:

10 Amp Crystal Can Relay

QUALIFIED:
MIL-R-5757/23
MIL-R-5757/28

This 10-ampere full size crystal can DPDT relay is available with plug-in pins and solder lug terminals. Three mounting styles are available.

Contacts: 2 Form C
Rating: 10 Amp
Sensitivity: 500 mW



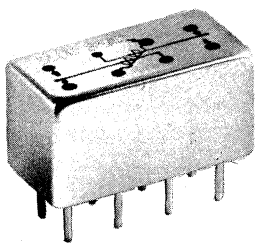
MILITARY DESIGNATION	HI-G PART NO.
M5757/23	
M5757/23-001	2T-2911-1
-002	-2
-003	-3
-004	-4
-005	-5
-006	-6
-007	-7
-008	-8
-009	-9
-010	-10
-011	-11
-012	-12
-013	-13
-014	-14
-015	-15
-016	-16
-017	-17
-018	-18
-019	-19
-020	-20
-026	-26
-027	-27
-028	-28
-029	-29
-030	-30
-031	-31
-032	-32
-033	-33
-034	-34
-036	-36
-037	-37
-038	-38
-039	-39
-040	-40
-041	-41
-042	-42
M5757/28	
M5757/28-001	2T-2994-1

Hi-G Commercial and Computer Relays

The advantages of the hermetically-sealed relay are also available for commercial and computer applications. These versatile, high-quality relays operate reliably under extreme environmental conditions, because they incorporate military design technology.

Series FS2:
Flagship™ 2-Ampere Relay

Versatile hermetically-sealed commercial DPDT relay, with 2 form C contacts, switches up to 60 W/100 VA, 2 amperes, maximum. Sensitivity is 350 mW.



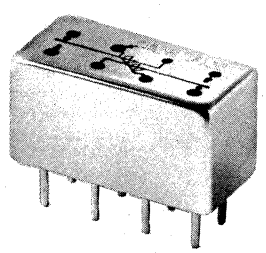
Operate Time: 4 ms max. at nominal coil voltage at 25°C.
Release Time: 4 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

COILS
Resistance: Standard available to 3500 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 350 milliwatts at 25°C.
Nominal Power Consumption: 660 milliwatts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.7	4.4	8.7	17.5	26.0	35.0
DROP-OUT VOLTAGE (MIN.)	0.3	0.3	0.7	1.4	2.2	2.9
COIL RESISTANCE (OHMS)	39	55	220	870	1960	3480

Series FS3:
Flagship™ Sensitive 2-Amp Relay

This sensitive 150 mW hermetically-sealed DPDT relay has 2 form C contacts and switches up to 60 W/100 VA at 2 amperes, maximum.



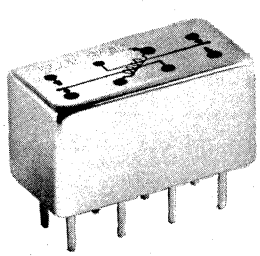
Operate Time: 6 ms max. at nominal coil voltage at 25°C.
Release Time: 4 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

COILS
Resistance: Standard available to 8300 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 350 milliwatts at 25°C.
Nominal Power Consumption: 280 milliwatts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.7	4.4	8.7	17.5	26.0	35.0
DROP-OUT VOLTAGE (MIN.)	0.25	0.3	0.7	1.4	2.2	2.9
COIL RESISTANCE (OHMS)	90	130	520	2070	4550	8300

Series FS5:
Flagship™ 5-Ampere Relay

This 5-ampere DPDT relay has 2 form C contacts and switches up to 150 W/300 VA, 5 amperes, maximum. Sensitivity is 725 mW.



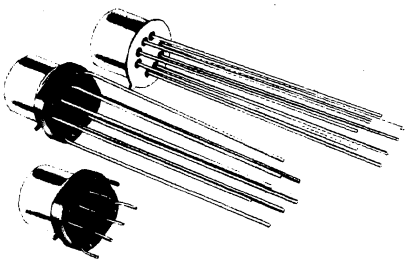
Operate Time: 5 ms max. at nominal coil voltage at 25°C.
Release Time: 3 ms max. at nominal coil voltage at 25°C.
Capacitance: Between contacts 2.5 pF.
Dielectric Strength: Between all other mutually insulated points 500 Vrms.
Insulation Resistance: 500 Megohms min.

COILS
Resistance: Standard available to 1600 ohms. Standard tolerance ±10%. Other resistances and tolerances available.
Operate Power: 725 milliwatts at 25°C.
Nominal Power Consumption: 1.4 Watts at 25°C.

VOLTAGE CODE	105	106	112	124	136	148
NOMINAL COIL VOLTAGE	5	6	12	24	36	48
MAX. CONTINUOUS VOLTAGE	6	7	14	29	43	57
PICK-UP VOLTAGE (MAX.)	3.6	4.3	8.5	17.0	26.0	34.0
DROP-OUT VOLTAGE (MIN.)	0.25	0.3	0.7	1.4	2.2	2.8
COIL RESISTANCE (OHMS)	18	25	100	400	900	1600

Series CA:
Commercial TO-5 Case Relay

These sensitive 185 mW 1-ampere TO-5 case DPDT relays, with 2 form C contacts, are available in 3 types: basic relay; with coil-suppression diode (D); and with integral transistor driver and coil-suppression diode (T).



Coil Data: Standard coil resistance available to 1,560 ohms. Design tolerance ±10%.

Contact Resistance: 200 milliohms max., initial.

Operate Time: 4.0 milliseconds max.

Release Time: 3.0 milliseconds max. basic. 6.0 milliseconds max. suppressed. 6.0 milliseconds max. transistor.

Dielectric Strength: 350 Vrms, 60 Hz, all points at sea level except between transistor terminals.

Insulation Resistance: 1,000 megohms min., all points at 500 Vdc.

Contact Capacitance: 0.7 pF typical, between contacts.

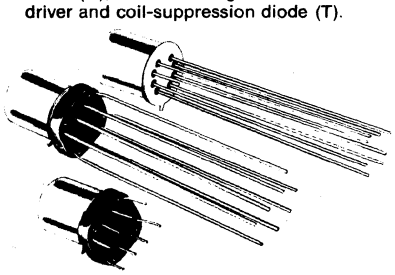
Series: CAW, CAWD, CAWT

Coil Voltage Code	Nominal Coil Voltage (Vdc)	Coil Resistance (ohms) ±10% @25°C	Pick-Up† (Vdc) Max. @25°C	Base Current to†† Turn-on (mAdc) (CAWT only)
-5	5	50	3.6	3.0
-6	6	100	4.2	2.04
-9	9	200	6.5	1.36
-12	12	390	8.4	1.03
-18	18	880	13.0	0.68
-26	26	1560	17.0	0.50

†CAWT — Not Applicable
††Limit Base/Emitter Current to 50 mA max.

Series CS:
Commercial Sensitive TO-5 Case Relay

These ultrasensitive 90 mW 1-ampere DPDT transistor-case relays, with 2 form C contacts, are available in 3 types: basic relay; with coil-suppression diode (D); and with integral transistor driver and coil-suppression diode (T).



Coil Data: Standard coil resistance available to 11,000 ohms. Design tolerance ±10%.

Contact Resistance: 200 milliohms max., initial.

Operate Time: 6.0 milliseconds max.

Release Time: 3.0 milliseconds max. basic. 7.5 milliseconds max. suppressed. 7.5 milliseconds max. transistor.

Dielectric Strength: 250 Vrms, 60 Hz, all points at sea level except between transistor terminals.

Insulation Resistance: 1,000 megohms min., all points at 500 Vdc.

Contact Capacitance: 0.7 pF typical, between contacts.

Series: CSW, CSWD, CSWT

Coil Voltage Code	Nominal Coil Voltage (Vdc)	Coil Resistance (ohms) ±10% @25°C	Pick-Up† (Vdc) Max. @25°C	Base Current to†† Turn-on (mAdc) (CSWT only)
-5	5.0	100	3.6	1.5
-6	6.0	200	4.2	1.00
-9	9.0	400	6.5	0.75
-12	12.0	850	8.4	0.47
-18	18.0	1600	13.0	0.36
-26	26.5	3300	17.0	0.24
-36	36.0	6500	24.0	†††
-48	48.0	11000	32.0	†††

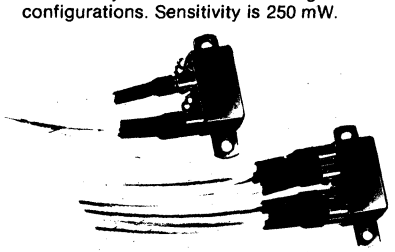
†CSWT — Not Applicable
††Limit Base/Emitter Current to 50 mA max.
†††Consult Factory

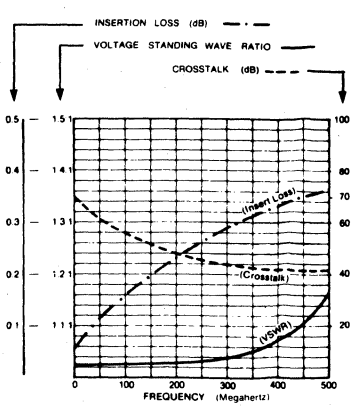
Hi-G Radio Frequency Relays

Coaxially terminated and hermetically sealed, these 0-500 MHz relays incorporate a relay design to provide reliable switching functions in the most demanding RF applications. Thousands of testing hours and millions of field operations assure the highest degree of reliability. Two-pole devices are available with either one or both sets of poles cabled. When only one set of poles is cabled, the other set is available for use with pin or hook termination.

Series RFK:
75 Watt 1/2 Crystal Can RF Relay

Coaxially-terminated, hermetically-sealed 0 to 500 MHz relays can carry 200 RF watts with low-level to 2 amperes auxiliary switching capability. These relays are available with two terminal styles and three mounting configurations. Sensitivity is 250 mW.





NOTE: Values shown are in a 50 ohm impedance coaxial system.

Voltage Code	106	112	126
Nominal Coil Voltage	6	12	26.5
Max. Continuous Coil Voltage	7.2	14.4	32.0
Max. Pick-up Voltage @ +25°C	3.3	6.5	13.5
Min. Drop-out Voltage @ +25°C	0.3	0.7	1.5
Effective DC Coil Resistance @ +25°C ohms	40	150	675

Hi-G Electronics Division

TIMING & SENSING DEVICES SOLID STATE RELAYS POWER MONITORS

PRODUCT LINES MILITARY/INDUSTRIAL

- Time Delay, Relay Output
- Time Delay, Solid State Output
- Flashers, Relay & Solid State
- Interval Timers
- Solid State Relays
- Custom Electronic Modules
- Power Monitor
- Voltage Sensor (AC & DC)
- Frequency Sensor
- Phase Sensor
- Current Sensor
- Liquid Level Sensor
- Custom Hybrids

QPL CROSS REFERENCE

SOLID STATE RELAYS

JTS5-1	M278750/5
JTS6-1	M278750/6
JTS7-1	M278750/7
JDS8-1	M278750/8
JDS9-1	M278750/9
JPS10-1	M278750/10

TIME DELAYS

6001	M83726/13
6600	M83726/7
6700	M83726/8
6800	M83726/24
6900	M83726/25

SPECIFICATIONS

TYPICAL ELECTRICAL

Input Voltage:	18-31 Vdc, 120/208 Vac
Timing:	50 msec to 600 sec
Timing Tolerance:	+/−10%
Contact Rating:	Dry circuit to 25 Amps
Voltage Sensing:	10-150 Vdc, 50-150 Vac
Frequency Sensing:	50, 60, 400 Hz

TYPICAL ENVIRONMENTAL

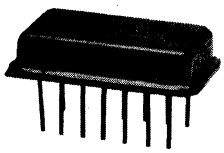
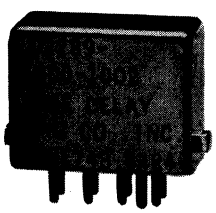
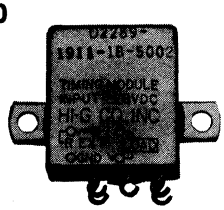
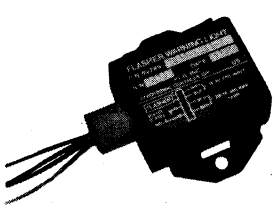
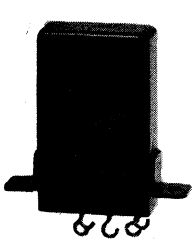
Temperature:	−55C to +85C, 125C
Vibration:	20g's, 10 to 2000 Hz
Shock:	50g's, 11+/−1 msec
Dielectric:	1000 Vrms 60 Hz
Sealing:	Hermetic 1.3 in hg
Life:	100,000 operations

PACKAGING

Hi-G offers P.C. board mount, stud mount, bracket mount, plug in headers, solder hook, connector, etc. Custom packages available. Contact factory.

Hi-G Electronics Division

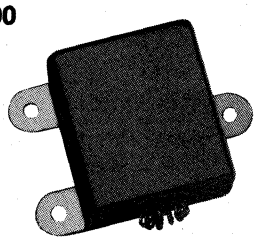
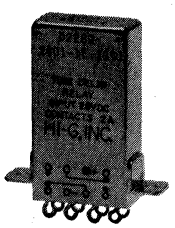
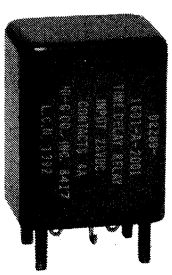
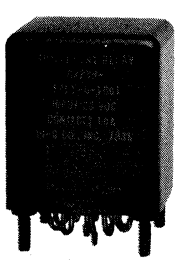
TIME DELAYS WITH SOLID STATE OUTPUT

Series	Function	Input	Output	Technology
6001  **6150**	Delay on Make Fixed	18 Vdc to 31 Vdc	300 mA SPNO SCR to ground	CMOS Digital Hybrid
6800  **6900**	Delay on Make Fixed Delay on Release	20 Vdc to 32 Vdc	150mA SPNO Transistor to B+	CMOS Digital Hybrid
1800  **1900**	Fixed Delay on Make Adjustable	18 Vdc to 31 Vdc	300mA SPNO SCR to ground	CMOS Digital Hybrid
2600 	Flasher Repeat Cycle Fixed	18 Vdc to 31 Vdc	100mA SPNO Transistor to B+ Relay Output available	CMOS Digital Discrete
4800 	Interval Fixed	18 Vdc to 31 Vdc	300mA SPNO Transistor to ground	Analog Discrete

Consult factory for: Custom Electronic Modules

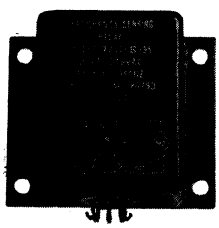
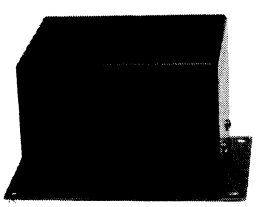
Hi-G Electronics Division

TIME DELAYS WITH RELAY OUTPUT

Series	Function	Input	Output	Technology
6600  **6700**	Delay on Make Fixed Delay on Release	18 Vdc to 31 Vdc	2 Amps DPDT	CMOS Hybrid Digital
2400 	Delay on Make Fixed	18 Vdc to 31 Vdc	2 Amps DPDT	CMOS Digital Hybrid
1600  **1700**	Fixed Delay on Make Adjustable	18/31 Vdc 115 Vac 60Hz/400Hz	4 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete
5600  **5700**	Fixed Delay on Release Adjustable	18 Vdc to 31 Vdc	2 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete
4600 **4700**	Fixed Interval Adjustable	18/31 Vdc 115 Vac 60Hz/400Hz	4 Amps to 10 Amps SPDT to 4DPT	CMOS Digital Discrete
Consult factory for: Custom Time Delay Relay				

Hi-G Electronics Division

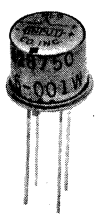
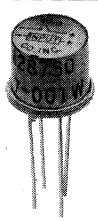
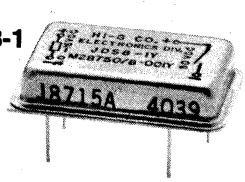
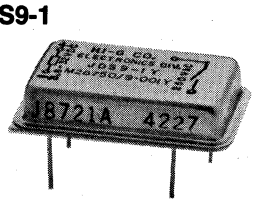
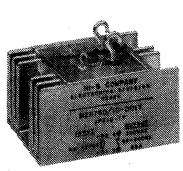
POWER MONITOR, VOLTAGE, PHASE, FREQUENCY, SENSORS

Series	Function	Input Range	Output	Sensing
1310 **1350**	DC Under/Over Voltage Sensors AC	10 Volts to 150 Volts Single phase or 3 phase	2 Amps DPDT	±2½% of set point or less
1400	Phase Sensor	115/208 Line to Line 60Hz/400Hz	2 Amps DPDT	Phase loss or reversal
7000 	Frequency Sensor	95 Vac to 135 Vac Single phase or 3 phase	4 Amps SPDT or DPDT	320/480Hz ±2% of set point 50/60Hz Available
9000 Power Monitor 	AC Under/Over Voltage	80/140 Vac 3 Phase 60/400Hz	1 Amp DPDT Bit test	±1% of set point ±3% field adjustable
	Phase Rotation	80/140 Vac 60/400Hz	1 Amp DPDT Bit test	Phase loss Reversal or missing neutral
	Under/Over Frequency	80/140 Vac 3 Phase 60/400Hz	1 Amp DPDT Bit test	40/480Hz ±1% of set point ±3% field Adjustable

Consult factory for: Custom Voltage, Phase, Frequency, Current Sensors

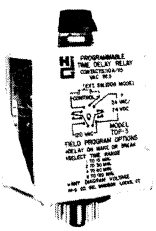
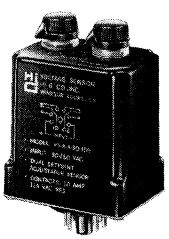
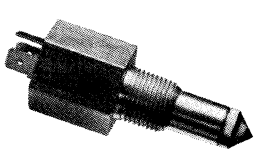
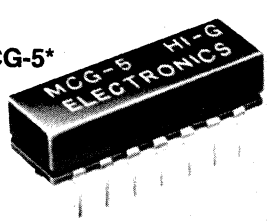
Hi-G Electronics Division

SOLID STATE RELAYS

Series	Function	Input	Output	Technologies
JTS5-1	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	40 Vac/dc 50 mA SPNO	Transformer isolation 1000 Volts P-P
JTS6-1 	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	40 Vdc 250 mA SPNO	Transformer isolation 1000 Volts P-P
JTS7-1 	Solid State Switch	4.0 Vdc to 7.0 Vdc TTL Compatible	250 Vdc 100 mA SPNO	Transformer isolation 1000 Volts P-P
JDS8-1 	Solid State Switch	3.0 Vdc to 16.0 Vdc	50 Vdc 600 mA SPNO	Optical isolation 100 Vrms
JDS9-1 	Solid State Switch	3.8 Vdc to 32 Vdc	250 Vac 40-440Hz 1 Amps heat sink 2 Amps SPNO	Optical isolation 1500 Vrms
JPS10-1 	Solid State Switch	4 Vdc to 32 Vdc	250 Vac 45-440Hz 25 Amps SPNO	Optical isolation 1500 Vrms
Consult factory for: Custom SSR's and Switches				

Hi-G Electronics Division

INDUSTRIAL TIMERS, SENSORS, LIQUID LEVEL

Series	Description	Input	Output	Function
TDP 	Multi-programmable Delay on Make Release Timing Adjustable	12Vdc 24Vdc 24Vac 120Vac 240Vac	10 Amp DPDT	.3 to 10 sec 3 to 80 sec 10 to 300 sec 1 to 15 min 2 to 30 min 4 to 60 min 8 to 120 min
VS 	AC/DC Voltage Sensor Under/Over	18-30 Volts 35-60 Volts 90-150 Volts	10 Amps DPDT	Adjustable Delay time 1 sec Repeatibility +1%
PS	Phase Sensor	115/220 Line/line 60/400Hz	2 Amps SPDT	Phase loss Reversal Shorted Missing
LQD 	Liquid Level Sensor	12 Vdc 24 Vdc	200mA or 1 Amp normally open or normally closed	Solid State Switch to Ground Transistor
MCG-5* 	Power on reset 500 msec Fixed	5 Vdc TTL Compatible	20mA sink current for 500 MS	Solid State Switch to Ground Transistor

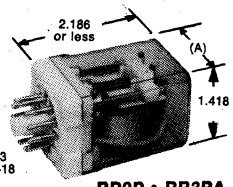
***Also available in: Hermetic Military Dip Package**

idec

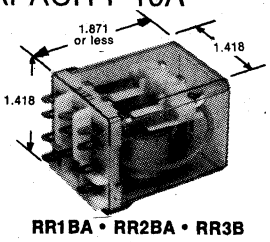
GENERAL PURPOSE RELAY/SOCKETS

RR SERIES

POWER TYPE LARGE CAPACITY-10A 1, 2, AND 3 POLES



RR2P • RR3PA



RR1BA • RR2BA • RR3B

FEATURES

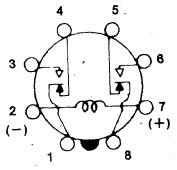
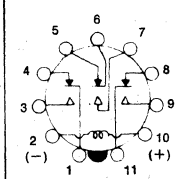
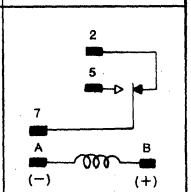
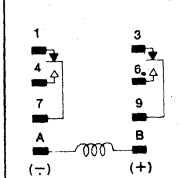
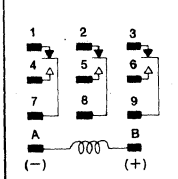
- Contact mechanism secured directly to molded resin base, eliminates the intermediate plate.
- Simple construction.
- UL recognized and CSA certified.
- Available with check button for test operation and indicator lights.
- Complete line of sockets and socket accessories available for flexible application.

SPECIFICATIONS

Contact Material: Silver (AG)
Contact Resistance: 30mΩ maximum (initial value)
Operate Time: 25ms maximum
Release Time: 25ms maximum
Power Consumption: AC: Approx. 3VA (50Hz), 2.5VA (60Hz); DC: Approx. 1.5W
Insulation Resistance: 100MΩ minimum (measured w/500 DC megger)
Dielectric Strength:
Pin Type (RR2P, RR3PA)
Bet. live and non-live parts: 1,500V AC, 1 minute
Bet. contact circuits and operating coil: 1,500V AC, 1 minute
Bet. contact circuits: 1,500V AC, 1 minute
(1,000V AC bet. NO-NC contacts)
Blade Type (RR1BA, RR2BA, RR3B)
Bet. live and non-live parts: 2,000V AC, 1 minute
Bet. contact circuit and operating coil: 2,000V AC, 1 minute
Bet. contact circuits: 2,000V AC, 1 minute
Bet. contacts of same polarity: 1,000V AC, 1 minute
Frequency Response: 1,800 operations/hour
Temperature Rise: Coil: 153°F (85°C) max. Contact: 117°F (65°C) max.
Vibration Resistance: 0 to 6g (55Hz maximum)
Shock Resistance: 10g minimum
Life Expectancy:
Electrical: Over 500,000 operations (120V, 50/60Hz, 10A)
Mechanical: Over 10,000,000 operations
Operating Temperature: −22°F to +158°F (−30°C to +70°C)

TYPES OF RR SERIES

Terminal Style	Contact Config.	Basic Type	with Indicator Light	with Check Button
P,PA (Pin)	DPDT	RR2P-U	RR2P-UL	RR2P-UC
	3PDT	RR3PA-U	RR3PA-UL	RR3P-UC
B,BA (Blade)	SPDT	RR1BA-U	RR1BA-UL	RR1BA-UC
	DPDT	RR2BA-U	RR2BA-UL	RR2BA-UC
	3PDT	RR3B-U	RR3B-UL	RR3B-UC

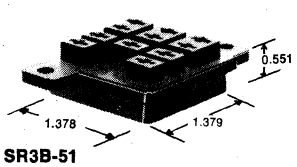
Type	Coil Input	Coil Resist Ohms	Coil Nom. Power Approx.	Contact Arrangement	Contact Amps (Max.)	Circuit Diagram
RR2P	6VAC	4.6	2.5VA	DPDT	10A	
	12VAC	20				
	24VAC	80				
	120VAC	2200				
	240VAC	8930				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8450				
RR3PA	6VAC	4.6	2.5VA	3PDT	10A	
	12VAC	20				
	24VAC	80				
	120VAC	2200				
	240VAC	8930				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8450				
RR1BA	6VAC	4.6	2.5VA	SPDT	10A	
	12VAC	20				
	24VAC	80				
	120VAC	2200				
	240VAC	8930				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8450				
RR2BA	6VAC	4.6	2.5VA	DPDT	10A	
	12VAC	20				
	24VAC	80				
	120VAC	2200				
	240VAC	8930				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8450				
RR3B	6VAC	4.6	2.5VA	3PDT	10A	
	12VAC	20				
	24VAC	80				
	120VAC	2200				
	240VAC	8930				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8450				

Note:
- Options: Light Emitting Diode (LED) Check Button and Neon; Neon; Check Button
- LED suited for 120VAC and less. Neon suited for greater than 120VAC

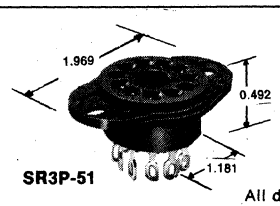
SOCKETS FOR RR SERIES

Relay	Socket No.
RR2P	SR2P-05 (DIN Rail Mount)
	SR2P-06 (DIN Rail Mount)
	SR2P-51 (Panel Mount)
RR3PA	SR3P-05 (DIN Rail Mount)
	SR3P-06 (DIN Rail Mount)
	SR3P-51 (Panel Mount)
RR1BA, RR2BA, RR3B	SR3B-02 (Surface Mount)
	SR3B-05 (DIN Rail Mount)
	SR3B-51 (Panel Mount)

Accessories	
BND-1000	(DIN Rail)
BNL-5	(End Clip)

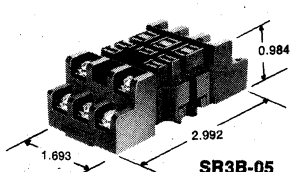


SR3B-51

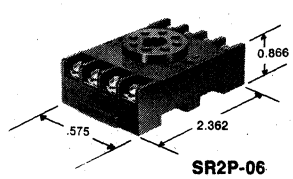


SR3P-51

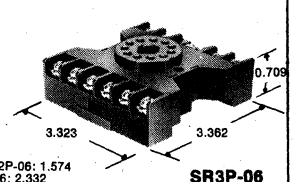
All dimensions in inches.



SR3B-05



SR2P-06



(B) SR2P-06: 1.574
SR3P-06: 2.332

SR3P-06

COMPLETE CATALOG INFORMATION: 800-538-8157, Ext. 844 (Outside CA) / 800-672-3470, Ext. 844 (In CA)
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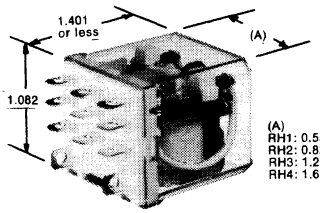
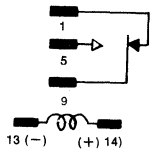
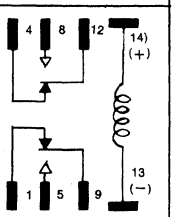
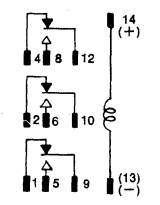
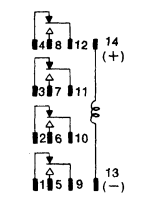
idec MIDGET POWER/GENERAL PURPOSE RELAYS

RH SERIES
MIDGET POWER TYPE LARGE CAPACITY-10A 1, 2, 3, AND 4 POLES



FEATURES
- Miniature size package allows compact system designing.
- 10 amp contact capacity.
- Dielectric strength — up to 2,000 volts.
- UL recognized and CSA certified.
- Indicator light or check button available on 2, 3 and 4-pole models.
- Complete accessories include IDEC's broad line of sockets, hold-down springs and mounting rails.

SPECIFICATIONS
Contact Material: Silver cadmium oxide (Ag-CdO)
Contact Resistance: 50 mΩ max. (initial value)
Operate Time: SPDT(RH1), DPDT(RH2) — 20 msec max., 3PDT(RH3), 4PDT(RH4) — 25 msec max.
Release Time: SPDT(RH1), DPDT(RH2) — 20 msec max., 3PDT(RH3), 4PDT(RH4) — 25 msec max.
Power Consumption (Approx.):
SPDT(RH1) — AC: 1.1 VA (50 Hz), 1 VA (60 Hz), DC: 0.8W
DPDT(RH2) — AC: 1.4 VA (50 Hz, 1.2 VA 60 Hz), DC: 0.9W
3PDT(RH3) — AC: 2 VA (50 Hz), 1.7 VA (60 Hz), DC: 1.5W
4PDT(RH4) — AC: 2.5 VA (50 Hz, 2 VA (60 Hz), DC: 1.5W
Insulation Resistance: 100 MΩ min. (measured at 500V DC megger)
Dielectric Strength:
SPDT(RH1)
Between live and non-live parts: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contacts of the same pole: 1000V AC, 1 minute
DPDT(RH2), 3PDT(RH3), 4PDT(RH4)
Between live and non-live parts: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contact circuit and operating coil: 2000V AC, 1 minute
Between contact circuits: 1500V AC, 1 minute
Between contacts of the same pole: 1000V AC, 1 minute
Frequency Response: 1800 operations/hour
Temperature Rise: Coil: 85 deg. max., Contact: 65 deg. max.
Vibration Resistance: 0 to 6g (55 Hz max.)
Shock Resistance: SPDT(RH1), DPDT(RH2) — 20g, 3PDT (RH3) 4PDT(RH4) — 10g
Operating Temperature: −22° to +158°F (−30°C to +70°C)
Weight (Approx:): RH1: 24g, RH2: 37g, RH3: 50g, RH4: 74g
Life Expectancy:
Electrical: 500,000 operations or more (120V AC, 10A)*
Mechanical: 50,000,000 operations or more
Note*: 200,000 operations or more (120V AC, 10A) in SPDT(RH1), 3PDT(RH3), 4PDT(RH4) Types.

Type	Coil: Input	Coil: Resist Ohms	Coil: Nom. Power Approx.	Contact: Arrangement	Contact: Amps (Max.)	Circuit Diagram
RH1	6VAC	18.8	1VA	SPDT	10A	
	12VAC	76.8				
	24VAC	300				
	120VAC	7680				
	6VDC	47	0.8W			
	12VDC	188				
	24VDC	750				
	48VDC	2600				
	110VDC	13800				
RH2	6VAC	9.6	1.2VA	DPDT	10A	
	12VAC	40.5				
	24VAC	156.7				
	120VAC	4280				
	240VAC	15720				
	6VDC	40	0.9W			
	12VDC	60				
	24VDC	650				
	48VDC	2600				
	110VDC	12100				
RH3	6VAC	6.0	1.7VA	3PDT	10A	
	12VAC	25.3				
	24VAC	103				
	120VAC	2770				
	240VAC	12110				
	6VDC	25	1.5W			
	12VDC	100				
	24VDC	400				
	48VDC	1600				
	110VDC	8600				
RH4	6VAC	5.4	2VA	4PDT	10A	
	12VAC	21.2				
	24VAC	84.5				
	120VAC	2220				
	240VAC	9120				
	6VDC	24	1.5W			
	12VDC	96				
	24VDC	388				
	48VDC	1550				
	110VDC	7340				

Note: • Options : Light Emitting Diode (LED); Check Button and Neon; Check Button
• LED suited for 120VAC and less. Neon suited for greater than 120VAC

TYPES OF RH SERIES

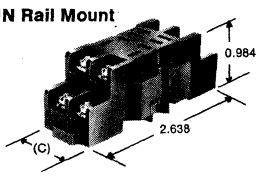
Terminal Style	Contact Config.	Basic Type	with Indicator Light	with Check Button	Top Bracket Mntg. Type
B (Blade)	SPDT	RH1B-U	—	—	RH1B-UT
	DPDT	RH2B-U	RH2B-UL	RH2B-UC	RH2B-UT
	3PDT	RH3B-U	RH3B-UL	RH3B-UC	—
	4PDT	RH4B-U	RH4B-UL	RH4B-UC	RH4B-UT
V2 (PCB)*	SPDT	RH1V2-U	—	—	—
	DPDT	RH2V2-U	RH2V2-UL	RH2V2-UC	—
	3PDT	RH3V2-U	RH3V2-UL	RH3V2-UC	—
	4PDT	RH4V2-U	RH4V2-UL	RH4V2-UC	—

Note*: 2mm (0.078) wide

SOCKETS FOR RH SERIES

Relay	Socket No.
RH1B	SH1B-05 (DIN Rail Mount) SH1B-51 (Panel Mount) SH1B-62 (PC Mount)
RH2B	SH2B-02 (Surface Mount) SH2B-05 (DIN Rail Mount) SH2B-51 (Panel Mount) SH2B-62 (PC Mount)
RH3B	SH3B-05 (DIN Rail Mount) SH3B-51 (Panel Mount) SH3B-62 (PC Mount)
RH4B	SH4B-05 (DIN Rail Mount) SH4B-51 (Panel Mount) SH4B-62 (PC Mount)
Accessories	
BND-1000	(DIN Rail)
BNL-5	(End Clip)

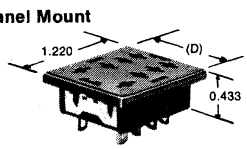
DIN Rail Mount



SH2B-05

(C)
SH1B-05: 0.787
SH2B-05: 1.181
SH3B-05: 1.575
SH4B-05: 1.968

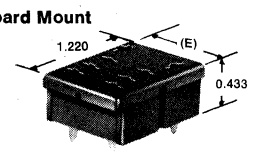
Panel Mount



SH2B-51

(D)
SH1B-51: 0.709
SH2B-51: 1.063
SH3B-51: 1.417
SH4B-51: 1.771

PC Board Mount



SH2B-62

(E)
SH1B-62: 0.709
SH2B-61: 0.835
SH3B-61: 1.447
SH4B-62: 1.772

All dimensions in inches

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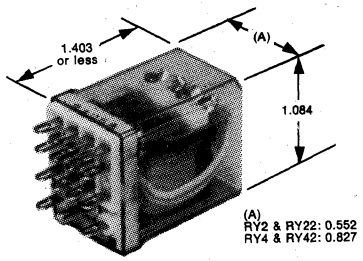
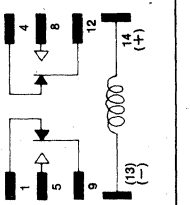
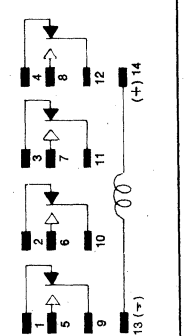
MINIATURE GENERAL PURPOSE RELAYS/SOCKETS

RY SERIES
3A RATING—2 AND 4 POLES
TWIN CONTACT ALSO AVAILABLE



FEATURES
- Available with check button for test operation and indicator lights (on 4PDT only).
- For dry circuit applications, bifurcated crossbar contacts available on both 2 and 4-pole models (contact material Ag-Pd alloy).
- Simple construction using the least possible number of components.
- UL recognized and CSA certified models.
- Complete line of sockets and socket accessories for flexible application.

SPECIFICATIONS
Contact Material: RY2, RY4: Fine Silver (Gold Plated)
RY22, RY42: Ag-Pd alloy
RY2, RY4 50 mΩ max.
Contact Resistance: RY22, RY42: 100 mΩ maximum
(Initial Value)
Operate Time: 20 ms maximum
Release Time: 20 ms maximum
Power Consumption:
RY2, RY22/AC: Approx. 1.1VA (50 Hz), 1 VA (60 Hz),
DC: Approx. 0.8W
RY4, RY42/AC: Approx: 1.4 VA (50 Hz), 1.2 VA (60 Hz),
DC: Approx. 0.9W
Insulation Resistance: 100 MΩ minimum (measured with 500V DC megger)
Dielectric Strength:
Between live and dead parts: 1500V AC, 1 minute
Between contact circuit and operating coil: 1000V AC 1 minute
Between contact circuits: 1000V AC, 1 minute
Between NO-NC contact: 700V
Frequency Response: 1800 operations/hour
Temperature Rise: Coil: 153°F (85°C) maximum; 117°F (65°C) maximum
Vibration Resistance: 0 to 6g (55 Hz maximum)
Shock Resistance: RY2, RY22: 10g minimum
RY4, RY42: 20g minimum
Life Expectancy:
RY2, RY4: Electrical: Over 200,000 operations (120V AC, 3A)
Mechanical: Over 50,000,000 operations
RY22, RY42: Electrical: Over 200,000 operations (120V AC, 1A)
Mechanical: Over 50,000,000 operations
Operating Temperature: −22° to +158°F (−30° to +70°C)

Type	Coil Input	Coil Resist Ohms	Coil Nom. Power Apprx.	Contact Arrangement	Contact Amps (Max.)	Circuit Diagram
RY2	6VAC	18.8	1VA	DPDT	3A	
	12VAC	76.8				
	24VAC	300				
	120VAC	7680				
	6VDC	47	0.8W			
	12VDC	188				
	24VDC	750				
	48VDC	2660				
*RY22	6VAC	18.8	1VA	DPDT	3A	
	12VAC	76.8				
	24VAC	300				
	120VAC	7680				
	6VDC	47	0.8W			
	12VDC	188				
	24VDC	750				
	48VDC	2660				
RY4	6VAC	9.6	1.2VA	4PDT	3A	
	12VAC	40.5				
	24VAC	156.7				
	120VAC	4280				
	240VAC	15720				
	6VDC	40	0.9W			
	12VDC	160				
	24VDC	650				
	48VDC	2600				
	110VDC	12100				
*RY42	6VAC	9.6	1.2VA	4PDT	3A	
	12VAC	40.5				
	24VAC	156.7				
	120VAC	4280				
	240VAC	15720				
	6VDC	40	0.9W			
	12VDC	160				
	24VDC	650				
	48VDC	2600				
	110VDC	12100				

Note: • Options: Light Emitting Diode (LED); Check Button and Neon; Check Button
• LED suited for 120VAC and less. Neon suited for greater than 120VAC
* UL Pending; Not CSA Certified

TYPES OF RY SERIES

Terminal Style	Contact Config.	Basic Type	with Indicator Light	with Check Button	Top Bracket Mntg. Type
S (Solder)	DPDT	RY2S-U	—	—	RY2S-UT
	DPDT*	RY22S	—	—	RY22S-T
	4PDT	RY4S-U	RY4S-UL	RY4S-UC	RY4S-UT
	4PDT*	RY42S	RY42S-L	RY42S-C	RY42-T
V (PCB)**	DPDT	RY2V-U	—	—	—
	DPDT	RY22V	—	—	—
	4PDT	RY4V-U	RY4V-UL	RY4V-UC	—
	4PDT*	RY42V	RY42V-L	RY42V-C	—
V1 (PCB)***	4PDT	RY4V1-CSA	RY4V1-L	RY4V1-C	—
W (Wrapping)	4PDT	RY4W-CSA	—	—	RY4W-T

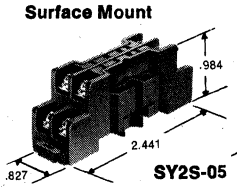
Note: *Twin contact **0.8mm (0.032) wide ***1.5mm (.060) wide

SOCKETS FOR RY SERIES

Relay	Socket No.
RY2S RY22S	SY2S-05 (DIN Rail Mount) SY2S-51 (Panel Mount) SY2S-61 (PC Mount)
RY4S RY42S	SY4S-02 (Surface Mount) SY4S-05 (DIN Rail Mount) SY4S-51 (Panel Mount) SY4S-61 (PC Mount)

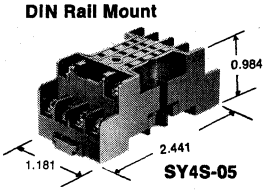
Accessories	
BND-1000	(DIN Rail)
BNL-5	(End Clip)

Surface Mount



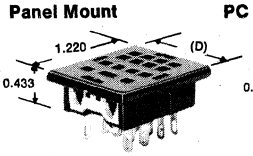
SY2S-05

DIN Rail Mount



SY4S-05

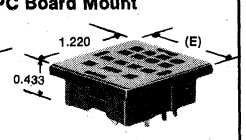
Panel Mount



SY4S-51

(D) SY2S-51: 0.709
SY4S-51: 1.063

PC Board Mount



SY4S-61

(E) SY2S-61: 0.709
SY4S-61: 1.063

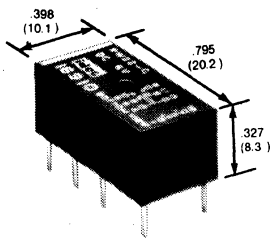
COMPLETE CATALOG INFORMATION: 800-538-8157, Ext. 844 (Outside CA) / 800-672-3470, Ext. 844 (In CA)
PRICING & DELIVERY: 800-262-IDEC • CORPORATE ADDRESS: 1213 ELKO DRIVE, SUNNYVALE, CA 94089-2211

idec

P.C. TYPE RELAYS

RW SERIES

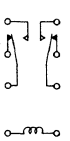
HIGHLY SENSITIVE 200mW POWER CONSUMPTION
10μA TO 2A CONTACT CAPACITY, DPDT
MEETS 1,500V FCC SURGE REQUIREMENTS
EPOXY SEALED PACKAGE



SPECIFICATIONS

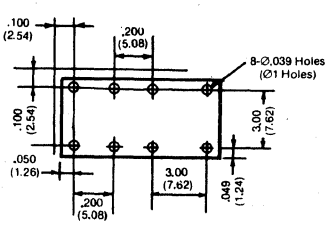
Contact Material: Silver (Gold-Clad)
Contact Resistance: 50mΩ maximum (initial value)
Operate Time: 5msec maximum (at the rated voltage)
Release Time: 5msec maximum (at the rated voltage)
Bounce Time: 5msec maximum
Insulation Resistance: 1,000MΩ minimum (500V DC megger)
Dielectric Strength: Between contact and coil: 1,500V AC, 1 minute
Between contacts of the same pole: 1,000V AC, 1 minute
Vibration Resistance: Damage Limits: 10 to 55Hz, 5 mm p-p
Operating Extremes: 10 to 55Hz, 3.3 mm p-p
Shock Resistance: Damage Limits: 1,000 m/sec^2 (Approx. 100G)
Operating Extremes: 500m/sec^2 (Approx. 50G)
Operating Temperature: −40°C to +70°C (no freezing)
Operating Humidity: 45 to 85%RH (no condensation)
Electrical Life: 500,000 operations (Rated load, at 1,800 operations/h)
Mechanical Life: 100,000,000 operations (at 36,000 operations/h)
Weight (Approx.): Approx. 3.5g

TYPE LIST

Basic Type No.	Coil			Contacts		Circuit Diagram (Bottom View)
	Input (VDC)	Resist. (Ω)	Nom. Power (mW)	Arrangement	Max. (A)	
RW22-G	1.5 3 5 6 12 24	11.3 45 125 180 720 2880	200 Approx.	DPDT	2	
	48	5760	400 Approx.			

PC BOARD LAYOUT

Dimensions in inches (mm).



ORDERING INFORMATION

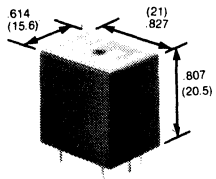
When ordering, specify the basic type number and coil voltage.

Example: **RW22-G** **DC12V**

RW22-G — Basic Type No.
DC12V — Coil Voltage

RCN SERIES

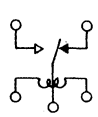
LOW COST PC RELAYS
3, 5 AND 10 AMP CONTACT RATING, SPDT
SEALED AND UNSEALED TYPE PACKAGES



SPECIFICATIONS

Contact Material: Silver (3A), Silver-Nickel (5A), Tin-Alloy (10)
Contact Resistance: 100 mΩ max. (initial value)
Operate Time: 15 msec max. (at the rated voltage)
Release Time: 10 msec max. (at the rated voltage)
Insulation Resistance: 100 MΩ min. measured with a 500V DC megger
Dielectric Strength:
Between contact and coil: 1,500V AC, 1 minute
Between contacts: 750V AC, 1 minute
Operating Frequency: 1,800 operations/hour
Vibration Resistance:
Damage limits: 10 to 55 Hz, total amplitude 1.5 mm
Operating extremes: 10 to 55 Hz, total amplitude 1.5 mm
Shock Resistance:
Operating extremes: 100 m/sec^2 (approx. 10G)
Damage limits: 1,000 m/sec^2 (approx. 100G)
Operating Temperature: −30°C to +70°C (3A) no freezing
−20°C to +50°C (5A) no freezing
Life (operations):
Mechanical: 10,000,000 (at 18,000 operations/hour)
Electrical: 100,000 (at 1,800 operations/hour)
Soldering Temperature: 260°C, 10 sec maximum
Weight: Approx. 14g

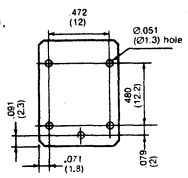
TYPE LIST

Basic Type No. Unsealed	Coil			Contact		Circuit Diagram (Bottom View)
	Input (VDC)	Resist. (Ω)	Nom. Power (mW)	Arrangement	Max. (A)	
RCN1V-3*	5 6 12 24 48	70 100 400 1600 6400	360	SPDT	3	
RCN1V-5*	5 6 12 24 48	70 100 400 1600 6400	360	SPDT	5	
RCN1V-10*	5 6 12 24 48	70 100 400 1600 6400	360	SPDT	10	

Note: *For sealed type, add G:RCN1V-3G; unsealed add B:RCN1V-3B

PC BOARD LAYOUT

Dimensions in inches (mm).



ORDERING INFORMATION

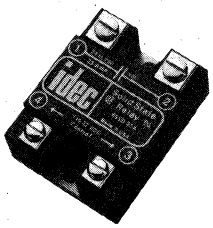
When ordering, specify the basic type number and coil voltage.

Example: **RCN1V-3B** — **DC6V**

RCN1V-3B — Basic Type No.
DC6V — Coil Voltage

idec **SOLID STATE RELAYS**

RSS SERIES
DC/AC AND AC/AC MODELS
10, 25 AND 40 AMP OUTPUT



- Photo isolation
- 600 volt blocking voltage
- 4000 volt isolation
- Zero voltage turn-on
- Built-in snubber
- 100% tested at rated current
- High surge capability
- U.L. recognized (File No. E59804)
- Dual SCR output (40A)

TYPE LIST

Basic Type No.	Input Voltage (VDC)	Output Current, Cont. (Amps)
RSSD-10A	3-32	10
RSSD-25A	3-32	25
RSSD-40A	3-32	40

Note: Part number nomenclature—
R: Relays, **SS:** Solid State, **D:** DC Input

Basic Type No.	Input Voltage (VAC)	Output Current, Cont. (Amps)
RSSA-10A	90-280	10
RSSA-25A	90-280	25
RSSA-40A	90-280	40

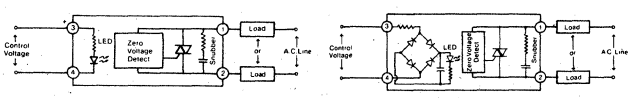
Note: Part number nomenclature—
R: Relays, **SS:** Solid State, **A:** AC Input

SPECIFICATIONS

INPUT	RSSD SERIES			RSSA SERIES		
Voltage Range	3–32VDC			90–280VAC		
Impedance	1500 Ohm			40K ± 10%		
Turn-On Voltage	3VDC			80VAC		
Turn-Off Voltage	1VDC			20VAC		
Dielectric Strength (Input-Output-Base)	4000 RMS (min)			4000 RMS (min)		
Capacitance (Input to Output)	3pF			3pF		
Reverse Voltage Protection	Yes (−75VDC)			N/A		
OUTPUT						
Current (Cont)	10A	25A	40A	10A	25A	40A
One Cycle Surge Current	100A	250A	650A	100A	250A	650A
One Second Surge Current	40A	80A	130A	40A	100A	150A
Voltage Range	24-330VAC					
Voltage Drop	1.5V					
Over Voltage Rating	600 PIV					
Off-State Leakage	8mA (max)					
Turn On/Off Time	1/2 cycle @60Hz					
Min. Holding Current	50mA					
Static DV/DT	200V/μSec					
Commutating DV/DT	Snubbed for .5 Power Factor at rated load					

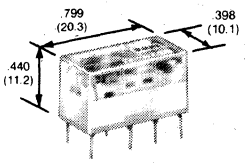
SCHEMATIC (10A & 25A)

RSSD (DC/AC) RSSA (AC/AC)



idec **P.C. TYPE RELAYS**

RD SERIES
LOW PROFILE PC RELAYS
HIGHLY SENSITIVE, 400mW POWER CONSUMPTION
100μA TO 1.25A CONTACT CAPACITY, DPDT
MEETS 1,500V FCC SURGE REQUIREMENTS



SPECIFICATIONS

Contact Material: Silver (Gold-Clad)
Contact Resistance: 100mΩ max. (initial value)
Operate Time: 5 msec max. @ Rated Voltage
Release Time: 5 msec max. @ Rated Voltage
Bounce Time: 6 msec max. @ Rated Voltage
Insulation Resistance: 100MΩ min. (initial value)
Dielectric Strength:
Between contact and coil: 1,000V AC, 1 minute
Between contact of different poles: 1,000V AC, 1 minute
Between contact of the same pole: 500V AC, 1 minute
Surge Withstand Voltage: 1,500V FCC
Operating Frequency: 3,600 operations/hr.
Vibration Resistance: 10 to 55 Hz (Total amplitude: 1.5 mm)
Shock Resistance: Damage limits: 1,000 m/sec² (Approx. 100G)
Operating extremes: 200 m/sec² (Approx. 20G)

Electrical Life
(Resistive Load): 500,000 operations minimum
AC: 110V, 0.3A
DC: 24V, 1.25A
Mechancial Life: 50,000,000 operations minimum
Operating Temperature: −30°C to +70°C (no freezing)
Weight: Approx. 4.5g

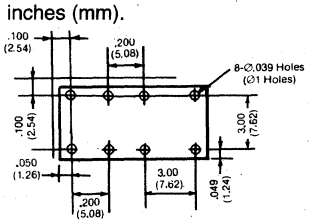
TYPE LIST

Basic Type No.	Coil			Contacts		Circuit Diagram (Bottom View)
	Input (VDC)	Resist. (Ω)	Nom. Power (mW)	Arrange-ment	Max. (A)	
RD2N-1U	3 5 6 12 24 48	22.5 62.5 90 360 1440 5760	400 Approx.	DPDT	1.25	

NOTE: Latching model also available, consult IDEC

P.C. BOARD LAYOUT

Dimensions in inches (mm).



ORDERING INFORMATION

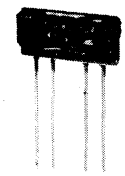
When ordering, specify the type number and coil voltage.

Example: **RD2N-1U – 24V DC**
Basic Type No. — Coil Voltage

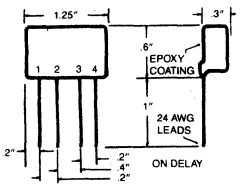
TIME DELAY RELAYS & SENSORS
SOLID STATE CONTROLS

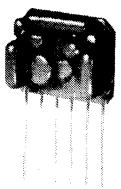
Unique tiny ICSOTIMER™ time delay modules solve big timer jobs

ICSOTIMER™ KH Series

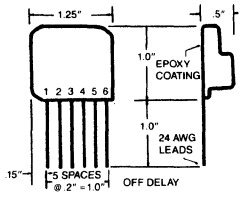


KH1





KH 2,3,4



Thick film hybrid RC type timers. Solid State Output.

Voltages: AC—12, 24, 120, 240
DC—12, 24, 48, 120

Ratings: UL File #E68153
CSA: LR54307

Action 1 = 100MA max, 10MA min

Actions 2, 3, 4 = 500MA max, 10MA min

Termination: 2" long #22AWG solid tinned leads

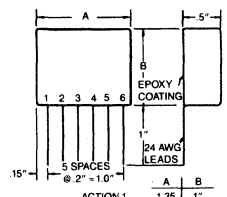
Coating: Conformal

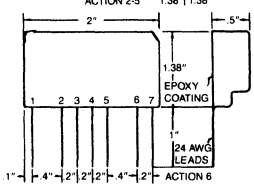
8 Time Ranges: .1 to 300 sec

Sizes: Action 1 = 1.3 × .6 × .3
Actions 2, 3, 4 = 1.3 × 1.0 × .5

ICSOTIMER™ KD Series

KD1





Digital Countdown—CMOS type timers. Solid State Output.

Voltages: AC—12, 24, 120, 240
DC—12, 24, 48, 120

Ratings:

Actions 1, 3, 5 = 1 Amp max, 20 MA min

Actions 2, 4, 6 = .5 Amp max, 10MA min

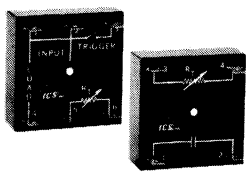
Termination: 2" long #22AWG solid tinned leads

Coating: Conformal

3 Time Ranges: .1 sec to 10 hrs

Sizes: Action 1 = 1.4 × 1.0 × .5
Actions 2, 3, 4, 5 = 1.4 × 1.4 × .5
Action 6 = 2.0 × 1.4 × .5

ICSOTIMER™ KE Series in Molded Block



Features the DIGI ICSOTIMER in a rugged 2" × 2" × ¾" package with 3/16" or ¼" quick connect terminals, center hole mounting. Drives loads to 1 amp.

Digital Countdown—CMOS type timers. Solid State Output.

Voltages: AC—12, 24, 120, 240
DC—12, 24, 48, 120

Ratings:

Actions 1, 2, 3 = 1 Amp max

Termination: 3/16" or ¼" Q.C. terminals

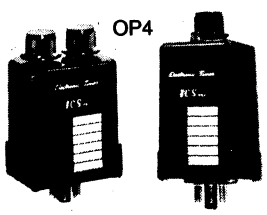
3 Time Ranges: .1 sec to 10 hrs

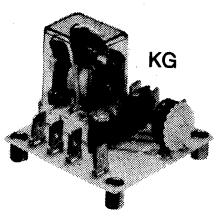
Sizes: Actions 1, 2, 3 = 2 × 2 × .8 less terminals

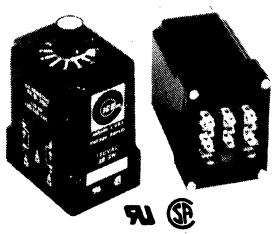
DESCRIPTION OF TIMING ACTIONS

1—On Delay, Delay on Make
2—Off Delay, Delay on Break
3—Interval
4—Triggered Interval, Single Shot
5—Recycle, Equal Off/On
6—Recycle, Off/On, independently adjustable

Time Delay Relays & Voltage Sensors







Time Delay Relays

Ratings:
DPDT—⅓ HP @ 120VAC
10 Amp res @ 240VAC, 28VDC

Voltages:
AC 12, 24, 120, 240
DC 12, 24, 48, 120

11 Time Ranges: .1 sec to 10 hours

Sizes:
OP4 Actions 1-5 = 2 × 2 × 3⅞"
OP4 Action 6 = 2⅜ × 1¾ × 3½
KG 2⅛ × 2⅛ × 1¾ high

Terminations:
OP4: Octal style plug-in base.
3/16" 11-Pin blade base.
KG: ¼" Q.C. Tabs

Voltage Sensor: K8001, 4, 5
True Off Delay: K7830, 5

Ratings:
5 Amp res @ 240VAC
Voltage Sensor DPDT
True Off Delay SPDT

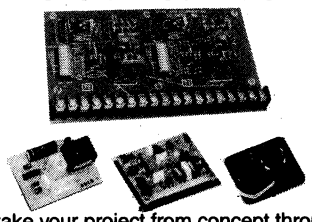
Voltages:
120, 240VAC

Size:
2⅜ × 1¾ × 3½

Terminations:
11-Pin blade base.

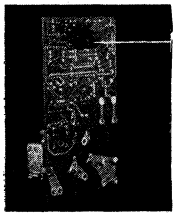
All Dimensions in Inches

Custom Controls



We take your project from concept through breadboard, prototype and production. We have over 20,000 ft² of production capability so we are able to handle any project, large or small. Our 24 years experience and QA program assures project success.

Infrared Time Controls



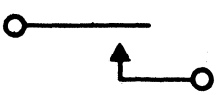
120 or 208/240. Senses an object up to 15 inches away. Heavy duty relay with contact rated 1 HP @ 125/250 VAC mounted on pcb. Sensing head available on the pcb or remote. Consult factory for time and other sensing configurations.

ICS/INSTRUMENTATION & CONTROL SYSTEMS, INC.
520 Interstate Road • Addison, Illinois 60101-4471 • 312/543-6200 • FAX: 312/543-6244 • Telex 27-1503 ICS-UR

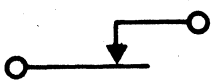
eem

MINIGLOSSARY
RELAY CONTACT FORMS

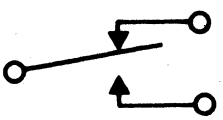
A
Make
SPST-NO



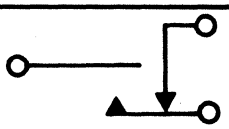
B
Break
SPST-NC



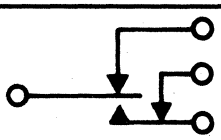
C
Break, Make
(Transfer)
SPDT



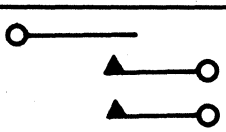
D
Make, Break
(Continuity
Transfer)



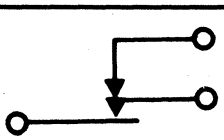
E
Break,
Make,
Break



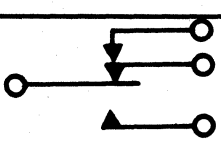
F
Make,
Make



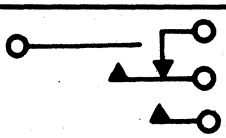
G
Break,
Make



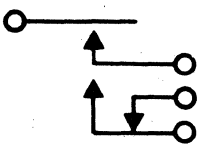
H
Break,
Break,
Make



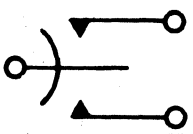
I
Make,
Break,
Make



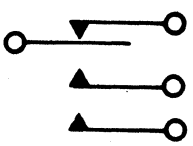
J
Make,
Make,
Break



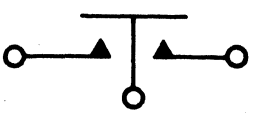
K
Center off
SPDT



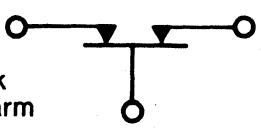
L
Break,
Make,
Make



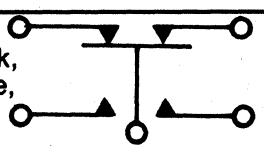
U
Double
make
Contact
on arm



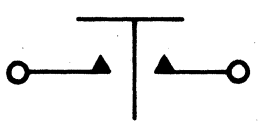
V
Double break
Contact on arm



W
Double break,
Double make,
Contact
on arm

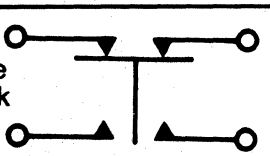


X
Double
make



Y
Double break

Z
Double make
Double break
SPDT-DB



International IOR Rectifier

MICROELECTRONIC POWER IC RELAYS

ChipSwitch® Solid State Relay

The ChipSwitch relays utilize power integrated circuits for AC power line switching while maintaining turn-on at zero voltage crossing and turn-off at zero current crossing. They are a compact, low cost, and highly reliable interface for isolating and switching AC loads such as solenoids, valves, lamps, contactors, small motors, and heaters from low level DC signals.

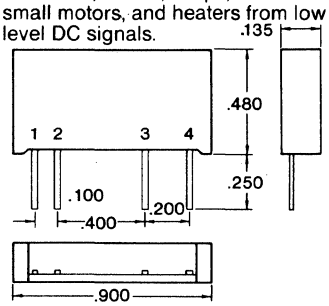


Figure 1 ChipSwitch SP

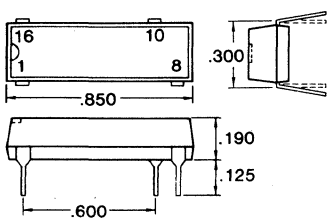
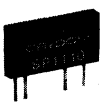


Figure 2 ChipSwitch DP

SERIES	PART NUMBER	Operating Voltage Range V(RMS)	Maximum Load Current @40°C A(RMS)	Trans. 'Over-Volt V(Pk)	Turn-On Signal (DC)	Outline Drawing	Tech. Bulletin No.
SP  1 FORM A	SP1110	20-140	1.0 Free Standing	300	5mA	Figure 1	SP-3
	SP1210	20-140		300	10mA		
	SP2110	20-280		450	5mA		
	SP2210	20-280	3.0 With Heat Sink	450	10mA		
	SP6110	20-280		600	5mA		
	SP6210	20-280		600	10mA		
DP 1 FORM A	DP1110	20-140	1.0	300	5mA	Figure 2	DP-4
	DP1210	20-140		300	10mA		
	DP1610	20-140		300	3.5V		
	DP2110	20-280		450	5mA		
	DP2210	20-280		450	10mA		
	DP2610	20-280		450	3.5V		
	DP6110	20-280		600	5mA		
	DP6210	20-280		600	10mA		
	DP6610	20-280		600	3.5V		
CS 1 FORM A	CS5005	20-280	0.3	500	5mA	Figure 3	CS60
	CS5010	20-280		500	10mA		
	CS6005	20-280		600	5mA		
	CS6010	20-280		600	10mA		

GENERAL CHARACTERISTICS	SP	DP	CS	UNITS
Dielectric Strength Input/Output	3750		4000	VRMS
Min. off state dv/dt @ rated V 25°C	600		1200	V/μ sec
Max. off state leakage	10			μ A
Power factor range	0.5 to 1	0.2 to 1		—
Ambient operating temperature	-30 to +80			°C

BOSFET® PhotoVoltaic Relay

International Rectifier Photo-Voltaic Relays utilize a unique power integrated circuit termed a BOSFET to form a solid state replacement for signal level electromechanical relays. They feature high speed, zero offset voltage, low pick-up power, miniaturization, and are widely applied in instrumentation, multiplexing, automatic test equipment, thermocouple switching and telecommunications for general purpose switching of AC/DC analog and digital signals.

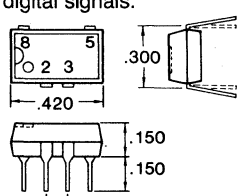


Figure 3 ChipSwitch CS, BOSFET PVD & PVA

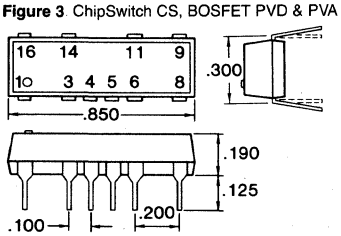


Figure 4 BOSFET PVR

SERIES	PART NUMBER	Operating Voltage Range V(Pk)	Max. On-State Res. @ 25°C Ohms AC	Max. On-State Res. @ 25°C Ohms DC	Max Load Current @ 40°C (DC) mA	Nom. Control Current (DC) mA	Min. Off-State Res. Ohms	Outline Drawing	Tech. Bulletin No.
PVR 2 FORM A	PVR1300	±100	5.0	1.5	600	10	10^8	Figure 4	PVR13
	PVR1301	±100	5.0	1.5	600		10^{10}		PVR13
	PVR2300	±200	24	6.0	260		10^8		PVR33
	PVR3300	±300	24	6.0	260		10^8		PVR33
	PVR3301	±300	24	6.0	260		10^{10}		PVR33
PVA 1 FORM A	PVA1052	±100	35	35	70	5.0	10^8	Figure 3	PVA10
	PVA1054	±100	35	35	70	5.0	10^{10}		PVA10
	PVA1352	±100	5.0	5.0	250	5.0	10^8		PVA13
	PVA1354	±100	5.0	5.0	250	5.0	10^{10}		PVA13
	PVA2352	±200	24	24	130	5.0	10^8		PVA33
	PVA3324	±300	24	24	130	2.0	10^{10}		PVA33
	PVA3354	±300	24	24	130	5.0	10^{10}		PVA33
	PVAZ172	±60	0.5	0.5	1000	10	10^8		PVAZ
PVD 1 FORM A	PVD1052	+100		8.0	160	5.0	10^8	Figure 3	PVD10
	PVD1054	+100		8.0	160	5.0	10^{10}		PVD10
	PVD1352	+100		1.5	500	5.0	10^8		PVD13
	PVD1354	+100		1.5	500	5.0	10^{10}		PVD13
	PVD2352	+200		6.0	220	5.0	10^8		PVD33
	PVD3354	+300		6.0	220	5.0	10^{10}		PVD33
	PVD172	+ 60		0.25	1400	10	10^8		PVD33

GENERAL CHARACTERISTICS	PVR	PVA	PVD	UNITS
Dielectric Strength Input/Output	1500	1500 and 4000		VRMS
Min. off state dv/dt @ rated V 25°C	1000			V/μ sec
Max. thermal offset voltage @ 5mA control	0.2			μV
Output	AC or DC	AC or DC	DC	—
Ambient operating temperature	-40 to +80			°C

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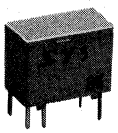
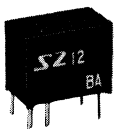
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

SY/SZ RELAYS

1 Amp SPDT
L — 0.492″,
W — 0.291″,
H — 0.374″





CONTACT DATA

Arrangement — 1 Form C

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial value)

Ratings — 0.5A, 120V AC or 1A, 24V DC (resistive) switched
2.0A carrying curent

Life Expectancy — Mechanical: Min. 5 million operations
Electrical: SZ Min. 200,000 operations at rated load
SY Min. 150,000 operations at rated load

COIL DATA

Voltages — 1.5 to 24V DC

Power (at 20°C) —
SZ Operate — 0.15 watt (0.16 watt for 18V coil, 0.18 watt for 24V coil)
Nominal — 0.3 watt (0.32 watt for 18V coil, 0.36 watt for 24V coil)
SY Operate — 0.075 watt
Nominal — 0.15 watt

Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 100 MΩ minimum at 500V DC

Dielectric Strength — 500V AC (50, 60 Hz), between open contacts
1000V AC between contacts and coil

Temperature Range — −40°C to +70°C (18V coil: −30°C to +65°C,
25V coil; −30°C to +60°C) (at nominal voltage)

Time Values (approx.) — Operate 1.5 mS, Release 1 mS (at nominal voltage)

Vibration Resistance — 20G (10 ~ 300 Hz) amplitude 3 mm

Shock Resistance — 50G

Mounting — For direct printed circuit mounting on grid spacing
of 2.54 mm (0.1 in.)

Approximate Weight — 1.7 gr (0.06 oz.)

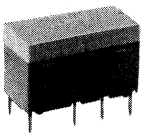
Enclosure — Polybutylene terephthalate (PBT)

Surge Strength — 1000V

Nominal Coil Voltage	Coil Resistance	Operate Voltage	Type No.	List Price
3	30	2.1	SZ-3W	$2.64
5	83	3.5	SZ-5W	$2.64
6	100	3.9	SZ-6W	$2.64
9	270	6.3	SZ-9W	$2.64
12	480	8.4	SZ-12W	$2.64
18	1000	12.6	SZ-18W	$2.64
24	1600	16.8	SZ-24W	$2.64
5	167	3.5	SY-5	$2.90
6	240	4.2	SY-6	$2.90
9	540	6.3	SY-9	$2.90
12	960	8.4	SY-12	$2.90

RY RELAY

1 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.472″



CONTACT DATA

Arrangement — 2 Form C, 2 Form D

Material — Gold overlay silver-palladium

Resistance — Max. 100 mΩ (initial)

Ratings — 0.5A 120V AC or 1A 24V DC (resistive)

Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 1A 24V DC
Min. 200,000 operations at 0.5A 120V AC

COIL DATA

Voltages — 4.5 to 48V DC

Power (at 20°C) —
Operate — 0.075 watt (0.098 watt for 18V, 24V coil, 0.138 watt
for 48V coil)
Nominal — 0.15 watt (0.2 watt for 18V, 24V coil, 0.3 watt for 48V coil)

Operate (at 20°C) — 68 ~ 71% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ min. at 500V DC

Dielectric Strength — 500V AC between open contact
1000V AC between all other conductors

Temperature Range — −40°C ~ +80° at nominal voltage

Surge Strength — 1500V between all conductors

Time Values (max.) — Operate 6 ms, Release 3 ms at nominal voltage

Vibration Resistance — 10G (10 ~ 55 Hz)

Shock Resistance — 10G 11 ±1 ms) — Unerror, 100G (6 ±1 ms) —
Destruction

Enclosure — Polybutylene terephthalate (PBT)

Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
B-M (2 form C)					
5	3.6	12.5	167	RY-5W	$3.70
6	4.3	15.0	240	RY-6W	$3.70
9	6.4	22.5	540	RY-9W	$3.70
12	8.5	30.0	960	RY-12W	$3.70
24	16.8	51.6	2880	RY-24W	$3.70
48	32.6	84.0	7680	RY-48W	$4.58
M-B (2 form D)					
5	3.3	7.1	55	RY-5D	$4.14
6	4.0	8.5	80	RY-60	$4.14
9	5.9	12.8	180	RY-9D	$4.14
12	7.9	17.0	320	RY-12D	$4.14
24	15.8	34.1	1280	RY-24D	$4.14
48	31.8	65.8	4800	RY-48D	$5.02

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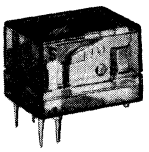
5 Jenner Street • Irvine, California • Phone: (714) 727-3001 • TWX: 910-595-1744 • Telex: 69-1389

TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

MZ RELAY

1 Amp SPDT
L — 0.606″,
W — 0.449,
H — 0.433″



CONTACT DATA

Arrangement — 1 Form C
Material — Gold overlay silver-palladium alloy
Resistance — 100 milliohms maximum (initial value)
Ratings — 50μ amps to 1 amp at 30V DC or 120V AC, resistive
2A maximum carrying current
Life Expectancy — Mechanical: 20 million operations
Electrical: 500,000 operations minimum at 1 amp 24V DC resistive load
200,000 operations minimum at 0.5 amps 120V AC resistive load

COIL DATA

Voltages — 1.5 to 24 volts DC
Power (at 20°C) —
Standard type: Operate—0.22 watt, Nominal—0.45 watt,
Maximum—1 watt
High sensitive type: Operate—0.1 watt, Nominal—0.2 watt,
Maximum—1 watt
Operate (at 20°C) — 70% of nominal voltage
Duty — Continuous

GENERAL DATA

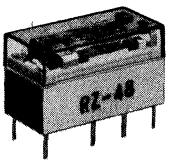
Insulation Resistance — 100 megohms minimum at 500V DC
Dielectric Strength — 500V AC (50/60 Hz), between all insulated elements
Temperature Range — Standard type: −40°C to +55°C
(at nominal voltage) High sensitive type: −30°C to +75°C
Time Values — Operate <3 ms standard, <6 ms sensitive;
release <1 ms
Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2.5 mm (0.98 in.)
Approximate Weight — 3.5 gr. (0.12 oz.)
Enclosure — Standard — polycarbonate
Washable or sealed — PBT

Standard Coil and Contact Combination (20°C)

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard Types					
1.5	1.05	2.0	5	MZ-1.5HG	$2.42
3	2.1	4.1	20	MZ-3HG	$2.42
5	3.5	6.8	56	MZ-5HG	$2.42
6	4.2	8.1	80	MZ-6HG	$2.42
9	6.3	12.2	180	MZ-9HG	$2.42
12	8.4	16.2	320	MZ-12HG	$2.42
24	16.8	32.4	1280	MZ-24HG	$2.42
High Sensitive Type					
1.5	1.05	3.0	12	MZ-1.5HS	$2.60
3	2.1	6.0	45	MZ-3HS	$2.60
5	3.5	10.0	120	MZ-5HS	$2.60
6	4.2	12.0	180	MZ-6HS	$2.60
9	6.3	18.0	400	MZ-9HS	$2.60
12	8.4	24.0	700	MZ-12HS	$2.60
24	16.8	48.0	2800	MZ-24HS	$2.60
Latching Types					
3	2.1	NA	5.7	MZL-3	$3.61
5	3.5	NA	15	MZL-5	$3.61
6	4.2	NA	21	MZL-6	$3.61
9	6.3	NA	50	MZL-9	$3.61
12	8.4	NA	87	MZL-12	$3.61
24	16.8	NA	350	MZL-24	$3.61

RZ/RZL RELAYS

2 Amp DPDT
L — 0.795″,
W — 0.386″,
H — 0.457″



CONTACT DATA

Arrangement — DPDT (B-M) — RZ, RZ( )W Type
Material — Gold overlaid silver-palladium alloy
Max. Switching Power —
30W/60VA — Single Contact
30W/50VA — Bifurcated contact at resistive load
Max. Switching Current —
2A AC or DC — Single Contact
1A AC or DC — Bifurcated contact at resistive load
Max. Switching Voltage —
150V DC/125V AC — Single Contact
100V DC/90V AC — Bifurcated contact at resistive load
Contact Resistance (Pin-pin) — 100mΩ Max.
Capacitance — 1.5PF max. between open contact
0.5PF max. between adjacent change-over contact
Life Expectancy —
Mechanical: 20 million operations — Single Contact
15 million operations — Bifurcated contact
Electrical: 0.5 million operations at 1.25A 24V DC or 0.4A 125V AC at resistive load — Single contact
0.5 million operations at 0.7A 24V DC or 0.25A 125V AC at resistive load — Bifurcated contact

COIL DATA

Nominal Voltage — 3 to 48 V DC — RZ, RZ( )W Type,
3 to 24V DC — RZ1, RZ1( )W Type
Power (at 20°C) — Nominal: 515 ~ 560 mW — RZ, RZ( )W Type,
Operate: 200 ~ 324 mW — RZ, RZ( )W Type
Max: 1050 mV
Temperature Range — −40°C ~ +65°C — RZ RZ( )W Type
(at nominal voltage) −40°C ~ +75°C — RZ1 RZ1( ) Type

GENERAL DATA

Dielectric Strength — 500V AC (50/60 Hz) between open contacts,
1000V AC contact-coil
Insulation Resistance — 1000 MΩ min. at 500V DC
Timing — Operate <4 ms, release <2
Bounce Time — Approx. 1 ms on operate
Approx. 4 ms on release
Vibration Resistance — 10 to 60 Hz amplitude 1.5 mm (10G)
Shock Resistance — Destruction shock: 100G (11 ms ±1 ms)
Unerror shock: 10G (11 ms ± 1 ms)
Surge Strength — 1500V AC between all conductors

Standard Coil and Contact Combinations (20°C

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code	List Price
Standard types					
5	3.2	7.0	45	RZ-5	$3.39
6	3.8	8.4	66	RZ-6	$3.39
9	5.1	12.6	140	RZ-9	$3.39
12	7.6	16.8	280	RZ-12	$3.39
24	15.2	33.6	1070	RZ-24	$3.39
48	36.0	67.2	4000	RZ-48	$3.78
Latching types					
5	3.2	NA	8.4	RZL-5	$4.53
6	3.8	NA	12	RZL-6	$4.53
9	5.7	NA	27	RZL-9	$4.53
12	7.6	NA	52	RZL-12	$4.53
24	15.2	NA	192	RZL-24	$4.53
48	36.0	NA	820	RZL-48	$4.93

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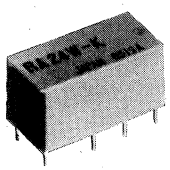
TAKAMISAWA ELECTRIC CO., LTD.

Sub Miniature Printed Circuit Board Relays

RA RELAY



1 Amp DPDT Relay
L — 0.795″
W — 0.394″
H — 0.394″

CONTACT DATA

Arrangement — 2 Form C (DPDT)
Material — Gold overlaid silver palladium alloy vs silver palladium alloy
Resistance — Max. 100 mΩ (Initial)
Rating — 24V DC 1A, or 120V AC 0.5A
Life Expectancy — Mechanical: Min. 20 million operations
Electrical: Min. 500,000 operations at 24V DC 1A
Min. 200,000 operations at 120V AC 0.5A
Max. Carrying Current — 2A

COIL DATA

Voltages — 1.5 to 48V DC
Power (at 20°C) — Operate: Standard 100—200 mW
Single winding latching 35~100 mW
Double winding latching 75~180 mW
Nominal: Standard 200~400 mW
Single winding latching 75~200 mW
Double winding latching 150~360 mW
Operate (at 20°C) — Less than 70% of nominal voltage
Duty — Continuous

GENERAL DATA

Insulation Resistance — 1000 MΩ at 500V DC
(Expect between P & S coil)
Dielectric Strength — 1000V AC between open contact
1500V AC between all other conductors
(Expect between P & S coil)
Temperature Range — −40°C~+80°C (RA-W, RA-WN, RAL-W, RAL-DW, RAL-WP, RAL-DWP)
−40°C~+70°C (RA-WM, RAL-DWM), at nominal voltage, Non carring Contact
Surge Strength — 1500V between coil and contact, adjacent contacts
Time Value (Max.) — Operate: (RA-WM, RAL-DWM) 4 mS
(RA-W, RA-WN, RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS
Release: (RA-WM) 3 mS
(RA-W, RA-WN, RAL-DWM) 4 mS
(RAL-W, RAL-DWN, RAL-WP, RAL-DWP) 6 mS, at nominal voltage
Vibration Resistance — 30G (10~55 Hz) Unerror
30G (10~55 Hz) Destruction
Shock Resistance — 50G (11 ±1 mS) Unerror
100G (11 ±1 mS) Destruction
Enclosure — Polybutylene terephthalate (PBT)

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE					
Non-Latching					
RA 1.5W-K	1.5	15	+1.0	+0.15	$4.14
RA 3W-K	3	60	+2.0	+0.3	$4.14
RA 4.5W-K	4.5	135	+3.1	+0.45	$4.14
RA 5W-K	5	167	+3.4	+0.5	$4.14
RA 6W-K	6	240	+4.0	+0.6	$4.14
RA 9W-K	9	540	+6.1	+0.9	$4.14
RA 12W-K	12	900	+8.1	+1.2	$4.14
RA 18W-K	18	2160	+12.3	+1.8	$4.14
RA 24W-K	24	2880	+16.1	+2.4	$4.14
RA 48W-K	48	11520	+32.2	+4.8	$4.97

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
RA( )W-K TYPE (Continued)					
Single Winding Latching					
RAL 1.5W-K	1.5	30	+1.0	−1.0	$4.75
RAL 3W-K	3	120	+2.1	−2.1	$4.75
RAL 4.5W-K	4.5	270	+3.1	−3.1	$4.75
RAL 5W-K	5	335	+3.4	−3.4	$4.75
RAL 6W-K	6	480	+4.1	−4.1	$4.75
RAL 9W-K	9	1080	+6.3	−6.3	$4.75
RAL 12W-K	12	1920	+8.3	−8.3	$4.75
RAL 18W-K	18	4320	+12.5	−12.5	$4.75
RAL 24W-K	24	5760	+16.6	−16.6	$4.75
RAL 48W-K	48	11520	+21.0	−21.0	$5.68
Double Winding Latching					
RAL D1.5W-K	1.5 P/S	15	+1.0*	+1.0**	$5.02
RAL D3W-K	3 P/S	60	+2.0*	+2.0**	$5.02
RAL D4.5W-K	4.5 P/S	135	+3.1*	+3.1**	$5.02
RAL D5W-K	5 P/S	167	+3.4*	+3.4**	$5.02
RAL D6W-K	6 P/S	240	+4.0*	+4.0**	$5.02
RAL D9W-K	9 P/S	540	+6.1*	+6.1**	$5.02
RAL D12W-K	12 P/S	960	+8.1*	+8.1**	$5.02
RAL D18W-K	18 P/S	2160	+12.3*	+12.3**	$5.02
RAL D24W-K	24 P/S	2880	+16.1*	+16.1**	$5.02
RAL D48W-K	48 P/S	11520	+32.2*	+32.2**	$7.61
RA( )WN-K TYPE					
Non-Latching					
RA 1.5WN-K	1.5	11.3	+1.0	+0.15	$4.05
RA 3WN-K	3	45	+2.0	+0.3	$4.05
RA 4.5WN-K	4.5	100	+3.1	+0.45	$4.05
RA 5WN-K	5	125	+3.4	+0.5	$4.05
RA 6WN-K	6	180	+4.0	+0.6	$4.05
RA 9WN-K	9	405	+6.1	+0.9	$4.05
RA 12WN-K	12	720	+8.1	+1.2	$4.05
RA 18WN-K	18	1620	+12.3	+1.8	$4.05
Double Winding Latching					
RAL D1.5WN-K	1.5 P/S	12.5	+1.0*	+1.0**	$4.93
RAL D3WN-K	3 P/S	50	+2.0*	+2.0**	$4.93
RAL D4.5WN-K	4.5 P/S	113	+3.1*	+3.1**	$4.93
RAL D5WN-K	5 P/S	139	+3.4*	+3.4**	$4.93
RAL D6WN-K	6 P/S	200	+4.0*	+4.0**	$4.93
RAL D9WN-K	9 P/S	450	+6.1*	+6.1**	$4.93
RAL D12WN-K	12 P/S	800	+8.1*	+8.1**	$4.93
RAL D18WN-K	18 P/S	1800	+12.3*	+12.3**	$4.93
RA( )WM-K TYPE					
Non-Latching					
RA 1.5WM-K	1.5	5.63	+0.9	+0.15	$3.96
RA 3WM-K	3	22.5	+1.9	+0.3	$3.96
RA 4.5WM-K	4.5	50.6	+2.9	+0.45	$3.96
RA 5WM-K	5	62.5	+3.3	+0.5	$3.96
RA 6WM-K	6	90.0	+3.9	+0.6	$3.96
RA 9WM-K	9	203.0	+5.9	+0.9	$3.96
RA 12WM-K	12	360.0	+7.9	+1.2	$3.96
RA 18WM-K	18	810.0	+11.8	+1.8	$3.96
RA 24WM-K	24	1440	+15.8	+2.4	$3.96
RA 48WM-K	48	5760	+31.6	+4.8	$4.84
Double Winding Latching					
RAL D1.5WM-K	1.5 P/S	6.2	+1.0*	+1.0**	$4.84
RAL D3WM-K	3 P/S	25	+2.0*	+2.0**	$4.84
RAL D4.5WM-K	4.5 P/S	56	+3.0*	+3.0**	$4.84
RAL D5WM-K	5 P/S	69	+3.3*	+3.3**	$4.84
RAL D6WM-K	6 P/S	100	+4.0*	+4.0**	$4.84
RAL D9WM-K	9 P/S	225	+6.0*	+6.0**	$4.84
RAL D12WM-K	12 P/S	400	+8.0*	+8.0**	$4.84
RAL D18WM-K	18 P/S	900	+12.0*	+12.0**	$4.84
RAL D24WM-K	24 P/S	1600	+16.0*	+16.0**	$4.84
RAL D48WM-K	48 P/S	6400	+32.1*	+32.1**	$7.44

Notes: • If correct polarity is not applied to the coil terminals, relay does not operate properly.
• To release latched contact, polarity to be applied to coil terminals should be reversed.

* P only. ** S only.

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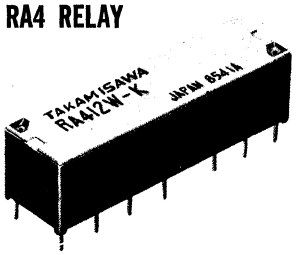
TAKAMISAWA ELECTRIC CO. LTD.

Sub Miniature Printed Circuit Board Relays

RA4 RELAY

1 Amp 4PDT
L — 1.387″,
W — 0.390″,
H — 0.433″



CONTACT DATA

Arrangement — 4 Form C (4PDT)
Material — Gold overlaid silver palladium alloy vs silver palladium alloy
Resistance — Max. 100 mΩ
Ratings — 120V AC 0.5A, 24V DC 1A (Resistive)
Max. Current — 2A
Life Expectancy Mechanical — Min. 20 million operations
Electrical — Min. 500,000 operations at 24V DC
Min. 200,000 operations at 120V AC 0.5A

COIL DATA

Voltages — 1.5 to 48V DC Power (at 20°C)

Type	RA4, RA4L		RA4-M, RA4L-M	
	Operate	Nominal	Operate	Nominal
Single Winding Non Latching	0.1W	0.2W	0.2W	0.4W
Single Winding Latching	0.045W	0.09W	0.09W	0.18W
Double Winding Latching	0.09W	0.18W	0.18W	0.36W

Operate (at 20°C) 70% of nominal voltage

GENERAL DATA

Insulation Resistance — 1000 mΩ min. at 500V DC
Dielectric Strength — 1000V AC between open contacts
1500V AC btween all other conductors
Temperature Range — −40°C ~ +80°C (RA4, RA4L),
−40°C ~ +70°C (RA4-M, RA4L-M)
Surge Strength — 1500V between coil and contact, adjacent contacts
Time Value — Operate: 6 msec max.
Release: 4 msec max.
Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
Shock Resistance — 100G (6 ±1 msec) Destructive
30G (11 ±1 msec) Unerring
} reference value
Enclosure — PBT

ORDERING INFORMATION

RA4 L D 12 W M —K

- Enclosure K: Washable
- Coil Sensitivity Nill: HighSensitive Power, M: Standard
- Contact W: Bifurcated
- Nominal Coil Voltage
- Coil Winding Nill: Single Winding, D: Double Windings
- Type of Relays Nill: Non-Latching Type, L: Latching Type
- Type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
STANDARD					
RA4 1.5W-K	1.5	11	+1.0	0.15	$ 9.72
RA4 3W-K	3	45	+2.0	0.3	$ 9.72
RA4 4.5W-K	4.5	101	+3.0	0.45	$ 9.72
RA4 5W-K	5	125	+3.4	0.5	$ 9.72
RA4 6W-K	6	180	+4.1	0.6	$ 9.72
RA4 9W-K	9	405	+6.1	0.9	$ 9.72
RA4 12W-K	12	720	+8.2	1.2	$ 9.72
RA4 18W-K	18	1620	+12.3	1.8	$ 9.72
RA4 24W-K	24	2880	+16.4	2.4	$ 9.72
RA4 48W-K	48	11520	+32.9	4.8	$11.66
RA4 1.5WM-K	1.5	5.63	+1.0	0.15	$ 9.24
RA4 3WM-K	3	22.5	+2.0	0.3	$ 9.24
RA4 4.5WM-K	4.5	50.6	+3.0	0.45	$ 9.24
RA4 5WM-K	5	62.5	+3.4	0.5	$ 9.24
RA4 6WM-K	6	90	+4.1	0.6	$ 9.24
RA4 9WM-K	9	203	+6.1	0.9	$ 9.24
RA4 12WM-K	12	360	+8.2	1.2	$ 9.24
RA4 18WM-K	18	810	+12.3	1.8	$ 9.24
RA4 24WM-K	24	1440	16.4	2.4	$ 9.24
RA4 48WM-K	48	5760	32.9	4.8	$11.09
SINGLE WINDING LATCHING					
RA4L 1.5W-K	1.5	25	+1.0	−1.0	$10.12
RA4L 3W-K	3	100	+2.1	−2.1	$10.12
RA4L 4.5W-K	4.5	225	+3.1	−3.1	$10.12
RA4L 5W-K	5	278	+3.5	−3.5	$10.12
RA4L 6W-K	6	400	+4.2	−4.2	$10.12
RA4L 9W-K	9	900	+6.3	−6.3	$10.12
RA4L 12W-K	12	1600	+8.4	−8.4	$10.12
RA4L 18W-K	18	3600	+12.6	−12.6	$10.12
RA4L 24W-K	24	6400	+16.8	−16.8	$10.12
RA4L 48W-K	48	25600	+33.6	−33.6	$12.06
RA4L 1.5WM-K	1.5	12.5	+1.0	−1.0	$ 9.64
RA4L 3WM-K	3	50	+2.0	−2.0	$ 9.64
RA4L 4.5WM-K	4.5	113	+3.1	−3.1	$ 9.64
RA4L 5WM-K	5	139	+3.4	−3.4	$ 9.64
RA4L 6WM-K	6	200	+4.1	−4.1	$ 9.64
RA4L 9WM-K	9	450	+6.2	−6.2	$ 9.64
RA4L 12WM-K	12	800	+8.2	−8.2	$ 9.64
RA4L 18WM-K	18	1800	+12.4	−12.4	$ 9.64
RA4L 24WM-K	24	3200	+16.5	−16.5	$ 9.64
RA4L 48WM-K	48	12800	+33.0	−33.0	$11.48
DOUBLE WINDING LATCHING					
RA4L D1.5W-K	1.5 P/S	12.5	+1.0	+1.0	$10.25
RA4L D3W-K	3 P/S	50	+2.0	+2.0	$10.25
RA4L D4.5W-K	4.5 P/S	113	+3.1	+3.1	$10.25
RA4L D5W-K	5 P/S	139	+3.4	+3.4	$10.25
RA4L D6W-K	6 P/S	200	+4.1	+4.1	$10.25
RA4L D9W-K	9 P/S	450	+6.2	+6.2	$10.25
RA4L D12W-K	12 P/S	800	+8.2	+8.2	$10.25
RA4L D18W-K	18 P/S	1800	+12.4	+12.4	$10.25
RA4L D24W-K	24 P/S	3200	+16.5	+16.5	$10.25
RA4L D48W-K	48 P/S	12800	+33.0	+33.0	$12.19
RA4L D1.5WM-K	1.5 P/S	6.3	+1.0	+1.0	$ 9.77
RA4L D3WM-K	3 P/S	25	+2.0	+2.0	$ 9.77
RA4L D4.5WM-K	4.5 P/S	56	+3.0	+3.0	$ 9.77
RA4L D5WM-K	5 P/S	69	+3.3	+3.3	$ 9.77
RA4L D6WM-K	6 P/S	100	+4.0	+4.0	$ 9.77
RA4L D9WM-K	9 P/S	225	+6.0	+6.0	$ 9.77
RA4L D12WM-K	12 P/S	400	+8.0	+8.0	$ 9.77
RA4L D18WM-K	18 P/S	900	+12.0	+12.0	$ 9.77
RA4L D24WM-K	24 P/S	1600	+16.0	+16.0	$ 9.77
RA4L D48WM-K	48 P/S	6400	+32.0	+32.0	$11.62

Notes
- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

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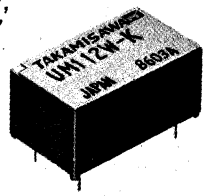
TAKAMISAWA ELECTRIC CO. LTD.

Sub Miniature RF Printed Circuit Board Relays

UM RELAY

0.1 Amp SPDT W — 0.449", L —0.787", H — 0.394"



CONTACT DATA
Arrangement — 1 form C (SPDT bifurcated)
Ratings — 24V DC 10 mA, 1W at 900 MHz
Resistance — 100 mΩ max. (initial value)
Max. Current — 100 mA DC
Max. Voltage — 30V DC
Max. Power — 1W DC, 10W at 900 MHz
Life Expectancy — Mechanical: 1,000,000 operations min.
Electrical: 300,000 operating min. at rated load

COIL DATA
Voltage — 1.5 to 48V DC
Power — (at 20°C)

Type	Operate	Nominal
Single Winding Non Latching	0.1W (0.11W for 48V coil)	0.2W (0.22W for 48V coil)
Single Winding Latching	0.1W	0.2W
Double Winding Latching	0.2W	0.4W

Operate wattage less than 70% of nominal voltage

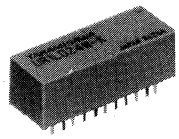
GENERAL DATA
Insulation Resistance — 1000 MΩ min. at 500V DC (UMIL-D, except between P.S. Coil)
Dielectric Strength — 500V AC between open contacts, between contacts and earth
1000V AC between coil and other terminals
Temperature Range — −30°C ~ +80°C at nominal voltage
Time Value — 6 msec max. at nominal voltage (UMI Release Time 5 ms)
Vibration Resistance — 30G (10 ~ 55 Hz) Destructive
20G (10 ~ 55 Hz) Unerring
Shock Resistance — 100G (6 msec) Destructive
50G (11 msec) Unerring
} reference value

HIGH FREQUENCY CHARACTERISTICS
Isolation — 60 dB min. at 900 MHz
Insertion Loss — 1 dB max. at 900 MHz
V.S.W.R. — 1.2 max. at 900 MHZ
(Impedance of the measuring devices is 75Ω)

Ordering Code		Nominal Coil Voltage (VDC)		Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
STANDARD							
UM1	3W-K	3		45	+2.1	+0.3	$7.13
UM1	5W-K	5		125	+2.1	+0.3	$7.13
UM1	6W-K	6		180	+4.2	+0.6	$7.13
UM1	9W-K	9		405	+6.3	+0.9	$7.13
UM1	12W-K	12		720	+8.4	+1.2	$7.13
UM1	18W-K	18		1620	+12.6	+1.8	$7.13
UM1	24W-K	24		2880	+16.8	+2.4	$7.13
UM1	48W-K	48		10472	+33.6	+4.8	$8.71
SINGLE WINDING LATCHING							
UM1L	3W-K	3		45	+2.1	−2.1	$7.66
UM1L	5W-K	5		125	+3.5	−3.5	$7.66
UM1L	6W-K	6		180	+4.2	−4.2	$7.66
UM1L	9W-K	9		405	+6.3	−6.3	$7.66
UM1L	12W-K	12		720	+8.4	−8.4	$7.66
UM1L	18W-K	18		1620	+12.6	−12.6	$7.66
UM1L	24W-K	24		2880	+16.8	−16.8	$7.66
UM1L	48W-K	48		11520	+33.6	−33.6	$9.24
DOUBLE WINDING LATCHING							
UM1L	D3W-K	3	P/S	22.5	+2.1	+2.1	$8.18
UM1L	D5W-K	5	P/S	62.5	+3.5	+3.5	$8.18
UM1L	D6W-K	6	P/S	90	+4.2	+4.2	$8.18
UM1L	D9W-K	9	P/S	202.5	+6.3	+6.3	$8.18
UM1L	D12W-K	12	P/S	360	+8.4	+8.4	$8.18
UM1L	D18W-K	18	P/S	910	+12.6	+12.6	$8.18
UM1L	D24-K	24	P/S	1440	+16.8	+16.8	$8.18
UM1L	D48W-K	48	P/S	5760	+33.6	+33.6	$9.77

Notes
- As to the positive (+) symbol of each value, such as working voltage, positive working voltage, open voltage and reverse working voltage, positive (+) electrode of power source should be connected to the positive (+) terminal of pin arrangements.
- Reverse working voltage for wirewound latch type.
As to the negative (−) symbol, positive (+) electrode of power source should be connected to negative (−) terminal of pin arrangements.

UR RELAY



L–1.291"
W–0.504"
H–0.425"

CONTACT DATA
Arrangement—2 Form C (DPDT bifurcated contact)
Ratings—24VDC 10mA, 1W at 900 MHz
Resistance—100 mΩ max. (Initial value)
Max. Current—100 mA DC
Max. Voltage—30 VDC
Max. Power—1WDC, 10W at 900 MHz
Life Expectancy—Mechanical: 1,000,000 operations min.
Electrical: 300,000 operations min.

COIL DATA
Voltage—1.5 to 48 VDC **Power**—(at 20°C)

Type	Operate	Nominal
Single winding non latching	0.18W (0.2W for 48V coil)	0.36W (0.39W for 48V coil)
Single winding latching	0.125W	0.25W
Double winding latching	0.25W (0.28W for 48V coil)	0.5W (0.55W for 48V coil)

GENERAL DATA
Insulation Resistance—1000MΩ min. at 500 VDC (Except between P & S Coil)
Dielectric Strength—500VAC between open contact, between contact & Shield terminals 1000VAC between coil & other terminals
Temperature Range—−30°C ~+80°C at nominal voltage
Time Value—approx. 6 ms at nominal voltage
Vibration Resistance—30G (10~ 55Hz)...Destructive
20G (10~ 55Hz)...Unerring
Shock Resistance—100G (6ms)...Destructive
50G (11ms)...Unerring
Reference value

TABLE-1 Non latching type

Ordering Code	Nominal Coil Voltage (VDC)	Coil Resistance ±10% at 20°C (Ω)	Must Operate Voltage at 20°C (VDC)	Release or Reverse Operate Voltage at 20°C (VDC)	List Price
UR1—1.5W-K	1.5	6.3	+1.05	+0.08	16.24
UR1—3W-K	3	25	+2.1	+0.15	16.24
UR1—4.5W-K	4.5	56.3	+3.15	+0.23	16.24
UR1—5W-K	5	69.5	+3.5	+0.25	16.24
UR1—6W-K	6	100	+4.2	+0.3	16.24
UR1—9W-K	9	225	+6.3	+0.45	16.24
UR1—12W-K	12	400	+8.4	+0.6	16.24
UR1—18W-K	18	900	+12.6	+0.9	16.24
UR1—24W-K	24	1600	+16.8	+1.2	16.24
UR1—48W-K	48	5900	+33.6	+2.4	17.82

TABLE-2 Single winding latching type

UR1L—1.5W-K	1.5	9	+1.05	−1.05	16.37
UR1L—3W-K	3	36	+2.1	−2.1	16.37
UR1L—4.5W-K	4.5	81	+3.15	−3.15	16.37
UR1L—5W-K	5	100	+3.5	−3.5	16.37
UR1L—6W-K	6	144	+4.2	−4.2	16.37
UR1L—9W-K	9	324	+6.3	−6.3	16.37
UR1L—12W-K	12	576	+8.4	−8.4	16.37
UR1L—18W-K	18	1296	+12.6	−12.6	16.37
UR1L—24W-K	24	2304	+16.8	−16.8	16.37
UR1L—48W-K	48	9216	+33.6	−33.6	17.95

TABLE-3 Double winding latching type

UR1L—D1.5W-K	1.5	P S	4.5 4.5	+1.05	+1.05	16.90
UR1L—D3W-K	3	P S	18 18	+2.1	+2.1	16.90
UR1L—D4.5W-K	4.5	P S	40.5 40.5	+3.15	+3.15	16.90
UR1L—D5W-K	5	P S	50 50	+3.5	+3.5	16.90
UR1L—D6W-K	6	P S	72 72	+4.2	+4.2	16.90
UR1L—D9W-K	9	P S	162 162	+6.3	+6.3	16.90
UR1L—D12W-K	12	P S	288 288	+8.4	+8.4	16.90
UR1L—D18W-K	18	P S	648 648	+12.6	+12.6	16.90
UR1L—D24W-K	24	P S	1152 1152	+16.8	+16.8	16.90
UR1L—D48W-K	48	P S	4189 4189	+33.6	+33.6	18.48

Notes • If correct polarity is not applied to the coil terminals, relay does not operate properly. • To release latched contact, polarity to be applied to coil terminals should be reversed. • Since this is the polarized relay, Confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

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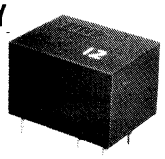
TAKAMISAWA ELECTRIC CO. LTD.

Miniature General Purpose Relays

LZ RELAY



5 Amp SPDT
L — 0.843″
W — 0.646″
H — 0.583″

CONTACT DATA

Arrangement — 1 Form C

Material — 5A type: Gold overlay silver-nickel alloy (single)
3A type: Gold overlay silver (single)
1A type: Gold overlay silver-palladium alloy (bifurcated)

Load — 5A type: 5A @ 30V DC or 120V AC, 4A @ 240V AC resistive, ⅛ HP
3A type: 3A @ 30V DC or 120V AC, 2.5A @ 240V AC resistive, $^1/_{10}$ HP
1A type: 1A @ 30V DC or 120V AC, resistive

Life — Mechanical: 20 million operations minimum
Electrical: 0.1 x 10^6 operations minimum at rated load

Timing — Operate: < 5 ms (standard type), < 6 ms (high sensitive type)
Release: < 2 ms

COIL DATA (@ 20°C)

Operate Power — 210 mW (standard type), 150 mW (high sensitive type)

Nominal Power — 450 mW (standard type), 330 mW (high sensitive type)

Maximum Power — 1.4W

GENERAL DATA

Insulation Resistance — 250 MΩ at 500V DC

Dielectric Strength — 750V AC between open contacts
2000V AC between all other points

Temperature Range — standard type −40°C to +70°C
sensitive type −40°C to +80°C

Vibration Resistance — 15G (10-55 Hz)

Shock Resistance — 15G (11 ms ±1 ms)

Approximate Weight — 8 gr (0.28 oz.)

Enclosure — Standard — polycarbonate
Washable or sealed — PBT

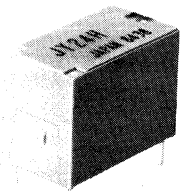
Surge Strength — 3000V

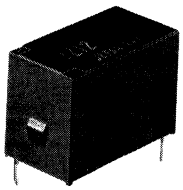
Standard Coil and Contact Combinations (20°C)

Nominal Voltage	Pull-In Voltage	Maximum Continuous Voltage	Coil Resistance ±10%, Ohms	Ordering Code 5A*	Ordering Code 3A	List Price
Standard types						
5	3.25	8.3	56	LZ-5H	LZ-5	$2.82
6	3.90	9.9	80	LZ-6H	LZ-6	$2.82
9	5.85	14.9	180	LZ-9H	LZ-9	$2.82
12	7.80	19.8	320	LZ-12H	LZ-12	$2.82
24	15.6	39.6	1280	LZ-24H	LZ-24	$2.82
48	28.8	79.2	3800	LZ-48H	LZ-48	$3.21
High sensitive types						
5	3.25	9.8	80	LZ-5HS	LZ-5S	$2.90
6	3.90	11.7	110	LZ-6HS	LZ-6S	$2.90
9	5.85	17.6	250	LZ-9HS	LZ-9S	$2.90
12	7.80	23.4	440	LZ-12HS	LZ-12S	$2.90
24	15.6	45.6	1780	LZ-24HS	LZ-24S	$2.90
Latch types						
5	3.4	NA	12	LZL-5H	LZL-5	$4.14
6	4.1	NA	17.5	LZL-6H	LZL-6	$4.14
9	6.2	NA	40	LZL-9H	LZL-9	$4.14
12	8.1	NA	70	LZL-12H	LZL-12	$4.14
24	16.2	NA	275	LZL-24H	LZL-24	$4.14
48	32.3	NA	1000	LZL-48H	LZL-48	$4.14
60	40.4	NA	1500	LZL-60H	LZL-60	$4.14

* Add $0.10 to List Price

JY/JZ RELAYS





5 Amp SPST-NO
L — 0.787″,
W — 0.394″,
H — 0.504″

CONTACT DATA

Arrangement — 1 Form A (SPST-N.O.)

Material & Rating —
JY-( )H, JY-( ) — Gold plated silver cadmium oxide alloy
JY-( )H — 5A, 30V DC or 250V AC resistive
JY-( ) — 3A, 30V DC or 250V AC resistive
JZ-( )H, JZ-( ) — Silver cadmium oxide alloy
JZ-( )H — 5A, 30V DC or 250V AC resistive
JZ-( ) — 3A, 30V DC or 250V AC resistive

Life Expectancy — Mechanical — 20 million operations
Electrical — 100,000 operations at rated load

COIL DATA

Voltage — JY- 4.5 to 24V DC
JZ- 4.5 to 48V DC

Power (at 20°C) — JY- Nominal 0.2W
JZ- Nominal 0.36W
JY- Operate 0.098W
JZ- Operate 0.165W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000MΩ at 500V DC

Dielectric Strength — JY- 750V AC (50/60 Hz) between open contacts
JZ- 1000V AC (50/60 Hz) between open contacts
2000V AC (50/60 Hz) between coil and contacts

Surge Strength — 6000V (1 x 40μs)

Temperature Range (at Nominal Voltage) —
JY- −40°C to +80°C — Non-carrying condition of contacts
JZ- −40°C to +70°C — Non-carrying condition of contacts

Time Value — Operate Max. 10ms
Release Max. 10ms

Weight — 5gr (Approx.)

Enclosure — PBT

Standard Coil and Contact Combinations

Nominal Voltage	Operate Voltage	Maximum Continuous Voltage	Coil Resistance	Ordering Code	List Price
5	3.5	11.5	125	JY-5-H-K	$3.70
6	4.2	13.8	180	JY-6-H-K	$3.70
9	6.3	20.7	405	JY-9-H-K	$3.70
12	8.4	27.6	720	JY-12-H-K	$3.70
18	12.6	41.4	1620	JY-18-H-K	$3.70
24	16.8	55.2	2880	JY-24-H-K	$3.70
5	3.4	8.5	69	JZ-5-H-K	$3.56
6	4.0	10.2	100	JZ-6-H-K	$3.56
9	6.1	15.3	225	JZ-9-H-K	$3.56
12	8.1	20.4	400	JZ-12-H-K	$3.56
18	12.2	30.6	900	JZ-18-H-K	$3.56
24	16.3	40.8	1600	JZ-24-H-K	$3.56
48	32.6	81.6	6400	JZ-48-H-K	$4.14
JY or JZ Socket				JK-4N	$1.41

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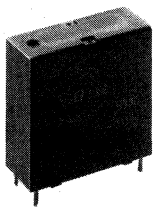
TAKAMISAWA ELECTRIC CO. LTD.

Sub Miniature General Purpose Relays

VG RELAY

L — 0.925″,
W — 0.386″,
H — 0.984″



CONTACT DATA

Arrangement — 1 Form C (SPDT)

Material & Rating —
VG-( )H, — Silver alloy 5A 24V DC or 120V AC resistive
VG-( ), VG-( )S — Silver alloy 3A 30V DC or 120V AC resistive
VG-( )L, VG-( )LS — Gold overlaid silver alloy 1A 30V DC or 120V AC resistive

Life Expectancy — Mechanical: 10 million operations
Electrical: 100,000 operations at rated load
30,000 operations at TV Rating

COIL DATA

Voltage — 5 to 48V DC (High sensitive type — to 24V DC)

Power (at 20°C) — Standard type: operate 0.18 ~ 0.2W
nominal 0.36 ~ 0.4W
High sensitive type: operate 0.1 ~ 0.13W
nominal 0.2 ~ 0.26W

Max. Operate (at 20°C) — 70% of nominal voltage

Duty — Continuous

GENERAL DATA

Insulation Resistance — Min. 1000 MΩ at 500V DC

Dielectric Strength — 750V AC (50/60 Hz) between open contacts
4000V AC (50/60 Hz) between coil and contacts

Surge Strength — 7000V (1 × 40 μs)

Temperature Range (at Nominal voltage) —
Standard type −40°C to +75°C } Non-carrying condition
High sensitive type −40°C to +85°C } of contacts

Time Value (at Nominal voltage) — Operate Max. 8 ms
Release Max. 5 ms

Mounting — For direct printed circuit mounting on grid spacing of 2.54 mm (0.1 in.) up to board thickness of 2 mm (0.08 in.)

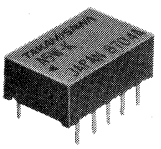
Weight — 12 gr (Approx.)

Enclosure — PBT

Coil Data			Ordering Code Gold Overlaid Silver Alloy					
Nom. Coil Voltage	Coil Resist. in Ohm ±10% at 20°C	Must operate Voltage at 20°C	5A 1 Form C	List Price	3A 1 Form C	List Price	1A 1 Form C	List Price
Standard Type								
5	69	3.5	VG- 5H	$3.56	VG- 5	$3.43	VG- 5L	$3.43
6	100	4.2	VG- 6H	$3.56	VG- 6	$3.43	VG- 6L	$3.43
9	225	6.3	VG- 9H	$3.56	VG- 9	$3.43	VG- 9L	$3.43
12	400	8.4	VG-12H	$3.56	VG-12	$3.43	VG-12L	$3.43
18	870	12.6	VG-18H	$3.56	VG-18	$3.43	VG-18L	$3.43
24	1450	16.8	VG-24H	$3.56	VG124	$3.43	VG-24L	$3.43
48	6000	33.6	VG-48H	$4.40	VG-48	$4.27	VG-48L	$4.27
High Sensitive Type								
5	120	3.5			VG- 5S	$3.43	VG- 5LS	$3.43
6	150	4.2			VG- 6S	$3.43	VG- 6LS	$3.43
9	325	6.3			VG- 9S	$3.43	VG- 9LS	$3.43
12	575	8.4			VG-12S	$3.43	VG-12LS	$3.43
18	1400	12.6			VG-18S	$3.43	VG-18LS	$3.43
24	2230	16.8			VG-24S	$3.43	VG-24LS	$3.43

A RELAY

L—0.551″,
W—0.354″,
H—0.197″



FEATURES

- Extremely low profile, super small & high sensitive poralized relay
  Height 5 mm
  Weight approx. 1.2 gr.
- High reliability
  —Bifurcated contact
- FCC Rules & Regulations
  (Dielectric strength 1000V AC...between all conductors)
- Wide operating range
- DIL pitch terminals
- Washable type
- Latching version available

SPECIFICATIONS

CONTACT DATA

Arrangement—2FormC (DPDT)

Material—Stationary...Gold overlaid silver palladium
Movable...Silver palladium

Resistance—Max. 100mΩ (Initial)

Rating—1A 30V DC or 0.5A 125V AC (Resistive)

Life expectancy—Mechanical: Min 100 million operations
Electrical: Min 500,000 operations at 1A 30V DC
: Min 200,000 operations at 0.5A 125V AC

COIL DATA

Voltages—4.5 to 24V DC

Power (at 20°C)—Operate 0.07W (0.11W for 24V coil)
Nominal 0.14W (0.2W for 24V coil)

Operate (at 20°C)—70% of nominal voltage

Duty—Continuous.

GENERAL DATA

Insulation resistance—Min. 1000MΩ at 500V DC

Dielectric strength—1000V AC between open contact, coil-contact, adjacent contact

Surge strength—1500V

Temperature range—−40°C ~+85°C at nominal voltage

Time Value (at nominal voltage)—Operate Max. 6mS Release Max. 4mS

Vibration Resistance—10 to 55Hz amplitude 3mm...Unerring
10 to 55Hz amplitude 5mm...Destructive } Reference Value

Shock Resistance—50G (11 mS)...Unerring
100G (6mS)...Destructive } Reference Value

Enclosure—PBT

Notes:
- Since this is the polarized relay, confirm the relays performance in the actual circuit, prior to use. When relays are expected to be mounted very closely together or to be used under strong magnetic fields.

ORDERING INFORMATION

Ordering Code	Nominal Coil Voltage (V, DC)	Coil Resistance ± 10% at 20°C(Ω)	Must Operate Voltage at at 20°C (V, DC)	List Price
A4.5W-K	4.5	145	3.15	5.06
A5W-K	5	178	3.5	5.06
A6W-K	6	257	4.2	5.06
A9W-K	9	579	6.3	5.06
A12W-K	12	1028	8.4	5.06
A24W-K	24	2880	16.8	5.06
A48W-K	48	7680	33.6	6.42

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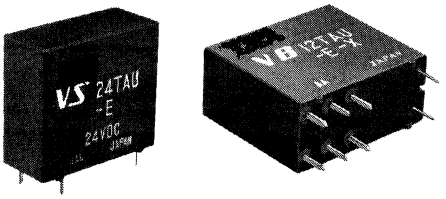
TAKAMISAWA ELECTRIC CO. LTD.

Miniature Power Relays

VB/VS RELAY

L — 1.150″
W — 0.508″
H — 0.996″



CONTACT DATA

Arrangement—1 Form A or C 15/10 Amp (VS)
2 Form C 5 Amp (VB)
Material—Silver Nickel (Standard), silver tin oxide (15A)
Rating—5 10/15 Amp at 24V DC or 240V AC
⅙ or ⅓ HP 120V AC motor load
Inrush Current — 51 or 78A at 120 V AC
Max. Carrying Current — SPDT 14A, DPDT 7A
Life Expectancy — Mechanical 5 million operations
Electrical: 100,000 operations at 5 or 10A 24V DC or 240V AC
200,000 operations at 5 or 10A 120V AC resistive
3.5 or 7A 24V DC or 240V AC
30,000 operations at ⅙ or ⅓ 120V AC motor load

COIL DATA

Nominal Voltage — 3 to 60V DC
Power (at 20°C) — Nominal: 0.72W Standard Type
0.53W High Sensitive Type
Operate: 0.35W Standard Type
0.26W High Sensitive Type
Maximum: 1.4W

GENERAL

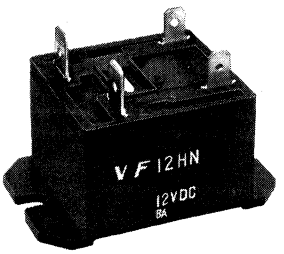
Dielectric Strength — Min. 1000V AC between open contact
Min. 5000V AC between all other conductors
Insulation Resistance — Min. 1000MΩ at 500V DC between conductors
Surge Strength — 10,000V
Temperature Range — (TV types) −40°C to +50°C
Standard types) −40°C to +65°C
(Sensitive types) −40°C to +75°C
Enclosure — Polycarbonate

Standard Coil and Contact Combinations

Type	Nominal Voltage DC (V)	Coil Resistance −10% at 20°C (V)	Must Operate Voltage at 20°C (V)	Ordering Code	List Price
Standard Types					
SPST-NO	5	36	3.5	VS- 5TBU-NR	$4.18
	6	50	4.2	VS- 6TBU-NR	$4.18
	12	200	8.4	VS-12TBU-NR	$4.18
	24	820	16.8	VS-24TBU-NR	$4.18
SPDT	5	36	3.5	VS- 5TBU-E	$4.36
	6	50	4.2	VS- 6TBU-E	$4.36
	12	200	8.4	VS-12TBU-E	$4.36
	24	820	16.8	VS-24TBU-E	$4.36
DPDT	5	36	3.5	VB- 5TBU-E	$4.71
	6	50	4.2	VB- 6TBU-E	$4.71
	12	200	8.4	VB-12TBU-E	$4.71
	24	820	16.8	VB-24TBU-E	$4.71
High Sensitive Type					
SPDT	5	47	3.5	VS- 5STBU-E	$4.58
	6	68	4.2	VS- 6STBU-E	$4.58
	12	270	8.4	VS-12STBU-E	$4.58
	24	1100	16.8	VS-24STBU-E	$4.58
DPDT	5	47	3.5	VB- 5STBU-E	$4.80
	6	68	4.2	VB- 6STBU-E	$4.80
	12	270	8.4	VB-12STBU-E	$4.80
	24	1100	16.8	VB-24STBU-E	$4.80

VF RELAY

L — 1.968″
W — 1.268″
H — 0.949″



CONTACT DATA

Arrangement — 1 Form A
Material — Silver Alloy
Rating:

Classification	Rating		Maximum Inrush Current
	Resistive	Motor Load	
H	30A 250V AC	2HP 25A 250V AC	70A 200V AC
M	25A 250V AC	1.5HP 20A 250V AC	60A 200V AC
L	20A 250V AC	1HP 15A 250V AC	55A 100V AC

Maximum Carry Current — 30A
Life Expectancy — Mechanical: 5 million operations
Electrical: 200,000 operations at motor load
100,000 operations at resistive load

COIL DATA

Nominal Voltage — 3 to 60V DC
Power (at 20°C) — Nominal: 1.2W
Operate: 0.59W
Maximum: 3.0W

GENERAL DATA

Dielectric Strength — 1200V AC between open contacts
4000V AC between all other conductors
Insulation Resistance — 1000MΩ (min.) at 500V DC
Surge Voltage — 10,000V
Timing (approx.) — Operate: 15ms at nominal
Release: 3ms at nominal
Temperature Range — −40°C to +70°C
Weight — 55 gr
Vibration — 10 - 55Hz
Shock — 20G
Enclosure — Polycarbonate

Standard Coil and Contact Combinations

Coil Data at 20°C			Ordering Code		
Nominal Coil Voltage	Coil Resistance in Ohms ±10%	Must Operate Voltage	Quick Connect Terminals	PCB Coil Terminals	List Price
6	30	4.2	VF- 6HU	VFB- 6HU	$8.80
12	120	8.4	VF-12HU	VFB-12HU	$8.80
24	480	16.8	VF-24HU	VFB-24HU	$8.80
48	1920	33.6	VF-48HU	VFB-48HU	$8.80
6	30	4.2	VF- 6MU	VFB- 6MU	$8.10
12	120	8.4	VF-12MU	VFB-12MU	$8.10
24	480	16.8	VF-24MU	VFB-24MU	$8.10
48	1920	33.6	VF-48MU	VFB-48MU	$8.10
6	30	4.2	VF- 6LU	VFB- 6LU	$7.48
12	120	8.4	VF-12LU	VFB-12LU	$7.48
24	480	16.8	VF-24LU	VFB-24LU	$7.48
48	1920	33.6	VF-48LU	VFB-48LU	$7.48

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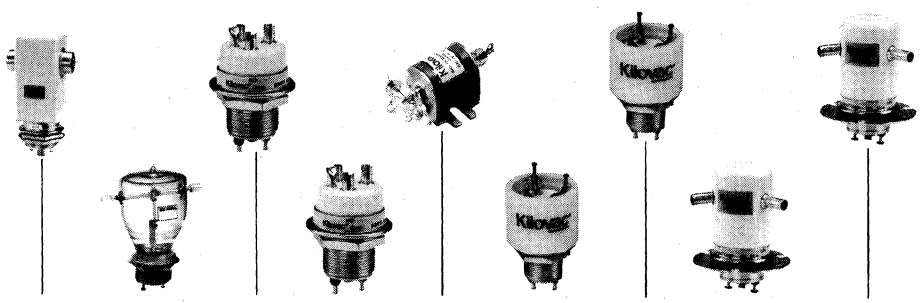
5 Jenner Street • Irvine, California • Phone: (714) 727-3001 • TWX: 910-595-1744 • Telex: 69-1389

High Voltage Relays

Applications
The capability to rapidly switch high voltages in a small package makes Kilovac® relays especially well suited for applications in ECM, communications, sonar and radar pulse forming networks, heart defibrillators and other capacitive discharge circuits, electrostatic coating equipment, laser and x-ray power supplies, digital antenna couplers (tuners), automatic dielectric-strength test equipment, and other high voltage equipment, or low voltage applications where extreme reliability is required.

Vacuum as a Dielectric
Since most high voltage arcs are initiated by ionization of the insulating medium, absence of any such medium (i.e., a hard vacuum) produces the greatest possible isolation between contact electrodes. In a vacuum of 10^{-8}mm of mercury, dielectric strengths can be achieved on the order of 2000 V/mil. A vacuum dielectric has the additional advantage of providing an inert (i.e., nonoxidizing) atmosphere in which high voltage contacts operate.

Low Contact Resistance
In conventional relays, contact resistance is variable from cycle to cycle. In Kilovac vacuum relays, it remains low and stable over the life of a relay (.015 ohms typical). Stability and low resistance are attributable to uniform cleanliness of parts, lack of oxidation or contamination, and use of only pure metals in the contact areas. Contact maintenance is never required.



Kilovac Part No.	KC-20[1A] KC-30	H-23 H-24	HC-1	HC-3[1][7]	H-4	HC-2	HC-4[1]	KC-2	KC-8[1][6]
Contact Arrangement	SPST[2]	SPST[2]	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	SPDT
Rated Operating Voltage (kVdc or 60 Hz peak)	25	30	3.5	3.5	5	8	8	15	15
Test Voltage (kVdc)	30	35	5	5	7.5	10	10	18	18
Continuous Current contacts closed, max (amps dc or 60 Hz peak)	110	30	25	18	10	25	15	50	30
Contact Resistance, max (ohms)	.005	.015	.010	.020	.02	.010	.020	.012	.025
Operate Time, max (ms)	30	30	6	6	10	6	6	18	18
Coil Resistance (ohms ±10% @ 20°C)	120	120	335	335	250	335	335	250	180
Coil Voltage [6] (Vdc, nominal)	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
Nominal Dimensions (inches)	1.31 Sq x 4.00H	2D x 3.62H	.75D x 1.50H	.75D x 1.50H	1.88L x .75H	1.13D x 1.88H	1.13D x 1.88H	1.00D x 2.50H	1D x 2.50H
Nominal Weight (oz)	10	7	1	1	1	1.25	1.25	3	3
Mounting Style	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Foot Bracket	Thr'ded Base	Thr'ded Base	Flange[3] Base	Flange[4] Base

[1] Suitable for power switching applications. Consult factory for details.
[1A] Also available: KC-22, KC-32, KC-28 and KC-38 for power switching
[2] KC-20 SPST-NO, KC-30 SPST-NC, H-23 SPST-NC, H-24 SPST-NO
[3] For threaded base, use P/N KC-11
[4] For threaded base, use P/N KC-12
[6] 12 Vdc and 115 Vdc coils available for most relays

Send for Kilovac catalog

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Kilovac® Corporation

High Voltage Relays

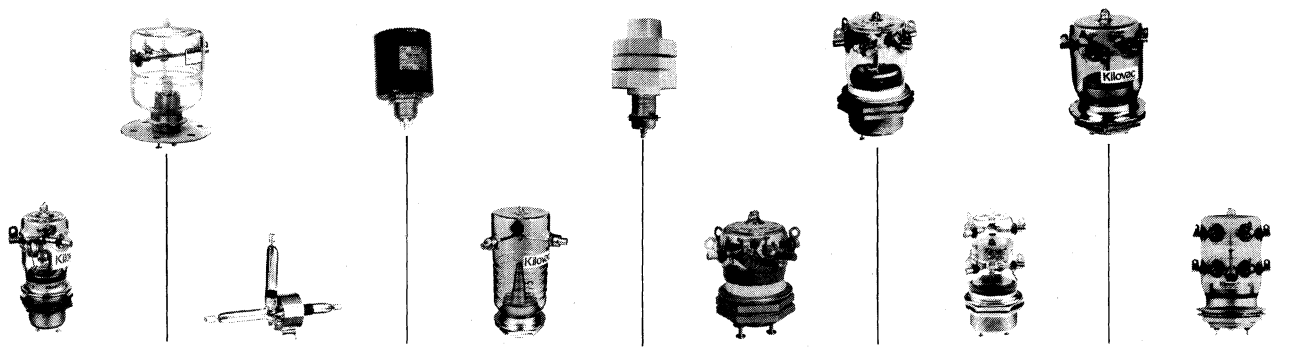
Small Size and Weight
The small contact gap and short contact travel possible with a vacuum dielectric result in minimal package size and weight.

Safety
Because contacts are sealed within the high voltage envelope, switching may be safely accomplished in explosive atmospheres.

Fast Switching Time
10 ms typical, due to small contact gap and short armature travel.

Electronegative Gas as a Dielectric
Kilovac gas-filled relays are pressurized with an electronegative gas mixture. This insulating medium offers several advantages, including high voltage isolation capability in a compact package. The primary advantage is its ability to suppress arcing in heart defibrillator and other capacitive discharge circuits.

Kilovac Medical Relays
Since 1964 Kilovac has produced and delivered thousands of high voltage relays especially designed for heart defibrillators. Kilovac produces several models of patient relays, safety discharge relays, and ECG relays, as well as a multifunction relay capable of performing all of these switching functions in a defibrillator.



H-8	H-17	H-35	K61C[1]	H-25	K52C	H-18	H-14	H-16	H-19	H-26
SPDT	SPDT	SPDT	SPDT	SPDT	SPDT	DPDT	DPDT	DPDT	DPDT	4PDT
15	25	35	35	50	100[5]	8	12	12	20	15
20	30	40	40	60	110[5]	10	15	15	25	17
15	30	10	10	30	1	10	30	30	30	30
.015	.015	.015	0.5	.015	2.0	.020	.015	.030	.015	.020
15	25	30	15	60	30	15	20	20	30	30
265	120	50	180	120	28	250	120	120	225	130
26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5	26.5
1D x 3H	2.38D x 3.57H	8.25L x 5.75H	2.0x 2.8H	3D x 7.5H	3.8D x 6.0H	1.03D x 1.97H	1.29D x 2.77H	1.03D x 3.26H	1.80D x 3.25H	1.80D x 4.31H
3	5	15	12	30	24	4	8	5	7	16
Thr'ded Base	Flange Base	Foot Bracket	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base	Thr'ded Base

[5] In Oil
[7] For Gas-Filled version, use P/N HC-5
[8] For Gas-Filled version, use P/N HC-15

Send for Kilovac catalog

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Kilovac® Corporation

Kilovac® High Voltage Relays

KILOVAC'S NEW K40 AND K80 SERIES RELAYS

The new Kilovac K40 and K80 series represent major advances in high voltage vacuum relay technology. Low cost, improved packaging, and high reliability make these relays the ideal choice in your high voltage and RF power applications. The Kilovac K40 series is available with up to 10 kV isolation, 15 amps dc continuous current carry, and RF ratings to 32 MHz. These relays can provide your antenna coupler, RF transmitter or frequency agile communication system with that necessary competitive edge.

The Kilovac K80 series represents a first in compact high voltage *and* high current printed circuit board mountable relays. With its unique package design, the K80 series weighs only 1.5 oz (42 gr) and occupies only 1.74 in² (11.21 cm²) of board space. The K80 series 8 kV rating (10 kV test voltage) and up to 10A current carry surpass the ratings available in any other PCB mountable relay. The K80 is available with high voltage flying leads for ease of design or, as an option, with the high voltage on the PC board terminals. The K80 series relays are built to the same tough military specifications as the K40 series.

The Kilovac Advantage

Kilovac has specialized in the manufacture of high voltage vacuum and gas-filled relays for over 20 years. It's our only business. We want to be your choice for high voltage relays; therefore, we maintain small quantities of the most commonly used K40 and K80 series in stock for immediate shipment. Call Kilovac for your special applications and unique design problems. Our factory sales engineers or our worldwide sales representative force will give you prompt and thorough assistance.

POWER SWITCHING

Kilovac K40 and K80 relays were specially designed for power switching applications—applications which require rugged relay life such as capacitive discharge circuits, pulse forming networks, and safety bleeder switches. Figure 1 shows the predicted electrical life for K40 and K80 SPST-NO relays for the contacts making a resistive load. Since circuit conditions vary widely, this figure can be considered a general guide only. Please contact the factory with your design requirements.

Hot Switching Resistive Load-Life Characteristics
K41A, K43A, K81A Relays

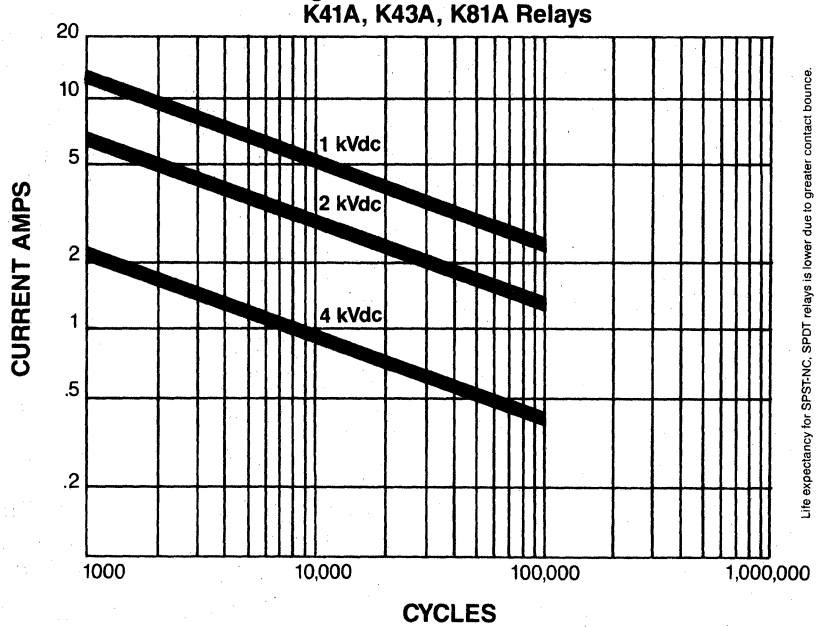

Figure 1

K80 SERIES RELAYS

In response to the need for printed circuit board mounted high voltage relays, Kilovac has introduced the K80 series. With a footprint up to 47% smaller than a high voltage reed relay, the K80 series provides many times the power handling ability of a reed relay. Compare the specifications found to the right.

Complete specifications of the K80 series can be found on the following pages.

	KILOVAC K80 SERIES	HIGH VOLTAGE REED RELAY
Continuous Current Rating	10 A	3 A
Switching Current at 4 kV 100,000 operations	up to 500 mA	4 mA
Maximum Switching Current at 1 kV	up to 12 A	0.004 A
Footprint	0.78″ × 2.23″ (1.74 in²)	1.01″ × 3.31″ (3.34 in²)

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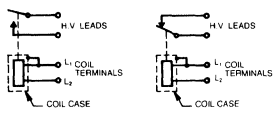
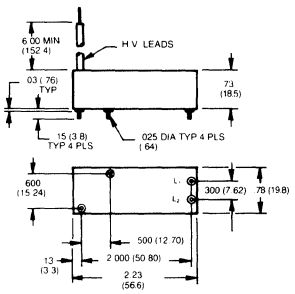
Kilovac® Corporation

K80 Series

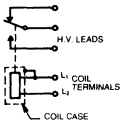
K81A, K81B 8 kV

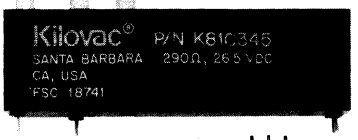


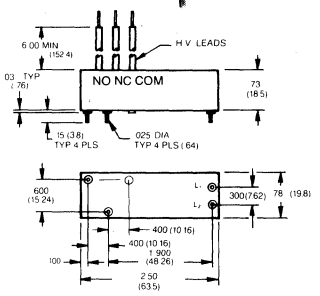


DIMENSIONS IN INCHES
(DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS)

K81C 8 kV







PART NUMBERS

	K81A	K81B	K81C
CONTACT ARRANGEMENT	SPST-NO	SPST-NC	SPDT
FORM	A	B	C
TEST VOLTAGE (dc OR 60 Hz, kV PEAK)	10	10	10
RATED OPERATING VOLTAGE (dc OR 60 Hz, kV PEAK)	8	8	8
CONTINUOUS CURRENT, CONTACTS CLOSED, MAX.* (A dc OR 60 Hz, RMS)	10	10	10
CONTACT RESISTANCE, MAX. (Ohms)	.050	.050	.050
OPERATE TIME, MAX. (ms)	10	10	10
RELEASE TIME, MAX. (ms)	10	10	10
SHOCK, 11 ms ½ SINE (PEAK G's)	30	30	30
VIBRATION, 10 G's PEAK (Hz)	55-500	55-500	55-500
OPERATING TEMPERATURE RANGE (°C)**	−55 to +85	−55 to +85	−55 to +85
MECHANICAL LIFE (OPERATIONS × 10^6)	2	2	2
WEIGHT, NOMINAL (oz)	1½	1½	2

*5A Rating for K81 Series with H.V. Terminals PC Board Mounted.
** Contact factory for ratings above 85°C.

Features:

- 8 kV Rating
- 10 A continuous current carry
- 2 × 10^6 cycles mechanical life
- Can hot switch 1 AMP or greater at 8 kV
- Can hot switch up to 500 mA 100,000 times at 4 kV
- Compact 1.75 in² footprint
- Lightweight 1.5 oz. design
- Up to 47% smaller than a high voltage reed relay
- 100 times the current rating of a reed relay in power switch applications.

K81 PART NUMBER SELECTION

K81 ___ ___ 5

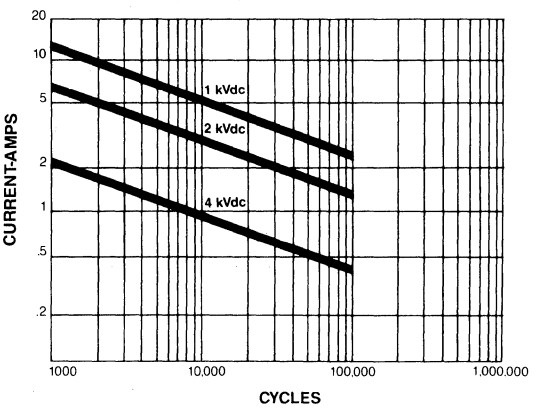
High Voltage Connections
4 = High Voltage Flying Leads (Standard)
3 = PC Board Solder

Coil Voltage
3 = 26.5 Vdc (Standard)
2 = 12 Vdc
5 = 115 Vdc (or 115 Vac with optional bridge rectifier)

Contact Arrangement
A = SPST-NO C = SPDT
B = SPST-NC

(EXAMPLE: K81B345 = SPST-NC, 26.5 Vdc coil, H.V. Flying Leads)

HOT SWITCHING RESISTIVE LOAD-LIFE CHARACTERISTICS K81A, K41A, K43A RELAYS



Life expectancy for SPST-NC, SPDT relays is lower due to greater contact bounce.

COIL DATA

Coil Voltage, Nominal (Vdc)	12	26.5	115
Pick-Up Voltage, Max. (Vdc)	8	16	80
Drop-Out Voltage (Vdc)	.5-5	1-10	5-50
Coil Resistance (Ohms ± 10%)	70	290	4700

Ratings listed are for 20°, sea level conditions.
Note: Ask for Kilovac's special catalog on K40 & K80 Series Relays.

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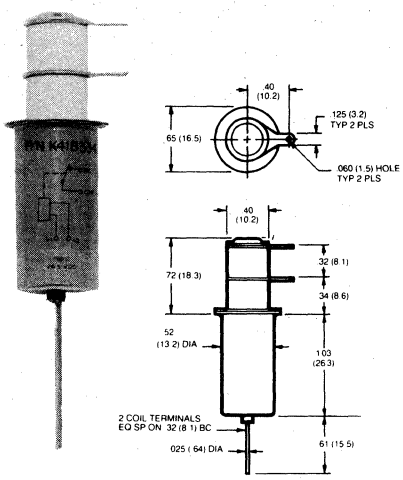
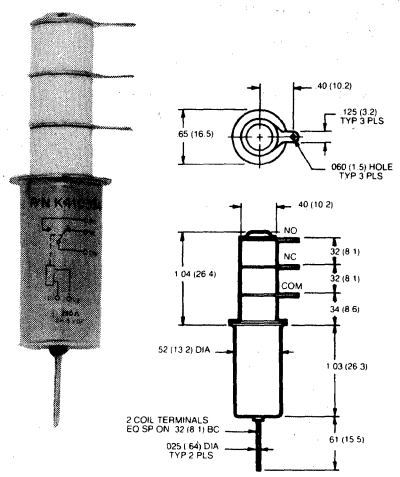
K41 Series

K41A, K41B 5 kV

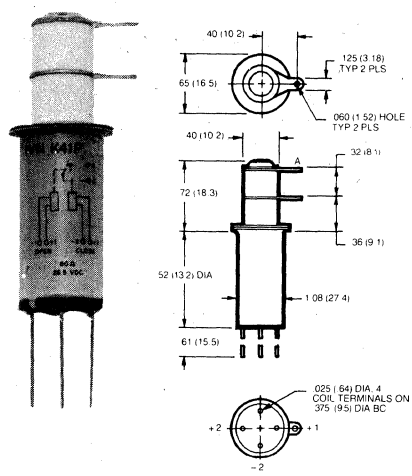


K41C 5 kV



DIMENSIONS IN INCHES
(DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS)

K41P 5 kV*



*Contact factory for 10 kV and fast operate versions

PART NUMBERS

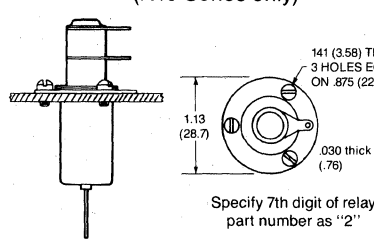
SPECIFICATIONS

	K41A	K41B	K41C	K41P
CONTACT ARRANGEMENT	SPST-NO	SPST-NC	SPDT	SPST
FORM	A	B	C	LATCHING
TEST VOLTAGE (dc OR 60 Hz, kV PEAK)	6	6	6	6
RATED OPERATING VOLTAGE (kV PEAK)				
dc or 60 Hz	5	5	5	5
2.5 MHz	4.5	4.5	4.5	4.5
16 MHz	3.5	3.5	3.5	3.5
32 MHz	2.8	2.8	2.8	2.8
CONTINUOUS CURRENT CARRY, MAX. (A RMS)				
dc OR 60 Hz	15	15	15	15
2.5 MHz	12	12	12	12
16 MHz	8	8	8	8
32 MHz	6	6	6	6
COIL HI-POT (V RMS, 60 Hz)	500	500	500	500
CONTACT CAPACITANCE (pF)				
BETWEEN OPEN CONTACTS	1.2	1.2	1.2	1.2
OPEN CONTACTS TO GROUND	1.2	1.2	1.2	1.2
CONTACT RESISTANCE, MAX. (Ohms)	0.020	0.020	0.020	0.020
OPERATE TIME, MAX. (ms)	10	10	10	6
RELEASE TIME, MAX. (ms)	10	10	10	N.A.
SHOCK, 11 ms ½ SINE (PEAK G's)	50	50	50	30
VIBRATION, 10 G's PEAK (Hz)	55-2000	55-2000	55-2000	55-2000
OPERATING TEMPERATURE RANGE (°C)	−55to+125	−55to+125	−55to+125	−55to+125
MECHANICAL LIFE (OPERATIONS × 10^6)	2	2	2	1
WEIGHT, NOMINAL (oz)	1	1	1	1

Features:

- Specifically Designed for Frequency Agile Communications Systems
- 5 kV operating voltage
- 15A Continuous Current Carry
- 6 msec operate time latching version
- RF ratings to 32 MHz
- Glazed Ceramic for low current leakage
- Flange Mounting Available
- 2 × 10^6 Mechanical Life
- Optional turret type coil terminals available upon request. See page 13 for outline drawing.

OPTIONAL FLANGE MOUNTING
(K40 Series only)



Specify 7th digit of relay part number as "2"

PART NUMBER SELECTION

K41 ___ 3 ___

Mounting Style
4 = Standard mounting
2 = Flange mounting (See Page 6)

Coil Voltage
3 = 26.5 Vdc, bus wire (Standard)
2 = 12 Vdc, bus wire
5 = 115 Vdc, bus wire
8 = 26.5 Vdc, turret terminal
7 = 12 Vdc, turret terminal
9 = 115 Vdc, turret terminal

Contact Arrangement
A = SPST-NO C = SPDT
B = SPST-NC P = SPST Latcher

(EXAMPLE: K41A334 = SPST-NO, 26.5 Vdc coil, bus wire, Standard Mounting)

COIL DATA

	K41A, B, C Contact Arrangements			K41P
Coil Voltage, Nominal (Vdc)	12	26.5	115	26.5*
Pick-Up Voltage, Max. (Vdc)	8	16	80	16
Drop-Out Voltage (Vdc)	.5-5	1-10	5-50	N.A.
Coil Resistance (Ohms ± 10%)	70	290	4700	80

Relay base should be grounded. Ratings listed are for 20°C, sea level conditions.
*6 msec Minimum Pulse. Not for Continuous Duty.
Note: Ask for Kilovac's special catalog on K40 & K80 Series Relays.

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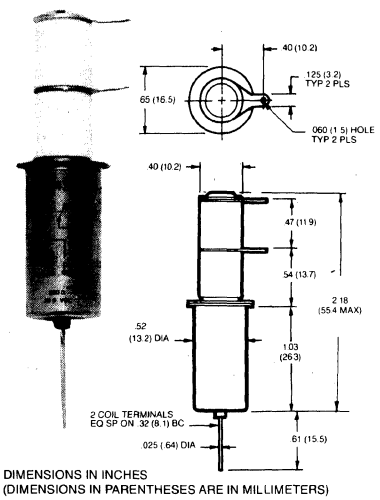
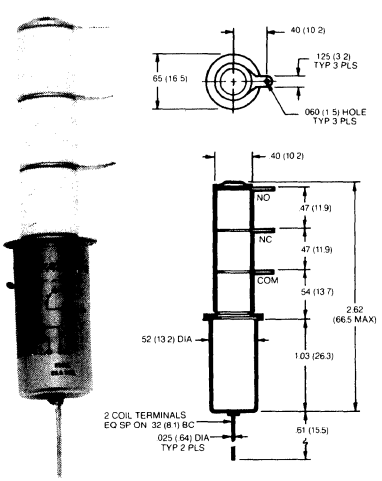
K43 and K47 Series

K43A, K43B 10 kV

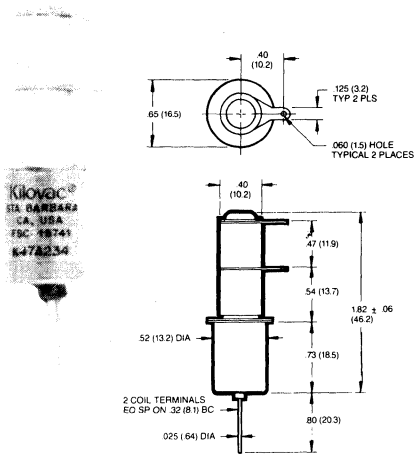


DIMENSIONS IN INCHES
(DIMENSIONS IN PARENTHESES ARE IN MILLIMETERS)

K43C 10 kV



K47A, K47B 8 kV



PART NUMBERS

SPECIFICATIONS

	K43A	K43B	K43C	K47A	K47B
CONTACT ARRANGEMENT	SPST-NO	SPST-NC	SPDT	SPST-NO	SPST-NC
FORM	A	B	C	A	B
TEST VOLTAGE (dc OR 60 Hz, kV PEAK)	11	11	11	9	9
RATED OPERATING VOLTAGE (kV PEAK)					
dc OR 60 Hz	10	10	10	8	8
2.5 MHz	7	7	7	7.5	7.5
16 MHz	6	6	6	7	7
32 MHz	4	4	4	5	5
CONTINUOUS CURRENT CARRY, MAX. (A RMS)					
dc OR 60 Hz	15	15	15	12	12
2.5 MHz	12	12	12	10	10
16 MHz	8	8	8	5	5
32 MHz	6	6	6	3	3
COIL HI-POT (V RMS, 60 Hz)	500	500	500	500	500
CONTACT CAPACITANCE (pF)					
BETWEEN OPEN CONTACTS	1.2	1.2	1.2	1.2	1.2
OPEN CONTACTS TO GROUND	1.2	1.2	1.2	1.2	1.2
CONTACT RESISTANCE, MAX. (Ohms)	0.020	0.020	0.020	0.030	.0.030
OPERATE TIME, MAX. (ms)	10	10	10	10	10
RELEASE TIME, MAX. (ms)	10	10	10	10	10
SHOCK, 11 ms ½ SINE (PEAK G's)	50	50	50	30	30
VIBRATION, 10 G's PEAK (Hz)	55-2000	55-2000	55-2000	55-1000	55-1000
OPERATING TEMPERATURE RANGE (°C)	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +125
MECHANICAL LIFE (OPERATIONS × 10^6)	2	2	2	2	2
WEIGHT, NOMINAL (oz)	1	1	1	.6	.6

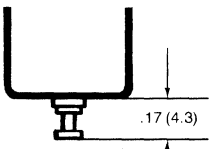
K43 Series Features:

- 10 kV operating voltage
- 15A Continuous Current Carry
- Glazed Ceramic for low current leakage
- 2 × 10^6 Mechanical Life
- Lightweight — 1 ounce
- RF ratings to 32 MHz
- Flange Mounting Available

K47 Series Features

- 8 kV ratings
- RF Ratings to 32 MHz
- 920 Ohm Coil
- Glazed Ceramic
- Short Actuator Design

OPTIONAL COIL TURRET TERMINAL (K41, K43 SERIES ONLY)



PART NUMBER SELECTION

K43
K47 — 3 — **Mounting Style**
4 = Standard mounting
2 = Flange mounting (See Page 6)

Coil Voltage
3 = 26.5 Vdc, bus wire (Standard)
2 = 12 Vdc, bus wire
5 = 115 Vdc, bus wire
8 = 26.5 Vdc, turret terminal
7 = 12 Vdc, turret terminal
9 = 115 Vdc, turret terminal

Contact Arrangement
A = SPST-NO C = SPDT
B = SPST-NC P = SPST Latcher

(EXAMPLE: K43A334 = SPST-NO, 26.5 Vdc coil, bus wire, Standard Mounting)

COIL DATA

Coil Voltage, Nominal (Vdc)	12	26.5	115
Pick-Up Voltage, Max. (Vdc)	8	16	80
Drop-Out Voltage (Vdc)	.5-5	1-10	5-50
K43 Coil Resistance (Ohms ± 10%)	70	290	4700
K47 Coil Resistance (Ohms ± 10%)	230	920	NA

Ratings listed are for 20°C, sea level conditions.
Note: Ask for Kilovac's special catalog on K40 & K80 Series Relays.

Kilovac Corporation, P.O. Box 4422, Santa Barbara, CA 93140 (805) 684-4560 TWX 910-336-1141 FAX (805) 684-9679

LEACH®

CONTROL PRODUCTS DIVISION

COMPONENTS FOR AEROSPACE ELECTRICAL POWER MANAGEMENT

TIME DELAY RELAYS • POWER MONITORS

Our reputation is built on products providing solid problem-solving capability. This began in 1919 with our first product, the break in relay, which greatly improved the efficiency of radio telegraphy.

In today's complex electrical power distribution systems, LEACH time delay relays solve sequencing problems, control "relay race" conditions and permit system tolerance of temporary nuisance signals.

Several models are electrically and physically interchangeable with widely used M6106 electromechanical relays. Our Series 6000, 7000 and 8000 provide the smallest, lightest 10 AMP, 2 and 4 pole timers in the business and are "plug compatible" with the popular MS 27400 and MS 27401 electromechanical relays. These devices combine the proven capability of industry-standard relays with highly reliable hybrid microelectronic timing circuits, screened to military standards. Most models, in our popular timing ranges, are available from our distributors for overnight delivery. Our Power Monitors and Sensors, designed to meet the requirements of the recently established specification, MIL-R-28894, constantly monitor and protect critical AC or DC circuits.

This selection guide offers a broad view of our products but for special applications or detailed specifications, please call us. Our problem solvers are anxious to work with you.

TABLE I. SPECIFYING A FIXED TIME DELAY PERIOD

LEACH and the Military identify the time delay period in the same manner. A four digit dash number specifies the delay period in milliseconds. The first three numbers are significant figures while the fourth indicates the number of zeros to follow the first three.

Examples:
—1001 = 1,000 milliseconds (1 second)
—2502 = 25,000 milliseconds (25 seconds)
—5000 = 500 milliseconds (0.5 seconds)

In the case of a repeat cycle timer (flasher), a similar method is used. The dash number indicates the length of each cycle. (Note: each cycle is 50% on, 50% off).

Examples:
—2500 = 250 milliseconds cycle or 4 cycles/sec.
—1001 = 1,000 milliseconds cycle or 1 cycle/sec.
—6002 = 60,000 milliseconds cycle or 1 cycle/min.

TABLE II. USE AND SELECTION OF ADJUSTABLE TIMERS

Adjustable timers are useful in system prototyping or breadboard circuits where the precise time delay period is unknown. By the use of an external resistor, these devices are adjustable over a specific DECADE RANGE. Although any decade range within the overall timing range can be supplied, the following ranges are offered as standards:

0.1 to 1 seconds	(Specify -1001)
1.0 to 10 seconds	(Specify -1002)
5 to 50 seconds	(Specify -5002)
50 to 500 seconds	(Specify -5003)

Note from the above that in specifying a decade range, the four digit dash number indicates the high or upper limit of the desired decade range.

The formula below provides the proper resistance value to achieve the desired time delay:

$$R_{ext} = \left(\frac{T_1}{T_0} - 1\right) 100{,}000 \text{ Ohms}$$

Where: R_{ext} = External resistance value (Ohms)
T_1 = Desired time in seconds
T_0 = Minimum time (low end of decade range) in seconds.

As an example, if using a 5 to 50 second adjustable timer and a 30 second delay is desired, the calculation is:

$$R_{ext} = \left(\frac{30}{5} - 1\right) 100{,}000 \text{ or } R_{ext} = 500 \text{ K Ohms}$$

Recommended resistors IAW MIL-R-55182 1/8 WATT, 1% (RNC6OHXXXXFS).

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LEACH®
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TIME DELAY ON OPERATE (PICK-UP)

FIXED TIME PERIOD

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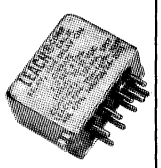
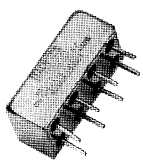
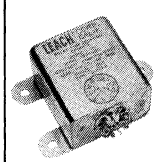
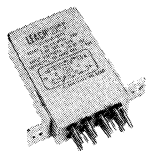
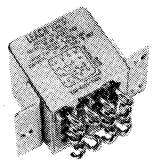
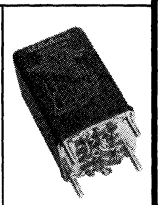

LEACH PART NUMBER	TDH-1609	TD-1435	TD-1480	TDH-6050/51	TDH-8050/51	TD-1370
MILITARY PART NUMBER	M83726/24	M83726/20	—	—	M83726/28	M83726/14
ELECTRICAL DATA						
Contact Rating—Resistive	150 mA	250 mA	2 A	10 A	10 A	10 A
Contact Form	SPST	SPST	2PDT	2PDT	2PDT	4PDT
Timing Range—Seconds	0.05 to 500	0.05 to 500	0.06 to 300	0.1 to 600	0.1 to 600	0.1 to 300
Accuracy, % (1)	±10	±10	±10	±10	±10	±10
Recycle Time, Max. (2)	10 msec	10 msec	50 msec	50 msec	50 msec	50 msec
Input & Control Voltage	20-32 V_{DC}	18-32 V_{DC}	18-31 V_{DC}	20-30 V_{DC}	20-30 V_{DC}	20-30 V_{DC}
Operating Current, Max.	10 mA	5 mA + Load	80 mA	150 mA	150 mA	150 mA
Control Current, Max.	—	—	—	—	—	—
EMI per MIL-STD-461 (5)	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D
Dielectric Strength, Vrms: (6)						
Sea Level, 60Hz	1,000	1,000	1,000	1,000	1,000	1,250
80,000 Ft., 60 Hz	—	350	350	350	350	350
Insulation Resistance megohms @ 500 V_{DC} (6)	1,000	1,000	1,000	1,000	1,000	1,000
ENVIRONMENTAL DATA						
Operating Temperature, °C	−55 to +125	−55 to +125	−65 to +125	−55 to +125	−55 to +125	−55 to +85
Vibration:						
Sine, G's	20	30	20	20	30	20
Random, G^2/Hz	—	—	—	0.2	0.4	0.4
Shock, G's	1,100	1,100	50	100	100	100
Acceleration, G's	100	100	50	20	15	—
Seal	Hermetic	Hermetic	Potted	Hermetic	Hermetic	Potted
MECHANICAL DATA						
Weight, Oz., Max.	0.56	0.5	4.0	1.9	2.5	10.0
Dimensions, In., Max.	.810 × .410	.810 × .410	1.59 × 1.00	1.025 × .525	1.025 × 1.025	1.531 × 1.531
L × W × H	× 6.40	× .310	× 1.75	× 1.520	× 1.010	× 2.34
Terminal Types (3)	TM	PC, SH	SH	TDH-6050 = PI TDH-6051 = SH	TDH-8050 = PI TDH-8051 = SH	SH
Mating Socket P/N	(3)	—	—	S0-1055-8690	S0-1048-8308	—

NOTES:

(1) The accuracy specification applies for any combination of temperature and voltage. For units with a timing range less than 1 second, add ±10 milliseconds to the ±% tolerance.

(2) Recycle time is that action which must occur to assure a new timing cycle can be completed within tolerance:

A. TD on Operate — Remove power from input terminals for the period specified.

B. TD on Release — Apply power to the control terminal for the period specified.

C. "True" TD on Release — Apply power to the input terminals for the period specfied.

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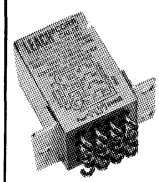
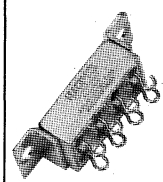
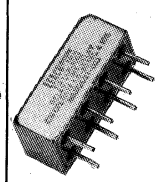
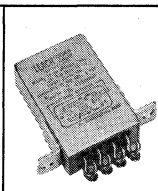
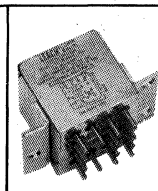
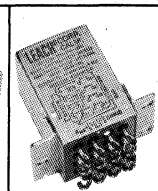
TIME DELAY ON OPERATE (PICK-UP)

	FIXED TIME PEDIOD	REPEAT CYCLE TIMER	ADJUSTABLE TIME PERIOD			
						
LEACH PART NUMBER	TDH-7050/51	TD-1412	TD-1436	TDH6060/61	TDH-8060/61	TDH-7060/61
MILITARY PART NUMBER	–	M83726/22	M83726/21	–	M83726/30	–
ELECTRICAL DATA						
Contact Rating—Resistive	10 A	250 mA (4)	250 mA	10 A	10 A	10 A
Contact Form	4PDT	SPST	SPST	2PDT	2PDT	4PDT
Timing Range—Seconds	0.1 to 600	1 cycle/min. to 10 cycles/second	0.05 to 500	0.1 to 600	0.1 to 600	0.1 to 600
Accuracy, % (1)	±10	±10	±10	±10	±10	±10
Recycle Time, Max. (2)	50 msec	10 msec	10 msec	50 msec	50 msec	50 msec
Input & Control Voltage	20-30 V_{DC}	18-32 V_{DC}	18-32 V_{DC}	20-30 V_{DC}	20-30 V_{DC}	20-30 V_{DC}
Operating Current, Max.	150 mA	5 mA + Load	5 mA + Load	150 mA	150 mA	150 mA
Control Current, Max.	–	–	–	–	–	–
EMI per MIL-STD-461 (5)	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D
Dielectric Strength, Vrms: (6)						
Sea Level, 60Hz	1,000	1,000	1,000	1,000	1,000	1,000
80,000 Ft., 60 Hz	350	350	350	350	350	350
Insulation Resistance megohms @ 500 V_{DC} (6)	1,000	1,000	1,000	1,000	1,000	1,000
ENVIRONMENTAL DATA						
Operating Temperature, °C	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +125
Vibration:						
Sine, G's	20	30	30	20	30	20
Random, G^2/Hz	0.2	–	–	0.2	0.4	0.2
Shock, G's	100	1,100	1,100	100	100	100
Acceleration, G's	20	100	100	20	15	20
Seal	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic	Hermetic
MECHANICAL DATA						
Weight, Oz., Max.	3.0	0.5	0.5	1.9	2.5	3.0
Dimensions, In., Max. L × W × H	1.025 × 1.025 × 1.50	.810 × .410 × .310	.810 × .410 × .310	1.025 × .525 × 1.520	1.025 × 1.025 × 1.010	1.025 × 1.025 × 1.500
Terminal Types (3)	TDH-7050 = PI TDH-7051 = SH	PC, SH	PC, SH	TDH-6060 = PI TDH-6061 = SH	TDH-8060 = PI TDH-8061 = SH	TDH-7060 = PI TDH-7061 = SH
Mating Socket P/N	S0-1056-8691	–	–	S0-1055-8690	S0-1048-8308	S0-1056-8691

NOTES:

(3) Definition of terminal styles codes:
- PI = Plug-in type for use with mating relay socket.
- SH = Tinned solder hook terminals for direct hard wiring.
- PC = Tinned straight pins for printed circuit board insertion.
- TM = Compatible with M6106/23 socket module and M6106/25 mounting track.

(4) Output rating equivalent of two MS25237-387 lamps in parallel.

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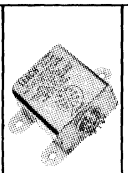
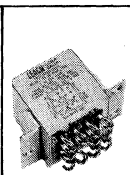
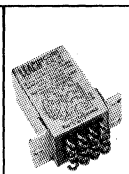
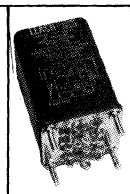
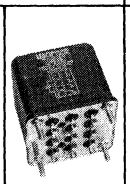
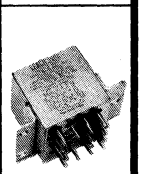
TIME DELAY ON RELEASE (DROP-OUT)

	FIXED TIME PERIOD							ADJUSTABLE TIME PERIOD
								
LEACH PART NUMBER	TDH-1610	TD-1490	TDH-6070/71	TDH-8070/71	TDH-7070/71	TD-1369	TD-1505	TDH-8080/81
MILITARY PART NUMBER	M83726/25	—	—	M83726/29	—	M83726/12	M83726/23	M83726/31
ELECTRICAL DATA								
Contact Rating—Resistive	150 mA	2 A	10 A	10 A	10 A	10 A	10 A	10 A
Contact Form	SPST	2PDT	2PDT	2PDT	4PDT	4PDT	4PDT	2PDT
Timing Range—Seconds	0.050 to 500	0.1 to 300	0.1 to 600	0.1 to 600	0.1 to 600	0.1 to 300	0.1 to 75	0.1 to 600
Accuracy, % (1)	±10	±10	±10	±10	±10	±10	±10	±10
Recycle Time, Max. (2)	10 msec	30 msec	50 msec	50 msec	50 msec	50 msec	100 msec	50 msec
Input & Control Voltage	20-32 V_{DC}	18-31 V_{DC}	20-30 V_{DC}	20-30 V_{DC}	20-30 V_{DC}	20-30 V_{DC}	20-32 V_{DC}	20-30 V_{DC}
Operating Current, Max.	10 mA + Load	150 mA	150 mA	150 mA	150 mA	150 mA	2.5 A	150 mA
Control Current, Max.	2 mA	20 mA	15 mA	15 mA	15 mA	20 mA	n/a	15 mA
EMI per MIL-STD-461 (5)	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D	Class 1D
Dielectric Strength, Vrms: (6)								
Sea Level, 60 Hz	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
80,000 Ft., 60 Hz	—	350	350	350	350	350	350	350
Insulation Resistance megohms @ 500 V_{DC} (6)	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
ENVIRONMENTAL DATA								
Operating Temperature, °C	−55 to +125	−65 to +125	−55 to +125	−55 to +125	−55 to +125	−55 to +85	−55 to +100	−55 to +125
Vibration:								
Sine, G's	20	20	20	30	20	20	20	30
Random, G^2/Hz	—	0.4	0.2	0.4	0.2	0.4	0.4	0.4
Shock, G's	1,100	50	100	100	100	100	50	100
Acceleration, G's	100	50	20	15	20	20	20	15
Seal	Hermetic	Potted	Hermetic	Hermetic	Hermetic	Potted	Potted	Hermetic
MECHANICAL DATA								
Weight, Oz., Max.	0.56	4.0	1.9	2.5	3.0	10.0	12.0	2.5
Dimensions, In., Max. L × W × H	.810 × .410 × .640	1.59 ×1.00 × 1.75	1.025 × .525 × 1.520	1.025 × 1.025 × 1.010	1.025 × 1.025 × 1.500	1.531 × 1.531 × 2.34	2.062 × 2.062 × 1.810	1.025 × 1.025 × 1.010
Terminal Types (3)	TM	SH	TDH-6070 = PI TDH-6071 = SH	TDH-8070 = PI TDH-8071 = SH	TDH-7070 = PI TDH-7071 = SH	SH	SH	TDH-8080 = PI TDH-8081 = SH
Mating Socket P/N	(3)	—	S0-1055-8690	S0-1040-8308	S0-1056-8691	—	—	S0-1040-8308

NOTES:

(5) EMI test limits will not be exceeded during the timing interval or when continuously energized under steady state conditions, per paragraph 3.23, MIL-R-83726A.

(6) Terminals X1 and X2 must be connected together during the test. Dielectric withstanding voltage and insulation resistance are measured between all mutually insulated terminals and between all terminals and case.

LEACH®
CONTROL PRODUCTS DIVISION

AC POWER MONITOR SENSOR

DESCRIPTION

The PMA-7000, PMA-8000 and PMA-9000 AC Power Monitoring Sensors have been designed with thick-film hybrid microelectronics sensing circuits and MIL-R-6106 relays, packaged in a hermetically sealed enclosure. The output of the relay will energize when: 1) each of the three phase voltages is within the under and over trip points, 2) the frequency is within the under and over trip points, 3) the phase rotation is ABC, and 4) the pickup time delay period is completed.

The output of the relay will change to, or remain in, the de-energized state when any or all of the above conditions are not met. The output will change state (energize or de-energize) after the selected time delay.

MODEL SELECTION

PMA-(7) 0 0 0 – 0 0 0 00 0

- Basic Series Designator
- Mounting Style: 0 = Standard Mount
- Phase/Frequency: 0 = 00, 400 Hz; 1 = 10, 400 Hz; 3 = 30, 400 Hz
- Pin Style: 0 = Plug-in; 1 = Solder Hook
- Frequency Bandwidth: 0 = No Frequency; 2 = ±20 Hz, 400 Hz; 3 = ±30 Hz, 400 Hz; 4 = ±40 Hz, 400 Hz; 5 = ±50 Hz, 400 Hz
- Undervoltage

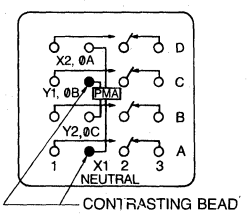
Code	Trip Point	Code	Trip Point
0	None	5	100
1	90 Vrms	6	102
2	92	7	104
3	94	8	106
4	96	8	108

- Overvoltage

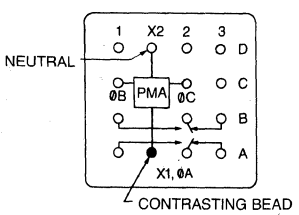
Code	Trip Point	Code	Trip Point
0	None	5	128
1	120 Vrms	6	130
2	122	7	132
3	124	8	134
4	126	9	136

- Time Delay on Operate (× 100 mS)
- Time Delay on Release (× 100 mS)

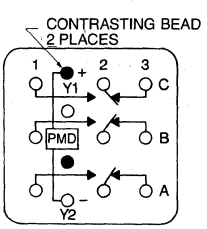
CIRCUIT DIAGRAM



AC POWER MONITOR SENSOR WITH FIXED TIME DELAY



AC POWER MONITOR SENSOR WITH FIXED TIME DELAY



DC POWER MONITOR SENSOR WITH FIXED TIME DELAY

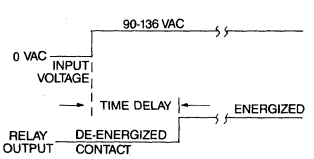
ELECTRICAL SPECIFICATIONS

Input Parameters	PMA-7000	PMA-8000	PMA-9000
Operation:			
a. Input: 10 or 30, 4 Wire	80 to 150 Vrms		
b. Under voltage trip point range	90 to 108 Vrms		
c. Over voltage trip point range	120 to 136 Vrms		
d. Voltage Hysteresis	2% Max.		
e. Frequency sensing range	350 to 450 Hz		
f. Frequency Hysteresis	2 Hz		
g. Phase Sequency sensing	ABC		
h. Operating Current per phase	75 MA, Max		
i. Accuracy - Frequency & Voltage	±2% [6]		
Timing:			
a. Operation	None, Operate and/or Release		
b. Method	Fixed Period		
c. Range: TD on Operate	0.1 to 9.9 Seconds		
TD on Release	0.1 to 0.9 Seconds		
d. Accuracy	±10% [1]		
e. Recycle Time	50 MS, Max [5]		
Transients: MIL-STD-704A, Limit 1			
a. Spike Susceptibility	+80; ±600 Volts Max		
b. Self-Generated	±50 Volts		
Electromagnetic Interference: Per MIL-STD-461A	Class 1D [3]		
Power Loss	500 Microseconds [2]		
Output (Load) Parameters	**PMA-7000**	**PMA-8000**	**PMA-9000**
Contact Form	4 PDT	2 PDT	3 PDT
Contact Rating Resistive	10 Amps	10 Amps	25 Amps
Leakage Current, Max.:			
a. at 28 Vdc and 25°C	1 Microampere		
b. at 28 Vdc and 125°C	10 Microamperes		
Dielectric Strength:			
a. @ Sea Level	1000 Vrms [4]		
b. @ 80,000 ft.	350 Vrms 60Hz		
Insulation Resistance @ 500 Vdc	1000 MEGOHMS [4]		

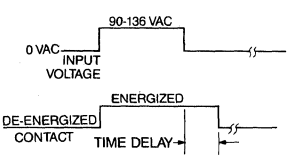
ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature Range:	
a. Operating	−55 TO +125°C
b. Non-Operating	−55 TO +125°C
Vibration:	
a. Sinusoidal, 10-3,000 Hz	30 G
b. Random, 50-2000 Hz, MIL-STD-810,	0.4G²/Hz
Shock, 0.5 MS, 1/2 Sine, 3 Axis	100 G
Acceleration, in any Axis	20 G
Life at Rated Resistive Load; Minimum	100,000 operations

TIMING DIAGRAM



TIME DELAY ON OPERATE WHEN TRIP LEVEL(S) ACHIEVED



TIME DELAY ON RELEASE WHEN TRIP LEVEL(S) ACHIEVED

NOTES

[1] The accuracy specification applies for any combination of operating temperature and voltage. For units with a timing range less than 1 second, add ±10 milliseconds to the ±10% tolerance.

[2] Transient and power loss specifications are based on a maximum duty cycle of 1/50.

[3] EMI test limits will not be exceeded during the timing interval or when continuously energized under steady state conditions.

[4] Terminals X1, X2, Y1 and Y2 must be connected together during the test. Dielectric withstanding voltage and insulation resistance are measured between all mutually insulated terminals and between all terminals and case.

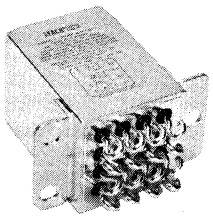
[5] Recycle time is defined as the minimum time that power must be removed to assure that the next timing cycle will be completed within the specified timing tolerance. (Units can be recycled during timing or after time-out.)

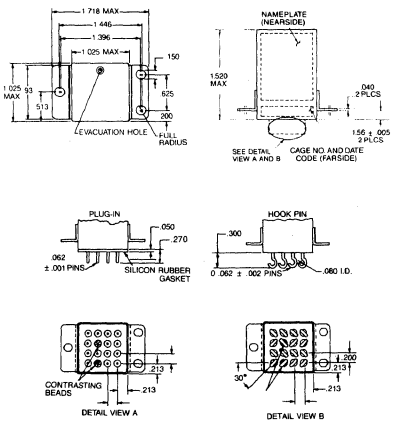
[6] Accuracy is specified measuring one parameter at a time, with all other conditions nominal. Combinations of marginal parameters may cause another ±2% variation. Frequency accuracy is ±2% at 25°C, ±4% over the entire temperature range with input voltages at 115 Vrms. Maximum variation with voltage is ±2%.

LEACH®
CONTROL PRODUCTS DIVISION

AC POWER MONITOR SENSOR

PMA-7000 SERIES, 4 PDT, 10 AMP

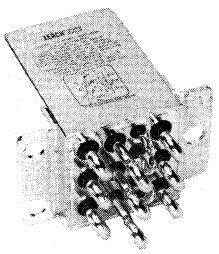


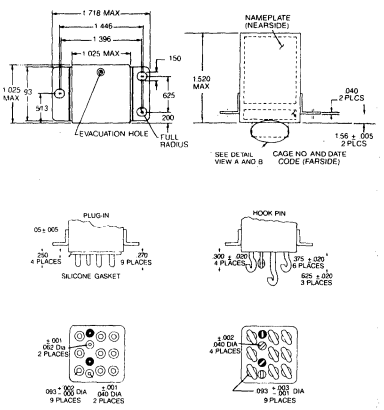


Dimensions are shown in inches.

Weight, Max.	3.0 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMA 7001 (Tin Plate) PMA 7000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1056-8691

PMA-9000 SERIES, - PDT, 10 AMP

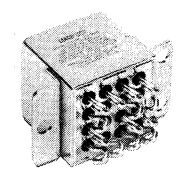


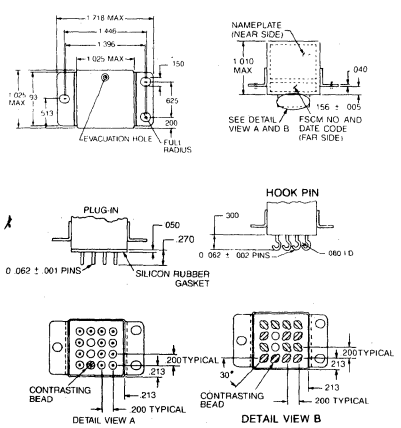


Dimensions are shown in inches.

Weight, Max.	2.5 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMA 9001 (Tin Plate) PMA 9000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1048-8308

PMA-8000 SERIES, 2 PDT, 10 AMP





Dimensions are shown in inches.

Weight, Max.	2.5 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMA 8001 (Tin Plate) PMA 8000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1048-8308

LEACH®
CONTROL PRODUCTS DIVISION

DC POWER MONITOR SENSOR

DESCRIPTION

The PMD-6000 DC, PMD-7000 DC, PMD-8000 DC and PMD-9000 DC, Power Monitoring Sensors have been designed with thick-film hybrid microelectronics sensing circuits and MIL-R-6106 relays, packaged in a hermetically sealed enclosure. The output of the relay will energize when: 1) the input voltage is within the under and over trip points, and 2) the pickup time delay period is completed.

The output of the relay will change to, or remain in, the de-energized state when any or all of the above conditions are not met. The output will change state (energize or de-energize) after the selected time delay.

FEATURES

- Small size and weight
- High-reliability design
- Hermetically sealed
- High transient immunity

MODEL SELECTION

PMD-(6) 0 0 0 — 0 0 0 00 0

Basic Series Designator

Pin Style: 0 = Plug-in
1 = Solder Hook

Frequency Bandwidth:
0 = DC

Undervoltage

Code	Trip Point	Code	Trip Point
0	None	5	23
1	18	6	24
2	20	7	25
3	21	8	26
4	22	9	27

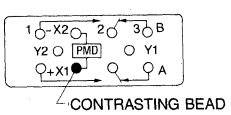
Overvoltage

Code	Trip Point	Code	Trip Point
0	None	5	33
1	29	6	34
2	30	7	35
3	31	8	36
4	32	9	38

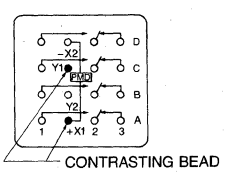
Time Delay on Operate (× 100 mS)

Time Delay on Release (× 100 mS)

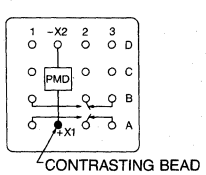
CIRCUIT DIAGRAM



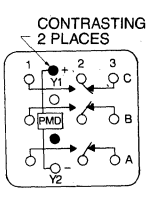
DC POWER MONITOR SENSOR WITH FIXED TIME DELAY



DC POWER MONITOR SENSOR WITH FIXED TIME DELAY



DC POWER MONITOR SENSOR WITH FIXED TIME DELAY



DC POWER MONITOR SENSOR WITH FIXED TIME DELAY

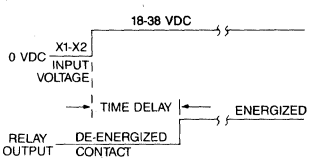
ELECTRICAL SPECIFICATIONS

Input Parameters	PMD-6000	PMD-7000	PMD-8000	PMD-9000
Operation: a. Input b. Under voltage trip point range c. Over voltage trip point range d. Voltage Hysteresis e. Operating Current f. Sensing Accuracy	18 to 38 Vdc 18 to 27 Vdc 29 to 38 Vdc 2% Max. 150 MA, Max. ±2%			
Timing: a. Operation b. Method c. Range: TD on Operate TD on Release d. Accuracy e. Recycle Time	None, Operate and/or Release Fixed Period 0.1 to 9.9 Seconds 0.1 to 0.9 Seconds ±10% [1] 50 MS, Max [5]			
Transients: MIL-STD-704A, Limit 1 a. Spike Susceptibility b. Self-Generated	+80; ±600 Volts Max ±50 Volts			
Electromagnetic Interference: Per MIL-STD-461A	Class 1D [3]			
Power Loss	500 Microseconds [2]			
Output (Load) Parameters	**PMD-6000**	**PMD-7000**	**PMD-8000**	**PMD-9000**
Contact Form Contact Rating Resistive	2 PDT 10 Amps	4 PDT 10 Amps	2 PDT 10 Amps	3 PDT 25 Amps
Leakage Current, Max.: a. at 28 Vdc and 25°C b. at 28 Vdc and 125°C	1 Microampere 10 Microamperes			
Dielectric Strength: a. @ Sea Level b. @ 80,000 ft.	1000 Vrms [4] 350 Vrms 60Hz			
Insulation Resistance @ 500 Vdc	1000 MEGOHMS [4]			

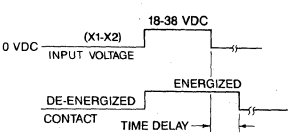
ENVIRONMENTAL SPECIFICATIONS

Ambient Temperature Range: a. Operating b. Non-Operating	−55 TO +125°C −55 TO +125°C
Vibration: a. Sinusoidal, 10-3,000 Hz b. Random, 50-2000 Hz, MIL-STD-810	30 G 0.4G²/Hz
Shock, 0.5 MS, 1/2 Sine, 3 Axis	100 G
Acceleration, in any Axis	20 G
Life at Rated Resistive Load; Minimum	100,000 operations

TIMING DIAGRAM



TIME DELAY ON OPERATE WHEN TRIP VOLTAGE REACHED



TIME DELAY ON RELEASE WHEN TRIP VOLTAGE REACHED

NOTES

[1] The accuracy specification applies for any combination of operating temperature and voltage. For units with a timing range less than 1 second, add ±10 milliseconds to the ±10% tolerance.

[2] Transient and power loss specifications are based on a maximum duty cycle of 1/50.

[3] EMI test limits will not be exceeded during the timing interval or when continuously energized under steady state conditions.

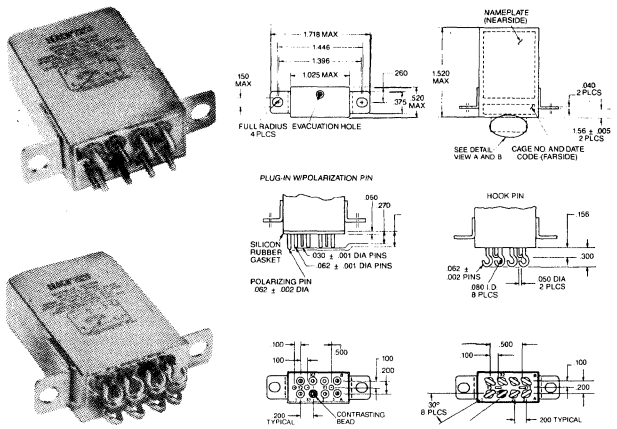
[4] Terminals X1 and X2 must be connected together during the test. Dielectric withstanding voltage and insulation resistance are measured between all mutually insulated terminals and between all terminals and case.

[5] Recycle time is defined as the minimum time that power must be removed to assure that the next timing cycle will be completed within the specified timing tolerance. (Units can be recycled during timing or after time-out.)

LEACH®
CONTROL PRODUCTS DIVISION

DC POWER MONITOR SENSOR

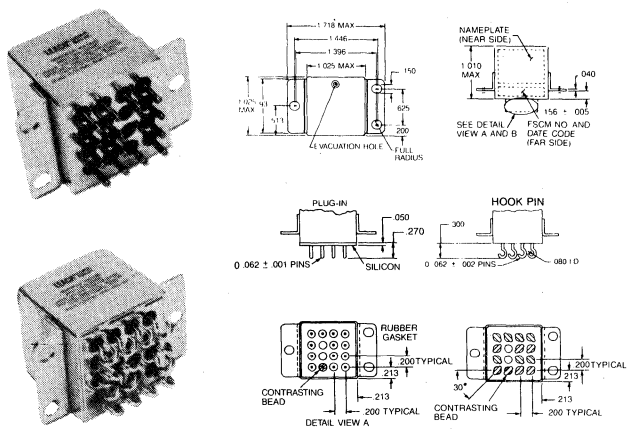
PMD-6000 SERIES, 2 PDT, 10 AMP



Dimensions are shown in inches.

Weight, Max.	1.9 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMD 6001 (Tin Plate) PMD 6000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1055-8690

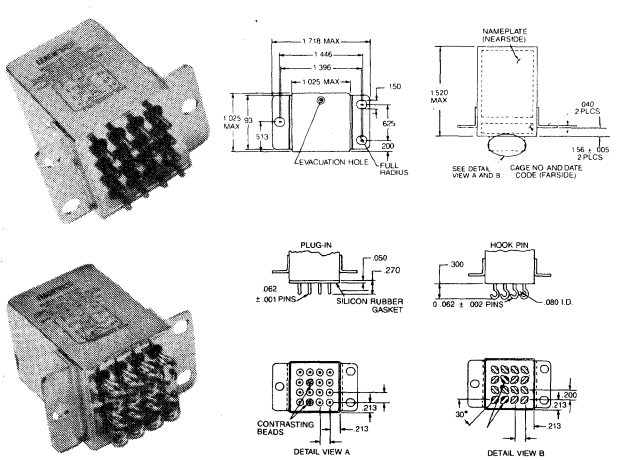
PMD-8000 SERIES, 2 PDT, 10 AMP



Dimensions are shown in inches.

Weight, Max.	2.5 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMD 8001 (Tin Plate) PMD 8000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1048-8308

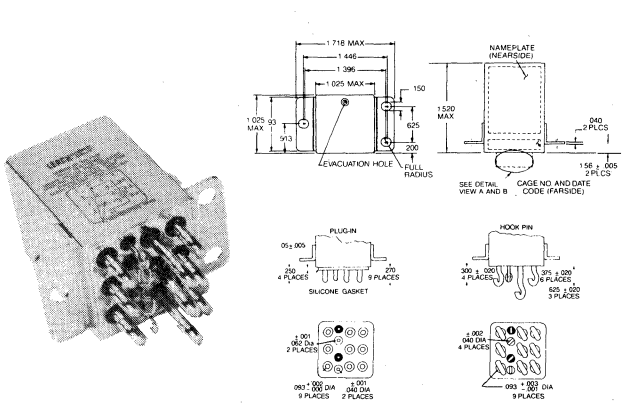
PMD-7000 SERIES, 4 PDT, 10 AMP



Dimensions are shown in inches.

Weight, Max.	3.0 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMD 7001 (Tin Plate) PMD 7000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1056-8691

PMD-9000 SERIES, 3 PDT, 25 AMP



Dimensions are shown in inches.

Weight, Max.	3.5 av. Ounce
Seal: Hermetic Tested per MIL-STD-883, Method 1014	1×10^{-8} atm, cm³/s max leakage
Finish: Per MIL-T-10727	Tin Plate
Terminals: PMD 9001 (Tin Plate) PMD 9000 (Gold Plate)	Solder-lug Plug-In* *Mating Socket P/N: S0-1058-8913

SUBMINIATURE RELAYS

Leach subminiature relays have set the industry standards for technology and reliability for decades. With their proven high performance in the most demanding applications, they are ideal for your critical subsea, shipboard, ground-based and aerospace applications.

Our Balanced Force™ subminiature relays are rugged, high-environment relays for applications where size, weight and reliability are important. For systems where size and weight are critical, our Series III subminiature relays are the smallest, lightest aircraft relays made with their contact ratings, and are 40% the size and weight of our J and K Series relays, yet offer the same high performance. Both relay types are available in a variety of terminal, mounting and operating configurations.

Dry Circuit to 12 Amp

LEACH® CORPORATION RELAY GROUP
SUBMINIATURE DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
FAX (213) 234-6461 ■ TWX (910) 321-2303
SALES DEPT. DIRECT LINE (213) 232-8228

	Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115/200 VAC 400 Hz, 3Φ (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s) — (Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, oz. (grams)
Low Level to 5A, 2PDT Non-Latch & Latch Series X, XL, XA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.410″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1064-001 (Non-Latch) DC Coil SO-1064-003 (Latch) DC Coil SO-1064-0444 (Non-Latch) AC Coil	5	3	2	1	Same as DC except inductive is 5A and motor is 3A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	DC Non-Latch 30 125 500 1600 DC Latch 730 AC Coil I, Max. .040 .024/.100	4	4	0.5	200	30 70 to 3000 Hz	.56 oz. (16 g)
Low Level to 5A, 4PDT Non-Latch & Latch Series Y, YL, YA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.810″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1066-001 (Non-Latch) DC Coil SO-1066-003 (Latch) DC Coil SO-1066-10385 (Non-Latch) AC Coil	5	3	2	1	Same as DC except inductive is 5A and motor is 3A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	DC Non-Latch 25 100 400 1275 DC Latch 600 AC Coil I, Max. .040 .030/.120	6	6	0.5	200	30 70 to 3000 Hz	1.06 oz. (30 g)
Low Level to 10A, 1PDT Non-Latch & Latch Series XC, XCL Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.410″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1064-10425 (Non-Latch)	10	6	4	2	Same as DC except inductive is 8A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC	DC Non-Latch 25 125 500 1600 DC Latch 730	6	6	1.0	200	30 70 to 3000 Hz	.56 oz. (16 g)
Low Level to 10A, 3PDT Non-Latch & Latch Series YC, YCL, YCA Series III design. 5 mounting & 3 terminal types. 0.810″ × 0.810″ × 0.640″ Designed to MIL-R-6106. Sockets available: SO-1065-001 (Non-Latch) DC Coil SO-1065-003 (Latch) DC Coil SO-1065-10392 (Non-Latch) AC Coil	10	6	4	2	Same as DC except inductive is 8A	DC Non-Latch 6 VDC 12 28 48 DC Latch 28 VDC AC Coil 400 Hz 115 50-400 Hz 115/28	DC Non-Latch 25 100 400 1275 DC Latch 600 AC Coil I, Max. .040 .030/.120	6 15	6 25	1.0	200	30 70 to 3000 Hz	1.09 oz. (31 g)
Low Level to 12A, 2PDT Non-Latch & Latch Series J, JA, JL Balanced Force* design. 5 mounting & 4 terminal types. DC — 1.015″ × 0.515″ × 1.000″ AC — 1.015″ × 0.515″ × 1.125″ Non-Latch applicable to MS27401. Latch applicable to MS27744, M6106/50. Sockets available: SO-1049-8309 (#16 Crimp) (Non-Latch) DC Coil SO-1049-8987 (#20 Crimp) SO-1049-8772 (#16 Crimp) AC-115 VAC SO-1049-8774 (#16 Crimp) 28 VAC SO-1055-8690 (#16 Crimp) (Latch) DC Coil	DC Coil 12 AC Coil 10	8	4	2	Same as DC Rating	DC Non-Latch 6 VDC 12 28 DC Latch 6 12 28 AC Coil 400 Hz 115/28 50-400 Hz 115/28	DC Non-Latch 20 80 320 DC Latch 38 150 600 AC Coil I, Max. .040/.240 .024/.100	10 10 15	10 N/A 50	1	200	30	1.4 oz. (40 g)

Dry Circuit to 25 Amp and 50 Amp

LEACH® CORPORATION RELAY GROUP
SUBMINIATURE DIVISION
5915 AVALON BLVD., LOS ANGELES, CA 90003
FAX (213) 234-6461 ■ TWX (910) 321-2303
SALES DEPT. DIRECT LINE (213) 232-8228

	Contact Rating (Amps) 28 VDC Resistive	Inductive	Motor	Lamp	115/200 VAC 400 Hz, 3Φ (Case Grounded)	Nominal Coil Voltage(s)	Coil Resistance(s) — (Ohms)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Shock, Minimum, G	Sinusoidal Vibration, Minimum, G	Weight, Maximum, oz. (grams)
Low Level to 12A, 4PDT Non-Latch & Latch Series K, KA, KL Balanced Force* design. 4 mounting & 3 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MS27400. Latch applicable to MS27745, M6106/51. Sockets available: SO-1048-8308 (#16 Crimp) (Non-Latch) DC Coil SO-1048-8518 (#20 Crimp) SO-1048-8776 (#16 Crimp) AC-115 VAC SO-1048-8779 (#16 Crimp) 28 VAC SO-1056-8691 (#16 Crimp) (Latch) DC	DC Coil 12 AC Coil 10	8	4	2	Same as DC Rating	DC Non-Latch 6 VDC 12 28 18 70 290 DC Latch 6 12 28 28 112 450 AC Coil 400 Hz 115/28 50-400 Hz 115/28 I, Max. .040/.225 .028/.120	15 15 N/A 20	15 15 N/A 50	1	200	30	DC Coil 2.5 oz. (71 g) AC Coil 2.7 oz. (77 g)
Low Level to 25A, 1PDT, Non-Latch & Latch Series JC, JCA, JCL(1)/JS, JSA (2) Balanced Force* design. 50 ADC & 80A, 400 Hz overload capabilities. JS Series 20A overload capabilities. Special Models available. 3 mounting & 3 terminal types. DC — 1.015″ × 0.515″ × 1.000″ AC — 1.015″ × 0.515″ × 1.125″ Non-Latch applicable to M6106/19. Latch applicable to M6106/20. Sockets available: SO-1063-9033 (Non-Latch) DC Coil SO-1063-9034 AC Coil SO-1063-9036 (Latch) DC Coil	(1) JC, JCA & JCL 25	12	10	5	Same as DC Rating	DC Non-Latch 6 VDC 12 28 20 80 320 DC Latch 6 12 28 38 150 600	10 10 N/A	10 10 N/A	1	200	30	1.6 oz. (45 g)
	(2) JS & JSA Series Only 115V, 60 Hz Case Grounded 10	10	8	4	N/A	AC Coil 400 Hz 115/28 50-400 Hz 115/28 I, Max. .040/.240 .024/.100	15	50				
Low Level to 25A, 3PDT Non-Latch & Latch Series KC, KCA, KCL Balanced Force* design. 50 ADC & 80A, 400 Hz overload capabilities. Special Models available. 3 mounting & 3 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MS27743. Latch applicable to MS27742. Sockets available: SO-1057-8912 (Non-Latch) DC Coil SO-1062-8917 AC Coil SO-1058-8913 (Latch) DC Coil	25	12	10	5	Same as DC except inductive 15A	DC Non-Latch 6 VDC 12 28 18 70 290 DC Latch 6 12 28 28 112 450 AC Coil 400 Hz 115/28 50-400 Hz 115/28 I, Max. .040/.225 .028/.120	15 15 N/A 20	15 15 N/A 50	1	200	30	3.0 oz. (85 g)
Low Level to 25A 3PST/NO, 2A 1PDT Aux. Non-Latch & Latch Series KD, KDA, KDL Balanced Force* design. Same design as Series KC with added auxiliary pole. Special Models available. 3 mounting & 2 terminal types. 1.015″ × 1.015″ × 1.000″ Non-Latch applicable to MIL-R-6106/13. Latch applicable to MIL-R-6106/12. Sockets available: SO-1059-8914 (Non-Latch) DC Coil SO-1061-8916 AC Coil SO-1060-8915 (Latch) DC Coil	25 Aux 2	12 Aux 1	10	5 Aux .05	Same as DC except inductive 15A	DC Non-Latch 6 VDC 12 28 18 70 290 DC Latch 6 12 28 28 112 450 AC Coil 400 Hz 115/28 50-400 Hz 115/28 I, Max. .040/.225 .028/.120	15 15 N/A 20	15 15 N/A 50	1 Aux 4	200	30	3.0 oz. (85 g)
50A 1PST-DB Non-Latch Series KM Balanced Force* design. Special models available. (For auxiliary contacts, etc., contact factory.)	50	20	20	10	N/A	DC Non-Latch 6 VDC 12 28 18 70 290	15	5	1	50	30	3.0 oz. (85 g)

*Patented and T.M. Leach Corp.

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	Contact Rating (Amps): 1 28 VDC; 2 115 VAC, 400 Hz, 1Ø; 3 115 VAC, 50/60 Hz, 1Ø — Resistive	Inductive	Motor	Lamp	Resistive 115/200 VAC, 400 Hz (Case Grounded)	Contact Configuration	Resistance, Ohms @ 25°C for 28 VDC ± 10%	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, oz./lbs.
10 Amp to 250 Amp Intelligent Switching Devices Designed to general requirements of MIL-R-6106 (contact factory for further information).									28 VDC 115 VAC					13.0 oz. to 4.0 lbs.
5 Amp, 2PDT **Series 9229** **Series 9235; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC 400 Hz. 1.750″ × 1.531″ × .687″ Applicable to MS25395, MS25321, MS25465, MS25455.	1 5 2 5 3 4	3 3 2	1.5 1.5 1	.8 .8 .6	N/A	—	9229 248Ω 9235 310Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20 9235 N/A	2	10G 55 to 2000 Hz	25	3.20 oz. 3.84 oz.
5 Amp, 4PDT **Series 9220** **Series 9228; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC 400 Hz. 1.750″ × 1.531″ × 1.032″ Applicable to MS25267, MS25268, MS25325, MS25467, MS25459.	1 5 2 5 3 4	3 3 2	1.5 1.5 1	.8 .8 .6	N/A	—	9220 248Ω 9228 200Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20 9228 N/A	2	10G 55 to 2000 Hz	25	4.9 oz. 5.76 oz.
5 Amp, 6PDT **Series 9226** **Series 9223; Magnetic Latch** Contact rating @ 28 VDC or 115 VAC, 400 Hz. 1.812″ × 1.531″ × 1.531″ Applicable to MS25269, MS25270, MS25329, MS25469, MS25463.	1 5 2 5 3 4	3 3 2	1.5 1.5 1	.8 .8 .6	N/A	—	9226 180Ω 9223 200Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20 9223 N/A	2	10G 55 to 2000 Hz	25	6.56 oz. 6.72 oz.
10 Amp, 2PDT **Series 9227** **Series 9237; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.781″ × 1.531″ × 1.032″ Applicable to MS25273, MS25323, MS25466, MS25457.	1 10 2 10 3 6	6 6 4	4 4 3	2 2 1.5	10	—	9227 175Ω 9237 200Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20 9237 N/A	2	10G 55 to 2000 Hz	25	5.28 oz. 5.44 oz.

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Contact Rating (Amps)
1 28 VDC
2 115 VAC, 400 Hz, 1Ø
3 115 VAC, 50/60 Hz, 1Ø

	Contact Rating (Amps)													
	Resistive	Inductive	Motor	Lamp	Resistive 115/200 VAC, 30 400 Hz (Case Grounded)	Contact Configuration	Resistance, Ohms ±10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, oz./lbs.
10 Amp, 4PDT **Series 9224** **Series 9225; Magnetic Latch** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.812″ × 1.531″ × 1.531″ Applicable to MS25271, MS25272, MS25327, MS25461, MS25468.	1 10	6	4	2	10	4PDT	9224 110Ω 9225 200Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20 9225 N/A	2	10G 55 to 2000 Hz	25	7.36 oz. 8.16 oz.
	2 10	6	4	2										
	3 6	4	3	1.5										
10 Amp, 2PDT **Series 9330** Contact rating @ 28 VDC or 115 VAC, 400 Hz. 1.781″ × 1.531″ × 1.032″ Applicable to MS24149.	1 10	10	6	2	10	2PDT	160Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 20 DC Coils 20	AC Coils 50 DC Coils 20	2	10G 15 to 1500 Hz	25	7.04 oz.
	2 10	10	6	2										
	3 6	4	3	1.5										
15 Amp, 4PDT **Series 9274** Contact rating @ 28 VDC or 3 phase 115/200 VAC, 400 Hz. 1.80″ × 2.06″ × 2.06″ Applicable to MS24568.	1 10	10	6	3	15	4PDT	92Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 25	AC Coils 50 DC Coils 20	N.O. 3 N.C. 5	10G 1000 to 2000 Hz	50	12.80 oz.
	2 15	10	6	3										
	3 10	6	4	2										
25 Amp **Series 9324 — 3PST/NO** 25 A @ 28 VDC or 115/200 VAC, 60 or 400 Hz. 1.47″ × 2.50″ × 2.40″ Applicable to MS27418.	1 25	15	20	10	25	3PST/NO	160Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 20	AC Coils 50 DC Coils 10	2	10G 55 to 1500 Hz	25	10.56 oz.
	2 25	25	20	10										
	3 25	25	12	10										
25 Amp **Series 9325 — 3PDT/NO** Mechanical interlock version of 9324. 3.71″ × 3.00″ × 3.20″ Applicable to MS27706.	1 25	15	20	10	25	3PDT/NO	160Ω (each coil)	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 20	AC Coils 50 DC Coils 10	5	10G 55 to 1500 Hz	25	1.4 lbs.
	2 25	25	20	10										
	3 25	25	12	10										
25 Amp **Series 9123 — 3PST/NO** 50g shock, 15g vibration. Auxiliary 5 amp contacts available. Repairable models available. 3.30″ × 3.73″ × 2.50″ Applicable to MS27997.	1 25	25	25	N/A	25	3PST/NO DB	50Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 20	AC Coils 50 DC Coils 10	2	15G 55 to 1500 Hz	50	1.25 lbs. 1.20 lbs.
	2 25	25	25	N/A										
	3 15	15	7	N/A										
25 Amp **Series 9339 — 3PST/NO** 25 A @ 28 VDC or 115/200 VAC, 60 or 400 Hz. Auxiliary Contact — 2 Amp. 1.47″ × 2.50″ × 2.40″ Applicable to M6106/41.	1 25	15	20	10	25	3PST/NO 1PDT Aux.	160Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 25 DC Coils 20	AC Coils 50 DC Coils 10	2 4 Aux.	10G 55 to 1500 Hz	25	7.04 oz.
	2 25	25	20	10										
	3 25	25	12	10										

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	Contact Rating (Amps)														
	[1] 28 VDC														
	[2] 115/200 VAC, 400 Hz, 3Ø														
	[3] 115 VAC, 50/60 Hz, 1Ø														
	Resistive	Inductive	Motor	Lamp	Resistive 220/440 VAC, 60 Hz, 3Ø (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, oz./lbs.	
25 to 100 Amp Series 9207 Unsealed rotary, 1, 2, 3 and 4 pole. Auxiliary contacts from 5 amps. Designed to MIL-R-6106. 3.62″ × 3.62″ × 2.87″ Applicable to Desc. Spec. 84192	[1] 100	100	100	N/A	50	3PST/NO DB 4PST/NO DB 2PNO 2PNC DB	44.5Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 40 DC Coils 30	AC Coils 50 DC Coils 20	10	10G 55 to 500 Hz	50	1.75 lbs.	
	[2] 100	100	100	N/A											
	[3] 50	50	50	N/A											
25 to 400 Amp Solenoid Type Power Contactors 1PST, 2PST Type shown: 3PST/NO, 25 amps. Designed to MIL-R-6106. Applicable to AN3370-1, AN3371-1, AN3380-1, MS24166-D1, MS24171-D1, MS24172-D1, MS24178-D2, MS24185-D1, MS24192-D1.	[1] 9071: 25	25	25	N/A	N/A	3PST/NO 1PDT 1PST/NO 2PST/NO	Varying	28 VDC	40	15	N/A	2G 250 to 500 Hz	25	15 oz. to 2.6 lbs.	
	[1] 7064: 50	50	50	25											
	[1] 7264: 200	100	200	N/A		1PST/NO									
	[1] 7401: 400	100	400	N/A		1PST/NO									
50 Amp Series 9124 — 3PST/NO 50g shock, 15g vibration. Auxiliary 5 amp contacts available. Repairable models available. Applicable to MS27222. 3.30″ × 3.73″ × 2.50″	[1] 50	50	50	N/A	N/A	3PST/NO DB	50Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 30 DC Coils 25	AC Coils 50 DC Coils 10	2	15G 55 to 1500 Hz	50	1.25 lbs.	
	[2] 50	50	50	N/A											
	[3] 30 Δ	30 Δ	15 Δ	N/A											
50 Amp Series 9125 — 6PST/NO Mechanical interlock version of 9124. Designed to MIL-R-6106. Aux. 5 amp contacts available. 6.21″ × 3.80″ × 2.70″	[1] 50	50	50	N/A	N/A	6PST/NO DB	50Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 30 DC Coils 25	AC Coils 50 DC Coils 10	2	10G 70 to 1500 Hz	50	2.90 lbs.	
	[2] 50	50	50	N/A											
	[3] 30 Δ	30 Δ	15 Δ	N/A											
60 Amp Series "H," "HT" "HT" — Power Transfer Model Auxiliary contacts 5 amps. Repairable models available. Basic unit: 2.50″ Dia. × 3.13″ Applicable to MS27751.	[1] 50	20	20	10	N/A	3PST/NO 3PDT 1PST/NO DB 1PST/NC DB 1PDT DB Various Aux.	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω 115 VAC, .09A	6, 12, 28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	50	AC Coils 80 DC Coils 25	3	10G 70 to 1000 Hz	50	13.5 oz.	
	[2] 60	60	40	15											
	[3] 30 Δ	30 Δ	30 Δ	N/A											
60 Amp Series "HC" Center-Off Repairable models available. Basic unit: 2.50″ Dia. × 3.13″ Applicable to MS27750.	[1] 25	15	15	10	N/A	3PDT	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω	6, 12, 28 VDC	35	25	3	10G 70 to 1000 Hz	50	14.0 oz.	
	[2] 60	60	30	15											
	[3] 30 Δ	30 Δ	30 Δ	N/A											

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	Contact Rating (Amps)														
	[1] 28 VDC														
	[2] 115/200 VAC, 400 Hz, 3Ø														
	[3] 115 VAC, 50/60 Hz, 1Ø														
	Resistive	Inductive	Motor	Lamp	Resistive 220/440 VAC, 60 Hz, 3Ø (Case Grounded)	Contact Configuration	Resistance, Ohms ± 10% @ 25°C for 28 VDC	Nominal Coil Voltage(s)	Operate Time, Maximum (MS)	Release Time, Maximum (MS)	Bounce Time, Maximum (MS)	Sinusoidal Vibration, Minimum, G	Shock, Minimum, G	Weight, Maximum, oz./lbs.	
60 Amp **Series "HL," "HLT"** **Magnetic Latch** "HLT" — Power Transfer Model Repairable models available. Basic unit: 2.50" Dia. × 3.13" Applicable to MS27749.	[1] 50	20	20	10	N/A	3PDT	6 VDC, 12Ω 12 VDC, 50Ω 28 VDC, 200Ω	6, 12, 28 VDC 15 VAC 400 Hz 115 VAC 60 Hz	35	—	3	10G 70 to 1000 Hz	50	14.0 oz.
	[2] 60	60	40	15											
	[3] 30 Δ	30 Δ	30 Δ	N/A											
100 Amp **Series "ZC"** **Center-Off** Repairable models available. Designed to MIL-R-6106. Basic unit: 3.65" Dia. × 4.28" Also available in magnetically latched model.	[1] 50	30	30	N/A	N/A	3PDT 1PDT DB NO	6 VDC, 9.3Ω 12 VDC, 38Ω 28 VDC, 150Ω 115 VAC, .09A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	60	40	4	5G 70 to 500 Hz	15	2.0 to 2.7 lbs.	
	[2] 100	100	60	N/A											
	[3] N/A	N/A	N/A	N/A											
100 Amp **Series 9213** Sealed rotary, 1, 2, 3, and 4 pole. Auxiliary contacts from 5 amps. Designed to MIL-R-6106. 4.22" × 4.23" × 4.53"	[1] 100	100	100	N/A	50	3PST/NO 4PST/NO 2PNO 2PNC DB	44.5Ω	28 VDC 115 VAC, 400 Hz 115 VAC, 60 Hz	AC Coils 40 DC Coils 30	AC Coils 60 DC Coils 20	10	10G 55 to 1500 Hz	25	2.7 lbs.	
	[2] 100	100	100	N/A											
	[3] 50	50	50	N/A											
120 Amp to 200 Amp **Series "Z," "ZG," "ZJ"** Auxiliary contacts — 5 amp. Available in many models of contact configuration. Repairable models available. Designed to MIL-R-6106. Basic unit: 3.65" Dia. × 4.28"	[1] 50	30	30	N/A	N/A	3PDT DB 3PST/NO DB SPST/NO SPST/NC DB	6 VDC, 7Ω 12 VDC, 28Ω 28 VDC, 113Ω 115 VAC, .12A	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	60	40	4	10G 70 to 1000 Hz	50	2.0 to 2.7 lbs.	
	[2] 120	120	80	N/A											
	[3] N/A	N/A	N/A	N/A											
120 Amp to 200 Amp **Series "ZL"** **Magnetic Latch** Repairable models available. Designed to MIL-R-6106. Basic unit: 3.65" Dia. × 4.28"	[1] 50	30	30	N/A	N/A	3PDT	6 VDC, 10Ω 12 VDC, 40Ω 28 VDC, 163Ω	6, 12, 28 VDC 115 VAC 400 Hz 115 VAC 60 Hz	60	N/A	4	10G 55 to 500 Hz	15	2.0 to 2.75 lbs.	
	[2] 120	120	80	N/A											
	[3] N/A	N/A	N/A	N/A											
300 Amp/400 Amp **Series A/AJ** Sealed Contactor SPST-NO. Auxiliary contacts — 5 amps. Applicable to MIL-R-6106/33. 3.64" × 3.90" × 2.80"	[1] 300	100	250	N/A	N/A	1PST/NO DB Various Aux.	60Ω	28 VDC	35	15	4	10G 70 to 500 Hz 5G 500 to 1500 Hz	25	1.75 lbs.	
	[1] 400	150	250	N/A											
	[2] N/A	N/A	N/A	N/A											
	[3] N/A	N/A	N/A	N/A											

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
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Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
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Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
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Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
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Military Qualified Products List ..... **B**•1003
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Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
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Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
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SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
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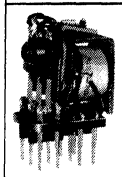
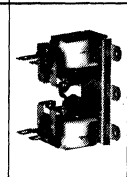
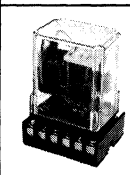
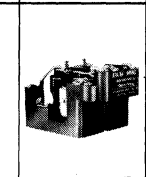
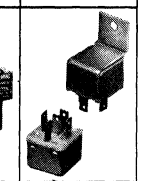
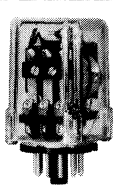
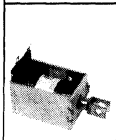
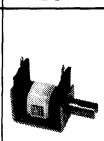
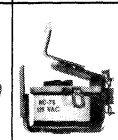
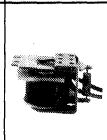
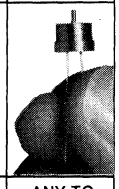
	OPEN GEN. PURPOSE	5 & 10 AMP ROUND P.I.	UNIVERSAL PLUG-IN	HERMITICALLY SEALED	LATCHING	MINIATURE POWER	GEN. PURPOSE MULTI-POLES OR LATCHING	30 AMP POWER	AUTOMOTIVE/ APPLIANCE
BASIC RELAY TYPE									
TYPICAL DIMENSIONS	W = 1.03 in. H = 1.22 in. L = 1.80 in.	W = 1.38 in. H = 2.16 in. L = 1.38 in. PINS	W = 1.52 in. H = 1.89 in. L = 1.40 in. PINS	W = 1.38 in. H = 2.19 in. L = 1.38 in. PINS	W = 1.75 in. H = 1.75 in. L = 2.75 in. OPEN	W = 1.63 in. H = 1.33 in. L = 2.16 in.	W = 1.47 in. H = 3.41 in. L = 2.63 in.	W = 2.50 in. H = 2.03 in. L = 2.31 in.	W = 1.02 in. H = 1.28 in. L = 1.02 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	SPST THRU 3PDT	1-6 PDT	SPST-NO-DB SPST-NC-DB	DPDT DPDT + 2NO DPDT + 1NO DPDT + 1NO,1NC 3PDT 2NO + 2NC	SPDT DPDT THRU SPST-NO-DM DPDT (2 AUX.)	SPST SPDT
CONT. RATING AVAILABLE (RESISTIVE)	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	5A 240VAC 10A 240VAC	15A TUNGSTEN 30A 120VAC 5A 120VAC 10A 120VAC	20A TUNGSTEN 30A 120VAC 1 H.P.	10 AMPS 15 AMPS	30A 277VAC 1 H.P.	30A RESISTIVE 24A IND AT 12VDC
COIL VOLTAGE	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-240 (DC) 6-110	(AC) 6-480 (DC) 6-110	6-24VDC

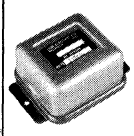
RELAYS

	SENSITIVE DC COIL	
	MKF & MKC	SK
BASIC RELAY TYPE		
TYPICAL DIMENSIONS	W = 1.38 in. H = 2.16 in. L = 1.38 in.	W = 1.38 in. H = 1.90 in. L = 1.38 in.
CONTACT ARRANGEMENT	SPST THRU 3PDT	SPDT DPDT 3PDT
CONT. RATING AVAILABLE (RESISTIVE)	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC	PILOT DUTY RATINGS 5A 240VAC 10A 240VAC
COIL VOLTAGE	1PDT-125mw 2PDT-250mw 3PDT-375mw	1PDT-60mw 2PDT-120mw 3PDT-180mw

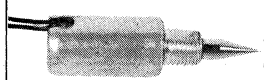
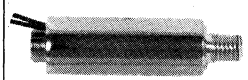
SOLENOIDS AND ACTUATORS

	D.C. OPERATED	U-FRAME	U-FRAME	U-FRAME	ACTUATOR	ACTUATOR	MINIATURE IMPULSE DUTY
	FA	DS	BR	KL	RC	RM	TO-5
BASIC SOLENOID TYPE							
OPERATING VOLTAGES	6, 12, 24, 48 AND 110VDC OTHERS AVAILABLE	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 110VDC ANY TO 240VAC	ANY TO 24VDC
DUTY Continuous	X	X	X	X	X	X	X
Intermittent	X	X	X	X	X	X	X
Pulse	X	X	X	X			X
DIMENSIONS IN INCHES	W = 1.640 H = 1.063 L = 2.125	W = 0.750 H = 1.406 L = 1.563	W = 1.000 H = 1.656 L = 1.563	W = 1.375 H = 2.063 L = 1.563	W = 0.859 H = 1.563 L = 1.375	W = 1.188 H = 1.563 L = 2.438	L = 0.500 D = 0.359
ACTION Push		X	X	X			
Pull	X	X	X	X	X	X	X

BUZZERS

	BUZZERS		
	MD	MA & MB	MC
BASIC RELAY TYPE			
TYPICAL DIMENSIONS	W = 0.88 in. H = 0.88 in. L = 1.66 in.	W = 1.03 in. H = 1.17 in. L = 2.16 in.	W = 2.84 in. H = 1.56 in. L = 3.47 in.
COIL VOLTAGE	6-240VAC	6-240VAC	6-240VAC

SOLENOIDS

	SMALL	MEDIUM
	TYPE EL	TYPE EP
BASIC SOLENOID TYPE		
DUTY Continuous	YES	YES
Intermittent	YES	YES
Impulse	YES	YES
ACTION Push	X	X
Pull	X	X
MINIMUM DIMENSIONS IN INCHES	LENGTH = 1.813 DIAMETER = 0.484	LENGTH = 2.250 DIAMETER = 0.484

LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

POWER MONITORS/AC & DC VOLTAGE MONITORS

GENERAL INFORMATION

Logitek power monitoring equipment is utilized to monitor incoming power on AC or DC power systems. When the system voltage, frequency or phase characteristics deviate from the predetermined acceptable limits, the relay de-energizes to activate an alarm indicator or system shut-down contactors. Voltage sensing is accomplished with an "RMS" type detector that is relatively insensitive to line distortion.

EQUIPMENT TYPES

Individual units monitor AC or DC voltage and line frequency for both high and low limits, and phase rotation for reversal/loss. Power monitors are also available incorporating any combination of these functions into a single unit. This equipment is available with factory set limits or as field adjustable.

OPERATING CHARACTERISTICS

When the voltage and frequency of the input signal are within prescribed high and low limits, and the phase rotation is ABC, the output relay will energize after the specified "pick-up" time delay. If the high or low voltage limits of any phase are exceeded for a time greater than the specified "drop-out" time delay, the relay de-energizes and remains de-energized until all phase voltages return within limits and remain at normal levels for longer than the specified "pick-up" time delay. If the input frequency exceeds the high or low frequency limits for a time exceeding the "drop-out" time delay, the relay de-energizes and remains de-energized until the frequency returns within limits and remains at normal levels for longer than the "pick-up" time delay. The ouput relay will not energize if the phase rotation is other than ABC or if any phase is disconnected. When the output relay is energized, loss of any phase will cause the relay to drop out immediately, overriding the time delay circuits.

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.

TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/ 230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50/60/400 Hz
Sense Voltage	As required
Sense Frequency	As required
Accuracy	±1%
Phase Sequence	ABC
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	6 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass to metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Steel case, hermetically sealed and encapsulated

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2 Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

LOGITEK

THE LOGICAL CHOICE OF THE TECHNICAL MIND

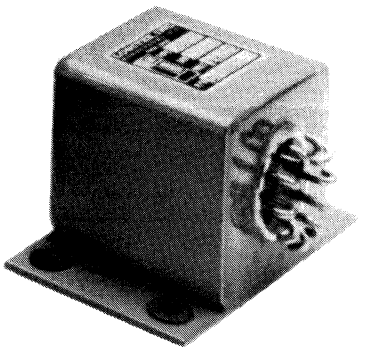
Logitek, Inc./101 Christopher St., Ronkonkoma, NY 11779-6922/Phone:516-467-4200/TWX: 510-224-6253/FAX: 516-467-4090

LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

FREQUENCY MONITORS/PHASE MONITORS

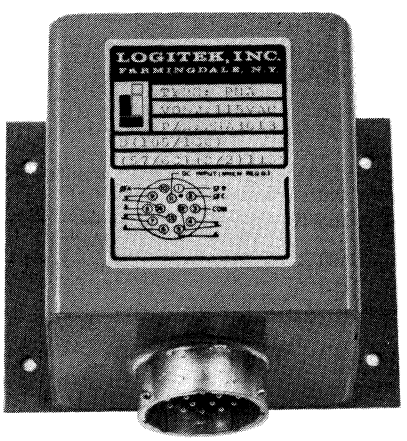
GENERAL INFORMATION



Frequency Monitors: Logitek Frequency Monitors are used in applications where electrical systems must be de-energized or alarm devices activated when the power line frequency departs from the predetermined normal range of operations.
Phase Monitors: Logitek Phase Monitors are used to protect three-phase loads, particularly rotating components, from damage resulting from phase reversals or the absence of phase. Contacts may be used to disconnect the load, to operate an alarm, or both.

OPERATING CHARACTERISTICS

Frequency Monitors: Signal voltage from the power line is applied to the designated terminals. If the line frequency is within the specified limits, the output relay energizes. If the frequency deviates from the preset limits for longer than the specified drop-out time delay, the unit de-energizes. After de-energizing, the frequency must return to within the pre-set band for longer than the pick-up time delay to re-energize the output relay.
Phase Monitors: Upon application of power, the output relay energizes if all phases are connected and the phase sequence is ABC. If any phase becomes disconnected, or if the phase rotation is abnormal, the relay immediately de-energizes.



SPECIAL PRODUCTS

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TYPICAL SPECIFICATIONS

ELECTRICAL

Input Volage	115 VAC/230 VAC
Voltage Transients	MIL-STD-704, Limits 1, 2, 3
Input Frequency	50/60/400 Hz
Sense Frequency	As required
Accuracy	±1%
Phase Sequence	ABC
Phase To Phase Balance	±0.5%
Time Delay (Pick-Up and Drop Out)	250 milliseconds to 10 seconds factory set or field adjustable
Relay Contacts	DPDT, 3PDT
Contact Rating	2 amp, 10 amp
Contact Life	50,000 operations min.
Power Dissipation	4 watts maximum

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, MS3113H-20-16PN Connector
Enclosure	Hermetically sealed and encapsulated or potted

LOGITEK
THE LOGICAL CHOICE OF THE TECHNICAL MIND

ENVIRONMENTAL

Temperature	−55°C to +125°C −40°C to +85°C −10°C to +70°C
Vibration	Per MIL-STD 810C, Method 514.2 Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

Logitek, Inc./101 Christopher St., Ronkonkoma, NY 11779-6922 / Phone: 516-467-4200/ TWX: 510-224-6253 / FAX: 516-467-4090

LOGITEK POWER PRODUCTS

THE LOGICAL CHOICE OF THE TECHNICAL MIND

TIME DELAY RELAYS • SOLID STATE FLASHERS REPEAT CYCLE & INTERVAL TIMERS

GENERAL INFORMATION

The design of complex electrical distribution systems often requires that certain operations be delayed or sustained for a precise interval of time from occurrence of a control or initializing signal. Combinations of various timing devices can be used for sequential startup or shutdown programs, load transfer or shedding, or delayed transfer to avoid race conditions. In addition, pulsers, interval timers, and flashers are used in applications, such as operating instrument panel warning lights or other annunciator devices, landing gear, door open indicators and navigation lights.

QUALITY ASSURANCE

Logitek's facilities are qualified under MIL-Q-9858A and maintains a MIL-I-45208 inspection system. These systems, along with Logitek's 100 hour burn-in cycle, contribute substantially to Logitek's uncompromising product integrity.

OPERATING CHARACTERISTICS

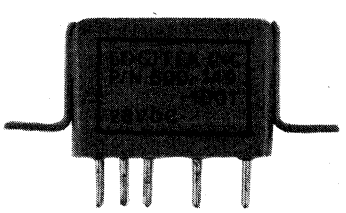
Logitek timing devices are generally CMOS integrated circuits appropriately protected from line transients and other line perturbations and either a solid state or electromechanical relay output circuit. Since there are no large capacitive timing or storage elements in these devices, recycle times (the time after control removal that will cause a new timing cycle within specified accuracy) are very short. In addition, the use of CMOS IC digital counting circuits allows the use of very stable timing elements resulting in excellent stability through wide temperature ranges.

APPLICATIONS

- Aircraft, Electrical Systems
- Mobile Radar Systems
- Equipment Test Stations
- Tanks
- Mobile Missile Launchers
- Offshore Drilling Rigs
- Computer Systems
- Shipboard Electrical Systems
- Hospital Auxiliary Power Systems

SPECIAL PRODUCTS

Logitek's engineering department is available to discuss your applications of our product or to design special equipment to satisfy your system requirements.



TYPICAL SPECIFICATIONS

ELECTRICAL

Input Voltage	115 VAC/208 VAC/ 230 VAC
Timing Range	50 milliseconds to 1000 seconds
Accuracy	±10%, ±5%, ±2%
Contacts	
Relay	DPDT
Solid State	
Radio Interference	Per MIL-1-26600

PHYSICAL

Finish	Gloss Blue #15177, in accordance with MIL-F-14072
Connector	Glass-to-metal seal solder hooks, solder pins, MIL connector, octal plug in
Enclosure	Hermetically sealed and encapsulated, Butyrate case

LOGITEK
THE LOGICAL CHOICE OF THE TECHNICAL MIND

ENVIRONMENTAL

Temperature	−55°C to +125°C −55°C to +85°C −55°C to +71°C −30°C to +30°C
Vibration	Per MIL-STD 810C, Method 514.2, Procedure I, 10-2000 Hz, 20g's
Shock	Per MIL-STD 810C, Method 516.2, Procedure I, 50g's 11 ±1 millisecond any axis
Acceleration	Per MIL-STD 810C, Method 513.2, Procedure I & II, 10g's
Humidity	Per MIL-STD 810C, Method 507.1, Procedure I
Altitude	Per MIL-STD 810C, Method 504.1, Category 6 equipment, sea level to 70,000 ft.

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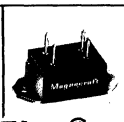
Magnecraft® ELECTRIC COMPANY

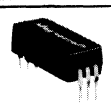
MAGNECRAFT ELECTRIC CO. 1910 TECHNY ROAD, NORTHBROOK, IL. 60062 312/564-8800•TWX:910-221-0122

Write or call for our FREE STOCK RELAY CATALOG

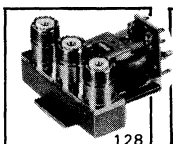
SOLID STATE

RELAY PRODUCTS AND CLASSES	Heat Sink 6	 226	232
CONTACT COMBINATIONS	SPST-NO	SPDT-NO	SPDT-NO
CONTACT RATING	2.5 to 40 Amps	7 Amps	10 Amps
COIL VOLTAGE	3-32VDC 90-280VAC	5VDC,12VDC	5VDC, 12VDC
FEATURES	2500VAC photo isolation zero crossing switching dual SCR or triac built in snubber	2500VAC photo	2500VAC photo isolation, zero crossing, triac
TERMINALS	Screw	Printed Circuit Push on connector.	Quick Connect

REED

RELAY PRODUCTS AND CLASSES	 101, 104, 131, 134	193	107, 117, 171 172, 173, 174
CONTACT COMBINATIONS	SPST-NO SPST-NC DPST-NO DPST-NC 3PST-NO	1A(or C) thru 6A(or 4C) or combinations	SPDT SPST-NC SPST-NO DPDT DPST-NO
CONTACT RATING	3VA to 50VA	Up to 10VA	1VA to 50VA
COIL VOLTAGE	5, 6, 12, 24 & 48VDC	5,6,12 or 24VDC	5, 6, 12 & 24VDC
FEATURES	Dry, Mercury wet latching, with or w/o diode, magnetic shield.	Small size, .125 or .180 pin length. Magnetic shielding	Dry or Mercury wetted, with or without diode.
TERMINALS	4, 6, 8 & 10 P.C. pins	Printed Circuit	8 or 14 pins P.C.

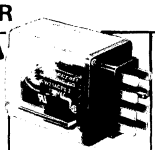
COAXIAL

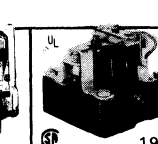
 128
SPDT
500 Watts max.
Up to 110VDC and 120VAC
Auxiliary contacts available Versatile
Integral connect-UHF,N,BNC,TUC

MIN. IND.

67
2P, 4P, 6P, 8P double throw standard, or bifurcated
3 AMP or 5 AMP
5-110VDC 120VAC
Ultra sensitive available @ 25mW per pole. solder & p.c. sockets available
Solder/plug-in or printed circuit.

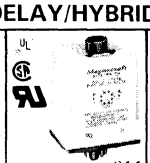
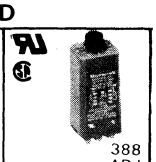
GENERAL PURPOSE AND POWER

RELAY PRODUCTS AND CLASSES	88	88UKD	 21	VDE 388
CONTACT COMBINATIONS	SPDT DPDT 3PDT	SPST-NO-DM	DPDT	SPDT DPDT 3PDT
CONTACT RATING	10Amps @ 120/240VAC or 28VDC Res.	30Amp up to 300VAC	20Amp Tungsten lamp	13Amp 12Amp 11Amp
COIL VOLTAGE	Up to 250VDC or 300VAC	Up to 300VDC or 600VAC	6VAC-240VAC 5VDC-110VDC	Up to 220VDC or 300VAC
FEATURES	Open style or Enclosed/octal plug-in style. Neon light option	High current switching in minimum space	Switches 2.4KW tungsten load. Socket available.	Standard General Purpose Relay, open, Enclosed, Flange cover or Plug-in
TERMINALS	Solder,.110 Q.C. or octal plug	Quick-connect and solder	Jones plug type	Solder,3/16,.205 1/4 Q.C. or P.C.

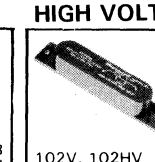
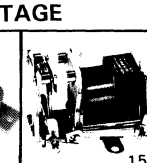
VDE 389 POWER	250	 199 POWER
SPDT, DPDT 3PDT	SPDT DPDT 3PDT	SPDT DPDT DPST-NO
20Amp	12Amp, 12Amp 10Amp	30Amps to 300VAC
Up to 300VDC or 300VAC	6VDC-110VDC 6VAC-240VAC	Up to 600VDC or 600VAC
Enclosed flange mount or open same size package as Class 388	Open or dust cover, AC or DC operation. Flange mount dust cover.	Available with auxiliary snap switch. Magnetic blow-out.
Solder,P.C. 1/4" quick-connect	Solder,P.C.3/16" Q.C.,Octal plug-in	Screws

78
4PDT
3AMP
6-110VDC 240VAC 60Hz/ 220VAC 50Hz
Indicator lamp or push to test button Mating sockets Flange cover available
Solder lug or Printed Circuit

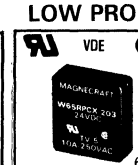
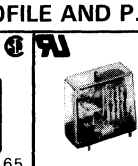
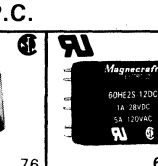
TIME DELAY/HYBRID

RELAY PRODUCTS AND CLASSES	 211	 388 ADJ.
CONTACT COMBINATIONS	DPDT	SPDT DPDT 3PDT
CONTACT RATING	10A 240VAC 120VAC 1/3HP 240VAC 1/2HP	12Amp 240VAC 1/3HP@120VAC 1/2HP@240VAC
COIL VOLTAGE	12-240VAC 12-120VDC	12-240VAC 12-120VDC
FEATURES	.1% repeatability calibrated dial slow operate, slow release, interval .1 sec. to 2 hrs.	.1% repeatability. graduated dial, slow operate slow release .1 sec. to 180 sec.
TERMINALS	Octal plug in	Plug-in .187 quick-connect

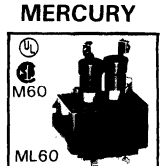
HIGH VOLTAGE

 102V, 102HV	 158
SPST-NO SPST-NC	Form Z SPDT-NC-NO (DB-DM)
50VA	200mA @ 5KV 1 A @ 1000V.
6, 12, 24 & 48VDC	24VDC, 110VDC
High voltage up to 10,000 VDC switching	High voltage up to 5000 VDC switching
Solder	Solder

LOW PROFILE AND P.C.

 65	 76	 60
SPDT	SPDT DPDT	SPDT and DPDT
10Amp	6, 10, & 16Amp	2Amps@28VDC or 120VAC
5 thru 48VDC	4.5 thru 48VDC	5-60VDC
Upright and flat-pack. Immersion proof epoxy sealed	Plastic dust cover. Switches heavy current at low coil power	Immersion cleanable. Low profile. Standard and sensitive coils. Heat resistant thermal set base
Printed Circuit	Printed Circuit	Printed Circuit

MERCURY

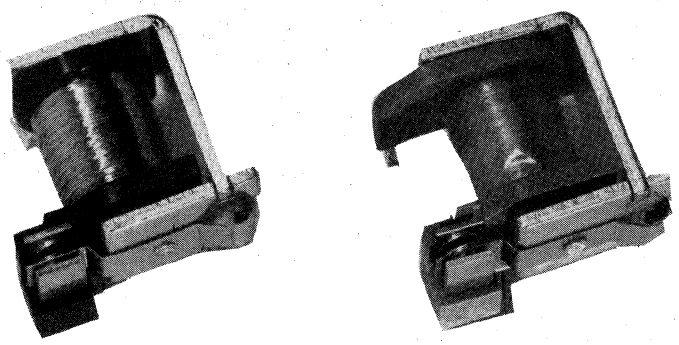
 M60 ML60
SPST DPST 3PST
60Amps @ 480VAC
6-480 AC 5-250 DC
Hermetically sealed. Silent operation Renewable contacts
Box collar

Shown Above Is A Condensed Listing Of Our Large Relay Selection

MALLORY

SERIES PCM DC COIL RELAYS

The Mallory DC coil relay is designed for direct printed circuit board mounting. 1 FORM A (SPST-NO), 1 FORM B (SPST-NC) and 1 FORM C (SPDT) circuit arrangements are available in each of two styles. Style A is designed primarily for AC loads up to 30 amps, but can be utilized for DC applications as well. Style D is designed primarily for DC loads up to 30 amps and certain low-voltage AC loads. Each style has a distinct "footprint", shown at right. A snap-on dust cover is available. Mallory relays are suited to a variety of applications including appliances, automotive, load management and heating, ventilating and air-conditioning.

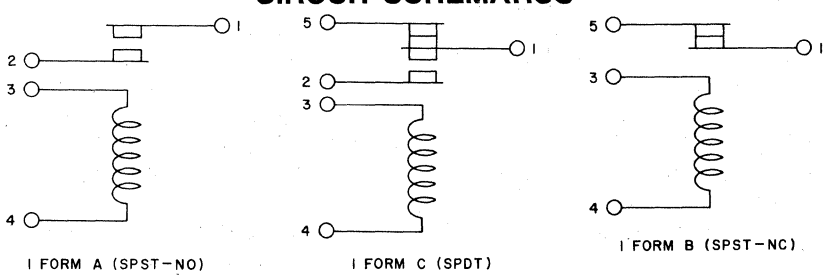


Switch Arrangements - 1 Form A (SPST-NO), 1 Form B (SPST-NC), 1 Form C (SPDT)

SWITCH RATINGS

Voltage	Load Type	Form A NO	Form B NC	Form C	
				NO	NC
AC	Inductive or Resistive	2-30 AMPS @ 12-240 VAC	2-15 AMPS @ 12-240 VAC	2-20 AMPS @ 12-240 VAC	2-10 AMPS @ 12-240 VAC
DC	Inductive	20 AMPS @ 5-28 VDC	15 AMPS @ 5-28 VDC	20 AMPS @ 5-28 VDC	10 AMPS @ 5-28 VDC
	Resistive	30 AMPS @ 5-28 VDC	20 AMPS @ 5-28 VDC	30 AMPS @ 5-28 VDC	10 AMPS @ 5-28 VDC

CIRCUIT SCHEMATICS



U.L. approval may be required for some ratings. Inquire for details.

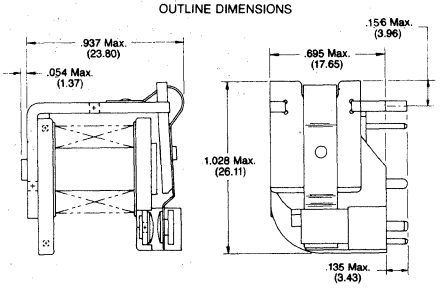
COIL DATA — Coil voltage ratings are available from 5 to 48 VDC. Consult Mallory for requirements regarding specific applications.

OPERATING DATA —
Must-Operate Voltage: Less than 70% of nominal voltage @ 25 degrees C.
Must-Release Voltage: More than 7% of nominal voltage @ 25 degrees C.

ENVIRONMENTAL DATA —
Storage: −55 to +105 degrees C.
Operating: −40 to +105 degrees C.

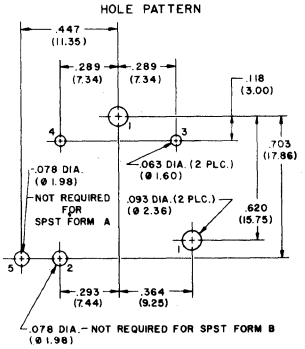
STYLE A

OUTLINE DIMENSIONS



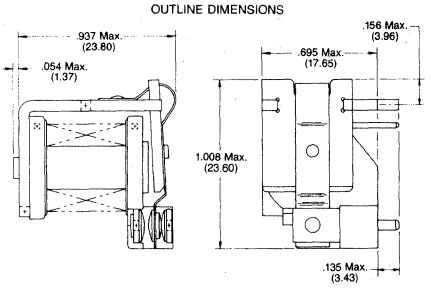
STYLE A

HOLE PATTERN



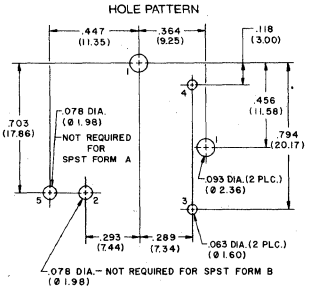
STYLE D

OUTLINE DIMENSIONS



STYLE D

HOLE PATTERN



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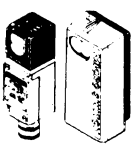
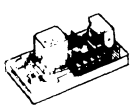
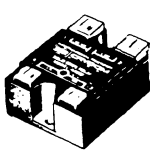
TOGGLE SWITCHES

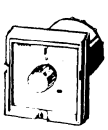

PHOTOELECTRICS

RELAYS

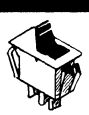

LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

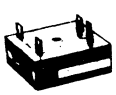
TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS


PADDLE SWITCHES

TRANSFORMERS

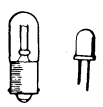

TIMERS

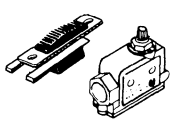
COUNTERS

FANS

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

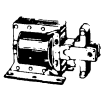
KNOBS


LAMPS & LEDS

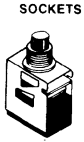

SWITCHES

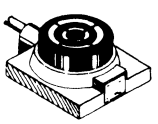
RELAYS

INDICATOR LIGHTS


SOLENOIDS

SOCKETS


PUSHBUTTON SWITCHES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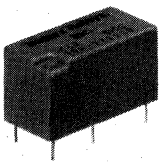
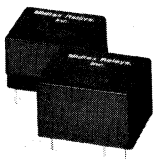
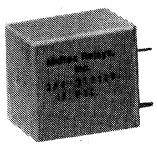
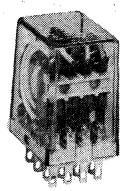
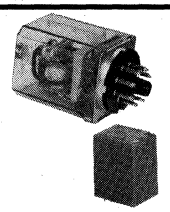
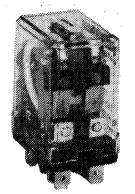
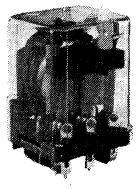
GENERAL PURPOSE RELAYS

						
SERIES	**190**	**294**	**296**	**156**	**158**	**258**
FEATURES	"The Dipper" Low level switching up to 2 amps. 16 pin dip. Sealed for PC board mounting & immersion.	Economical 3 & 5 amp switching. Designed for economy printed circuit board switching. Meets FCC Part 68 1500 VDC surge.	Economical & reliable designed for low cost PCB switching such as industrial, communications, vending or commercial equipment.	Compact & versatile 2&4 pole industrial relay. Low level switching. Available with many options.	Designed for UL Component Recognition for Motor Controllers through 240 VAC in accordance with UL Std 508, Industrial Control Equipment. Available in Octal Plug-in version.	Economical 2PDT, 10 amp rated relay, available with printed circuit terminals or 3/16", .187 quick connect terminals for plug-in socket capability or direct wiring with flange mounting option.
EPOXY SEALED	YES	YES	YES	YES	YES	NO
CONTACT ARRANGEMENTS	2 Form C 1 Form C	1 Form C	1 Form C 1 Form A	2 Form C 4 Form C	1 Form C 2 Form C Form A Form B Form X Form Y Form C (1 & 2PDT) Octal	2 Form C
CONTACT MATERIAL RATINGS	Material -100 Pal./Sil. w/gold overlay 2.0 amp, 28 VDC, resistive 2.0 amp, 120 VAC, resistive -1UO Pal./Sil. w/Gold Overlay 2.0 amp, 28 VDC, resistive -200 Pal./Sil./Gold Bifurcated 2.0 amp, 28 VDC, resistive 2.0 amp, 120 VAC, resistive	Material -100 Silver & Silver Cadmium Oxide -3 amps at 125 VAC or 30 VDC resistive -1 amp at 125 VAC or 30 VDC inductive -200 Silver Cadmium Oxide -5 amps at 125 VAC or 30 VDC resistive -1.5 amps at 125 VAC or 30 VDC inductive	Material -100 Silver/Gold flashed -3 amps at 24 VDC or 125 VAC resistive (UL) -1 amp at 24 VDC or 125 VAC inductive -1.5 amps at 250 VAC resistive -0.5 amps at 250 VAC inductive -200 Silver Cadmium Oxide 5 amps at 24 VDC or 125 VAC resistive (UL) -2 amps at 24 VDC or 125 VAC inductive -2.5 amps at 250 VAC resistive -1 amp at 250 VAC inductive -300 Silver Cadmium Oxide -10 amps at 24 VDC or 125 VAC resistive (UL) -4 amps at 24 VDC or 125 VAC inductive -5 amps at 250 VAC resistive -2 amps at 250 VAC inductive	Material -100 3/32" Silver (Gold flash) -*3 amp, 228 VDC/120 VAC, 80% pf -700 3/32" Pure fine Silver, Gold diffused -2 amp, 240 VAC, 80% pf -200 3/32" Silver Cadmium Oxide (Gold flash) -*5 amp, 28 VDC/120 VAC, 80% pf -3 amp, 24 VAC, 80% pf *1/10 horsepower, 125 VA, 120/240 VAC	Material 5/32" Silver Cadmium Oxide -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC 5/32" pure fine Silver (Gold flash) -10 amp, 28 VDC/120 VAC, 7 amp at 240 VAC; 80% pf 1/3 hp, 120/240 VAC	Material 5/32" Silver Cadmium Oxide -10 amps at 30 VDC, 120 or 240 VAC 1/3 hp at 120/240 VAC
COIL VOLTAGE	5, 6, 12, 24, 48 VDC	5, 6, 9, 12, 24, 48 DC	5, 6, 9, 12, 24, 48 DC	5, 6, 12, 24, 48, 90, 110 DC & 6, 12, 24, 48, 120, 240 AC and "Specials"	5, 6, 12, 24, 48, 90 110 (DC) 6, 12, 24, 48, 120, 240 (AC) and "Specials"	5, 6, 12, 24, 48, 110 (DC) 6, 12, 24, 120, 240 (AC) & Specials
POWER RATING	(DPDT) Nominal-550 mw Maximum continuous-1.0 w	Nominal-450 MW Maximum continuous-700 MW	Nominal-360 MW Maximum continuous-562 MW	Nominal (AC) 1.2 VA (DC) 0.9 watts Maximum continuous (AC) 2.0 VA (DC) 2.0 watts	Nominal 1.2 VA (AC) 0.9 watts (DC) Maximum continuous 2.0 VA (AC) 2.0 watts (DC)	Nominal 1.5 VA (AC), 0.9 watts (DC) Maximun continuous 2.0 VA (AC), 2.0 watts (DC)
DIELECTRIC	(Meets FCC Part 68) 1000 VAC coil to poles 1000 VAC between poles 1100 VAC across open contact (1500 VDC FCC surge)	2000 VAC coil to contacts 750 VAC across open contacts (1500 VDC FCC surge)	1500 VAC RMS 60 Hz all mutually insulated terminals (open contacts 750 VAC)	Greater than 500 VAC RMS 60 Hz across open contacts Greater than 500 VAC RMS 60 Hz all other mutually insulated elements	Greater than 500 VAC RMS 60 Hz across open contacts. Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements.	Greater than 500 VAC RMS 60 Hz across open contacts. Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements.
LIFE EXPECTANCY	**Mechanical**- in excess of 10 million operations. **Electrical**- 100,000 operations minimum at 1.0 amps.	**Mechanical**-in excess of 20 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 5 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 50 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 50 million operations **Electrical**-100,000 operations minimum at rated loads	**Mechanical**-in excess of 5 million operations **Electrical**-100,000 operations minimum at rated loads
MAX. SIZE IN INCHES (L×W×H)	.827×.410×.443	.906×.709×.575	.890×.642×.985	1.190×.859×1.281 (Dust Cover)	1.109×.859×1.281 (Dust Cover)	1.08×.830×1.36 (Plain Cover w/quick connect)
TERMINALS—PC SOLDER/PLUG-IN	Yes No	Yes No	Yes No	Yes Yes	Yes Yes	Yes Yes
OPTIONS				Opposite Polarity Barrier Push Button Diode across coil (DC only) Lamp across coil Lamp & Push Button	Opposite Polarity Barrier Push Button Actuator Diode Across Coil, DC only Lamp Across Coil Lamp & Push Button	Special Customer Requirements
AGENCY APPROVALS	UL	UL/CSA	UL/CSA	UL/CSA	UL/CSA	UL/CSA

FOR ENGINEERING ASSISTANCE CALL TOLL FREE

GENERAL PURPOSE RELAYS

1-800-MIDTEX1



157

UL recognized for motor controllers up to 600 VAC. Magnetic latching version provides switchable core which cannot be falsely latched.

NO

1 Form C
2 Form C
3 Form C
2 Form A
2 Form B
1 Form X
1 Form Y

Material
-100 1/8" Fine Silver (gold flash) 5 amp
Ratings
5 amp, 28VDC/ 120/240 VAC, 80% pf
2 amp, 480/600 VAC, 80% pf
1/8 hp, 120 VAC
1/4 hp, 240 VAC
-200 3/16" Silver Cadmium Oxide 10 amp
10 amp, 28 VDC/ 120/240 VAC, 80% pf
1/3 hp, 120 VAC
1/2 hp, 240/480/600 VAC
3 amp, 480/600 VAC, 80% pf
-300 3/16" Silver Cadmium Oxide 15 amp (UL on 1 & 2PDT only)
15 amp, 120 VAC
10 amp, 240 & 277 VAC
28 VDC
3 amp, 480/600 VAC
1/3 hp, 120 VAC
1/2 hp, 240/480/600 VAC
-700 1/8" Fine Silver Gold Diffused
5 amp, 28 VDC/ 120/240 VAC, 80% pf
2 amp, 480/600 VAC, 80% pf
1/8 hp, 120 VAC
1/4 hp, 240 VAC
All hp ratings are single phase

5, 6, 12, 24, 48, 110 (DC) & 6, 12, 24, 120, 240 (AC) & specials

Nominal-1.7 VA (1 & 2 pole AC); 2.0 VA (3 pole AC); 1.2 watts (DC)
Maximum continuous-2.7 VA (1 & 2 pole AC); 3.1 VA (3 pole AC); 1.9 watts (DC)

Greater than 750 VAC, RMS 60 Hz across open contacts.
Greater than 2500 VAC, RMS 60 Hz all other mutually insulated elements.

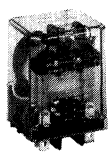
Mechanical
10 million operations
Electrical
100,000 operations at rated load.

1.400×1.525×1.905 (dust cover)

YES
YES

Lamp across coil
Class B Coil
Push Button Actuator
Open style
Varnished coil

UL/CSA



157

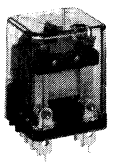
MAGNETIC LATCHING SERIES

When there is a need to conserve power, retain logic function during power outages, or improve reliability by several order-of-magnitude over outdated mechanical latching relays, the Type 157 magnetic latching state-of-the-art relay is made to order for these applications. All of the superior electrical characteristics available in the standard Type 157 relays, including 1/4" through air and 3/8" over surface spacing, are offered in the magnetic latching version. Magnetic latching is achieved by a specially designed magnet core that makes it possible to maintain a substantial magnetic force of attraction after termination of the electrical pulse that energizes the core. There are no mechanical latches associated with the design, nor permanent magnets that can result in inadvertent operation. To restore the relay to its unoperated position, a short pulse of opposite polarity and lower magnitude than the operate pulse is applied to the coil or a second concentric wound coil.

TIMING
Latching time: 13 MS nominal with a one second pulse of nominal voltage.
Unlatch time: 13 MS nominal with a one second pulse of nominal unlatch voltage after latching with a one second pulse of nominal latch voltage.
A latch pulse of 50 MS min. at nominal voltage is recommended to insure positive latching.

DESIGN & CONSTRUCTION
Insulation material, weight, marking, shock, vibration, dielectric breakdown, insulation resistance and temperature range are identical to the Type 157 relay.
UL/CSA

MAGNETIC LATCHING OPTION ALSO AVAILABLE ON 187 AND 188 SERIES



187

DPDT power relay is rated at 20 amps; DPST-NO and NC contact arrangements are rated at 25 amps. Open stud mounted or dust covered versions with 1/4" quick-connect terminals are available.

NO

2 Form C
2A, DPST
2B, DPST
1 Form X
1 Form Y

Material
-100 1/4" Diameter Fine Silver
20 amp, 28 VDC
20 amp, 120/240/277 VAC
10 amp, 480/600 VAC
3/4 hp, 120 VAC
1-1/2 hp, 240 VAC
-200 1/4" Diameter Silver Cadmium Oxide
20 amp, 28 VDC
20 amp, 120/240/277 VAC
10 amp, 480/600 VAC
3/4 hp, 120 VAC
1 1/2 hp, 240 VAC
-300 3/16" Diameter Silver Cadmium Oxide
10 amp, 28 VDC
15 amp, 120/240/277 VAC
3 amp, 480/600 VAC
1/3 hp, 120 VAC
1/2 hp, 240/480/600 VAC
-400 3/16" Silver Cadmium Oxide High Conductivity Blade
10 amp, 28 VDC
10 amp, 120/240 VAC
3 amp, 480/600 VAC
1/3 hp, 120 VAC
1/2 hp, 240/480/600 VAC
-600 1/4" Silver Cadmium Oxide
(On contacts 2A & 2B only)
25 amp, 28 VDC
25 amp, 120/240/277 VAC
10 amp, 480/600 VAC
3/4 hp, 120 VAC
1-1/2 hp, 240 VAC

5, 6, 12, 24, 48, 110, (DC) and 6, 12, 24, 120, 208, 240 (AC) and Specials

Nominal-2.7 VA (AC); 1.2 watts (DC)
Maximum continuous-3.4 VA (AC); 1.9 watts (DC)

Greater than 750 VAC RMS 60 Hz across open contacts
Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.

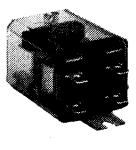
Mechanical-10 million operations
Electrical-100,000 operations at rated load

1.400×1.525×1.905

YES
YES

Class B Coil
Varnished Coil
Lamp in Parallel with Coil
Special Customer Requirements

UL/CSA



188

30 Ampere relay is an expanded version of the Type 187 20 amp 2PDT relay, utilizing a common coil/mates structure. The 188 is limited to single-pole switching, in order to provide for the 30 amp contact ratings.

NO

Form X
Form Y
Form Z

Material
-100 1/4" Silver
30 amp 120/240/277 VAC
30 amp 28 VDC
15 amp 480/600 VAC
1 hp 120 VAC, 1 phase
1-1/2 hp 240 VAC, 1 phase
-200 1/4" Silver Cadmium Oxide Ratings Identical for -100 & -200 contacts.

5, 6, 12, 24, 48, 110 (DC)
6, 12, 24, 120, 208, 240 (AC)
Special customer requirements

Nominal-2.0 VA (AC); 1.2 watts (DC)
Maximum continuous-3.1 VA (AC); 1.9 watts (DC)

Greater than 750 VAC RMS 60 Hz across open contacts
Greater than 2500 VAC RMS 60 Hz all other mutually insulated elements.

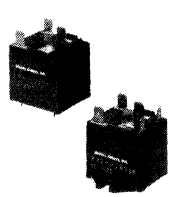
Mechanical-10 million operations
Electrical-100,000 operations at rated load

1.400×1.525×1.905

YES
YES

Lamp in parallel with coil
Class B Coil
Varnished Coil
Special Customer Requirements

UL/CSA



297

A DPST-NO 15 amp economy power relay. Available in PC circuit & quick connect combination version. Recognized under UL #508.

NO

2 Form A

Material
-200 Silver Cadmium Oxide
15 amp, 125 VAC, resistive (UL)
10 amp, 250 VAC, resistive
15 amp, 12 VDC, resistive
5 amp, 48 VDC, resistive
6 amp, 125 VAC, inductive 40% PF
4.8 amp, 250 VAC, inductive 40% PF
6 amp, 12 VDC, inductive
2 amp, 48 VDC, inductive
1 hp, 120 VAC
1½ hp, 240 VAC
50 amp, inrush 20 ms max

6, 12, 24, 48 (DC)

Nominal-1.0 watts
Maximum continuous-1.30 watts

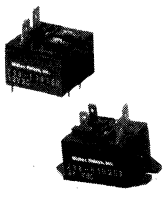
1500 VAC coil to contacts and between poles; 600 VAC across open contacts.

Mechanical-In excess of 500,000 operations
Electrical-200,000 operations minimum at rated loads

1.378×1.197×1.181

PC & Quick Connects In Combination

UL



298

A SPST-NO 15 or 25 amp economy power relay. PC and Quick Connect terminal combination. Recognized under UL #508.

NO

SPST-NO

Material
-100 Silver Cadmium Oxide
15 amp, 125 VAC, resistive (UL)
10 amp, 250 VAC, resistive
15 amp, 12 VDC, resistive
5 amp, 48 VDC, resistive
6 amp, 125 VAC, inductive 40% PF
4.8 amp, 250 VAC, inductive 40% PF
6 amp, 12 VDC, inductive
2 amp, 48 VDC, inductive
1 hp, 120 VAC
1-1/2 hp, 240 VAC
50 amp, inrush 20 ms max
-200 Silver Cadmium Oxide
25 amp, 125 VAC, resistive
20 amp, 125 VAC, resistive (UL)
20 amp, 250 VAC, resistive
25 amp, 12 VDC, resistive
10 amp, 48 VDC, resistive
15 amp, 125 VAC, inductive 40% PF
10 amp, 250 VAC, inductive 40% PF
15 amp, 12 VDC, inductive
5 amp, 48 VDC, inductive
1 hp, 120 VAC
1-1/2 hp, 240 VAC
70 amp, inrush 20 ms max

6, 12, 24, 48 (DC)

Nominal-0.9 watts
Maximum continuous-1.1 watts

1500 VAC coil to contacts
750 VAC across open contacts

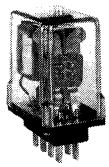
Mechanical-In excess of 500,000 operations
Electrical-200,000 operations minimum at rated loads

1.201×1.240×.787

PC & Quick Connect terminal combination

NO
YES

UL



136

A small power relay that will switch 20 amps for industrial use in multipole configuration and 30 amps in multipole configuration at 120 VAC or 240 VAC for appliance use under UL #508.

NO

1 Form C
2 Form C
2PST-NC
2PST-NO
1PST-NO-DM
1PST-NC-DB
3PST-NO

Material
-3/8" diameter Silver
20 amp, 120/240 VAC
20 amp, 28 VDC
-3/8" diameter Silver Cadmium Oxide (UL recognized)
Industrial Use
1/4 hp, 120 VAC
15 amp, 120 VAC
15 amp, 28 VDC
10 amp, 240 VAC
1 kw tungsten, 120 or 240 VAC
Appliance Use
1/4 hp, 120 VAC
20 amp, 28 VDC
30 amp, 120 or 240 VAC
1 kw tungsten, 120 or 240 VAC

6, 12, 24, 48, 110 (DC)
6, 12, 24, 120, 240 (AC)
Special Customer Requirements

Maximum continuous-10 VA (AC); 2.9 watts max. (DC)

Mechanical-5 million operations
Electrical-100,000 operations at rated load

2.375×1.75×2.80

NO
YES

Special Customer Requirements

UL

Midtex Relays, Inc.

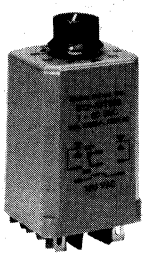
9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FACS: 915-772-1116

TIME DELAY RELAYS

611 SERIES

An amplifier driven relay that allows an input signal as low as 12 microwatts to control a DPDT 10 amp output. This low control sensitivity permits direct interfacing with most types of logic.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
Sensitivity—12 microwatts, 60 microwatts
Operating time (nom voltage & temp.) 15 ms.
Release time (nom. voltage & temp.) 30 ms.
Max. input voltage or current—30 VDC or 1 ma.
Max. negative blocking voltage 50 VDC
Voltage—12, 24, 48 VDC (+10%)
Power—1.2 watts
Polarity protection—YES
Duty—Continuous
Switching action 2PDT
Switching rating
-Fine silver contacts (gold flash) 5 amp, 28 VDC, 120/240VAC 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120/240 VAC 1/3 hp, 120 VAC 1/2 hp, 240 VAC
TEMPERATURE RANGE
-10°C to +55°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)



612 SERIES

Delay-on-release timer which utilizes an R-C solid state trigger circuit to drive a secondary solid state switch, which in turn controls the integral 10 amp output relay.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
Repeatability ±3%
Total timing variation ±10%
Operate time (max.) 100ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits—
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 1.5 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contact (Gold flash) 5 amp, 28 VDC/120,240VAC; 80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC/120,240 VAC; 80% pf, 1/3 hp, 120 VAC 1/2 hp, 240 VAC
Delay types Delay-on-release
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

613 SERIES

Economy version **Delay-on-operate** timer, which utilizes a simple R-C solid state trigger circuit, which in turn controls the integral 10 amp output relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 200ms
Recycle time (max.) 200ms
Dial scale Ref. only
Input voltage limits
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 3.0 VA
DC (approx.) 1.5 watts
Switching action 2PDT
Switching rating (max.)
-Fine silver contact (gold flash) 5 amp, 28 VDC/120/VAC, 3 amp, 240 VAC .80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120 VAC, 1/3 hp 120 VAC, 6 amp, 240 VAC .80% pf 1/2 hp, 240 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption.....YES
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

614 SERIES

Identical to the 612 series, except it functions as a **delay-on-operate.** Available with "fixed", "external resistor" adjust time setting, or "knob adjust", through an overall range of 1 to 300 seconds delay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset (release) time (max.) 50ms
Recycle time (max.) 100ms
Dial scale Ref. only
Input voltage limits
AC ±10%
DC ±25%
Power requirements—
AC (approx.) 3.0 VA
DC (approx.) 1.2 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash) 5 amp, 28 VDC/120 VAC, 3 amp, 240 VAC .80% pf 1/8 hp, 120 VAC
-Silver Cadmium Oxide (Gold flash) 10 amp, 28 VDC/120 VAC, 1/3 hp, 120 VAC, 6 amp, 240 VAC .80% pf 1/2 hp, 240 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption.....NO
TEMPERATURE RANGE
-operating: -10°C to +55°C
-storage: 40°C to +85°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)
TIMING SET
Fixed
External Resistor
Knob Adjust

618 SERIES

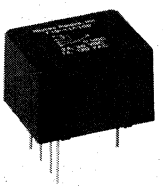
An electronic time delay module that provides a 0.5 or 2 amp SCR output to drive relays, solenoids or lamps. Units are fully encapsulated and are versatile and economic, especially when used in conjunction with power relays in the 30 amp rating category.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time (max.) 75ms
Recycle time (max.) 25ms
Input voltage limits
+25%. DC must be filtered, max. ripple 5% at nominal voltage
Switching action SPST
Solid State Output, 1.5 V voltage drop max. when on
Switching rating (max.)
-Type 1-0.5 amp at +55°C
-Type 2-2.0 amp at +25°C
1.25 amp at +55°C
TEMPERATURE RANGE
-40°C to +55°C

619 SERIES

IMPULSE RELAY
An electronically controlled single input latching relay. Repetitive input pulses cause the relay to latch and unlatch alternately up to 1,200 total pulses per minute.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient
Pulse width 25 ms. min.
Pulse repetition rate 1200 pulses per minute max.
Duty Continuous
Input voltage
12, 24, 48, 110 VDC (±25%)
Power requirements
1.8 watts
Switching action 2PDT
Switching rating (max.)
-Fine Silver contacts (Gold flash) 5 amp, 28 VDC, 120/240 VAC 1/8 hp, 120 VAC
-Silver Cadmium Oxide 10 amp, 28 VDC, 120/240 VAC 1/3 hp, 120 VAC 1/2 hp, 240 VAC
TEMPERATURE RANGE
-10°C to +55°C
SHOCK
15 g's, 11±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10 to 55 Hz (non-operating test)



719 SERIES

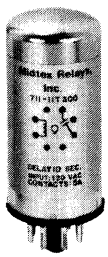
IMPULSE RELAY
Miniature PC style impulse relay that will alternately change states when pulsed at a common input, without changing polarity.

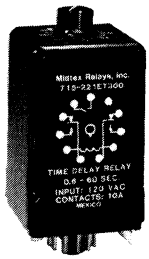
ELECTRICAL/MECHANICAL CHARACTERISTICS (25°C)
LIFE EXPECTANCY:
Mechanical—100 million operations min.
Electrical—100,000 operations min. at rated load
CONTROL VOLTAGES:
5 to 48 VDC standard
Set & Reset time 3ms typical
DIELECTRIC
1500 VAC input to contacts
1000 VAC across open contacts
TEMPERATURE
-40°C to +70°C
CONTACTS
-Silver/Gold bifurcated Rating
2.0 amp 30 VDC resistive
0.6 amp 110 VDC resistive
1.0 amp 125 VAC resistive

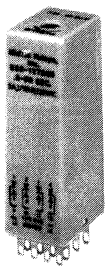
FOR ENGINEERING ASSISTANCE CALL TOLL FREE

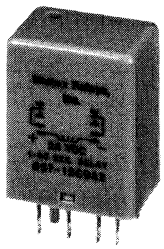
1-800-MIDTEX1 TIME DELAY RELAYS

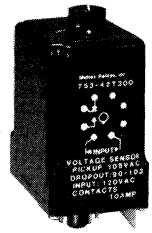
LINE MONITORING DEVICES/CURRENT VOLTAGE • PHASE

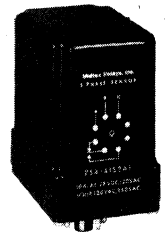












711 SERIES

Superior replacement for plug-in thermal timers. The 711 series offers 10 amp SPST-NO or NC, and SPDT snap action switching, metal enclosure is standard, (encapsulated units available), long life, and solid state type timing performance.

ELECTRICAL/MECHANICAL CHARACTERISTICS
All ratings at 25°C ambient.
CONTACTS:
10 amps 120 VAC resistive
10 amps 30 VDC resistive
4 amps 240 VAC resistive
POWER REQUIREMENTS
0.75 watts typ.
TEMPERATURE:
Storage -40°C to +85°C
Operating -25°C to +65°C
(extended ranges available)
DIELECTRIC
1000 VAC min., 750 VAC across open contacts
TIMING
Accuracy: ±10%
Repeatability: ±3%
Reset & Recycle time: 50 ms typical, 100 ms max.
SHOCK 50 g's (non-operating)
VIBRATION:
10 g's, 10-55 Hz min., without false contact action

715 SERIES

Multi-function time delay relay industry standard 8 and 11 pin octal, side terminal strip for flush mounting, and the 11 pin square base to fit the Midtex Type 157 relay sockets. UL/CSA approval.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±2%
Total timing variation ±10%
Reset time—25 ms typical, 50 ms max. (release of delay-on-operate)
Recycle time—50 ms typical.
100 ms. max. (minimum off time between timing intervals)
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC 2.5VA
DC 1.5watt
Switching action 2PDT
Switching rating (max.)
-Silver Cadmium Oxide
10 amp, 28 VDC/120 VAC; 1/3 hp, 120/240 VAC
Delay types
Delay-on-operate, Delay-on-release, Cycle, Interval and Interval-momentary start timing.
Momentary transfer upon timing cycle interruption: NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10-55 Hz (non-operating test)

655 SERIES

Delay-on-operate timers which use solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±3%
Total timing variation ±10%
Reset time 50 ms
Recycle time (max.) 100 ms
Input voltage limits
AC ±10%
DC ±25%
Power requirements
AC (approx.) 3VA at 120 VAC
DC (approx.) 1.2 watts
Switching action 1,2,4PDT
Switching rating
5 amp, 28 VDC, 120 VAC
10 amp, 28 VDC, 120 VAC
Delay types Delay-on-operate
Momentary transfer upon timing cycle interruption .NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave
VIBRATION
10 g's; 10 to 55 Hz
TERMINALS-
Solder, PC, Plug-In.

657 SERIES

Delay-on-operate timer which uses solid state timing circuits to control an integral relay.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±5%
Total timing variation ±10%
Reset time (max.) 100 ms
Recycle time (max.) 100 ms
Input voltage limits
DC ±25
Power requirements
DC (approx.) 0.7 watt
Switching action 2PDT
Switching rating
2 amp, 28 VDC, 120 VAC
Momentary transfer upon timing cycle interruption .NO
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
8 g's; 10 to 55 Hz
MAX SIZE IN INCHES
(L × W × H)
1.190 × .859 × 1.281
TERMINALS
Solder, PC, Plug-In

658 SERIES

Extremely accurate long range **delay-on-operate** with timing tolerance and timing variation of plus or minus 2%. Available in either a variable time range or fixed (factory preset) time range.

ELECTRICAL/MECHANICAL CHARACTERISTICS
Timing tolerance ±2%
Repeatability ±.1%
Total timing variation ±2%
Reset time (max.) 50 ms
Recycle time (max.) 150 ms
Timing ranges
*1-102.3 sec.
*1-409.5 sec.
*1-1023 sec.
*1-4095 sec.
*Factory preset
Power requirements (max.) 3VA
Operating temperature -10°C to +55°C
Switching action 2PDT
Delay function
Delay-on-operate
Contact rating
10 amp at 28 VDC, 120 VAC, 80% pf; 7 amp at 240 VAC 80% pf; 1/3 hp at 120/240 VAC
Contacts
5/32" Silver Cadmium Oxide
Expected life at rated load (min.) 100,000 operations
SHOCK
15 g's, 11 ±1ms, 1/2 sinewave (non-operating test, no mechanical damage)
VIBRATION
0.06" DA or 10 g's 10-55 Hz (non-operating test)

753 SERIES

753 series voltage sensor is designed for use in monitoring voltage fluctuations. It is designed to energize and de-energize at predetermined voltage levels that may be fixed or set with adjusting knobs. Packages are available for either direct plug-in or terminal strip connection.

ELECTRICAL CHARACTERISTICS
All ratings at 25°C ambient
Repeatability ±1% max.
Response time 15 ms typical
25 ms maximum
Duty cycle is continuous, maximum input limit of 125% of nominal input voltage.
Switching action SPDT
Switching rating
—100 silver/gold flash
3 amps at 24 VDC or 125 VAC resistive;
1 amp at 24 VDC or 125 VAC inductive;
1.5 amps at 250 VAC resistive;
0.5 amps at 250 VAC inductive
—200 Silver Cadmium Oxide
5 amps at 24 VDC or 125 VAC resistive
2 amps at 24 VDC or 125 VAC inductive
2.5 amps at 250 VAC resistive
1 amp at 250 VAC inductive
—300 Silver Cadmium Oxide
10 amps at 24 VDC or 125 VAC resistive
4 amps at 24 VDC or 125 VAC inductive
5 amps at 250 VAC resistive
2 amps at 250 VAC inductive
TEMPERATURE RANGE
—operating -10°C to +55°C
—storage -40°C to +85°C
SHOCK
15 g's, 11 ±1 ms, 1/2 sinewave (non-operating test)
VIBRATION
0.06" DA or 10 g's, 10-55 Hz (non-operating test)

754 SERIES

3-Phase sequence sensor is designed to detect loss of power on one leg or reverse phase sequence in conventional 3-phase, 4 wire, wye connected or 3-wire Delta connected 60 Hz circuits. The delay will remain energized with power applied unless a loss or reverse is detected. The 654 is ideal for the protection of expensive motors and 3-phase equipment from failure due to phase problems.

FEATURES
—Reliability of solid state sensing
—Power output switching to 10 amps
—Form DPDT contact output
—Flexibility for variety of applications
—Available with plug-in or direct wire termination
—4-wire wye or 3-wire Delta connection
—Responds to line failure in 30MS typical
CONTACTS
—5/32" Silver Cadmium Oxide 10 amp, 28 VDC/120 VAC, 80% pf
LIFE EXPECTANCY
Mechanical—in excess of 50 million operations
Electrical—100,000 operations minimum at rated loads
DIELECTRIC BREAKDOWN
Greater than 500 VAC RMS 60 Hz across open contacts;
Greater than 1500 VAC RMS 60 Hz all other mutually insulated elements
TEMPERATURE RANGE
-10°C to +55°C
DUTY CYCLE
Continuous
RESPONSE TIME
15 MS operate, 30 MS release typical
OPERATE POWER
2 watts max.

Midtex Relays, Inc.

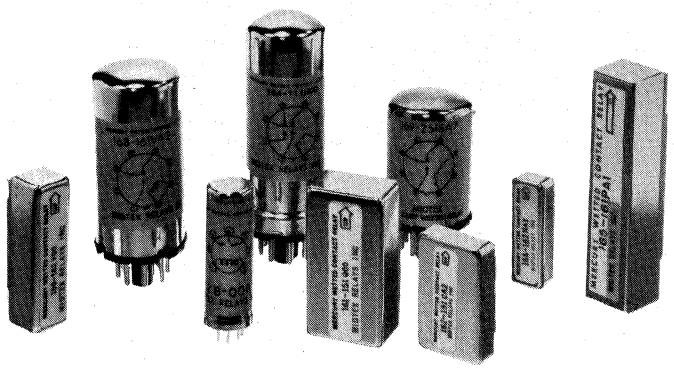
9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FACS: 915-772-1116

FOR ENGINEERING ASSISTANCE CALL TOLL FREE

1-800-MIDTEX1

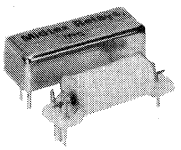
MERCURY RELAYS

Mercury-wetted contacts represent the nearest thing to the perfect contact yet developed, being characterized by such parameters as: Bounce-free operation; very low and stable contact resistance; hermetic protection; fast operating speeds; Form C or Form D contact action; contact life measured in billions of operations.



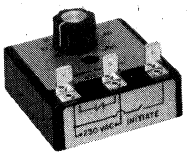
	TWO-AMPERE RATED RELAYS						FIVE-AMPERE RATED RELAYS		
PARAMETER	**TYPE 159**	**TYPE 160**	**TYPE 161**	**TYPE 162**	**TYPE 166**	**TYPE 169**	**163**	**164**	**165**
COILS									
Single wound—max. ohms	8,600	9,000	43,500	3,500	9,000	11,000	4,000	4,000	4,300
Double wound—max. ohms	4,275	4,500	21,700	1,750	4,275	5,500	2,000	2,000	8,000
Rating—watts continuous	2.0	1.75	3.0	3.0	1.5	2.0	4.0	4.0	4.0
Temp. rise—° C per watt	30°	35°	20°	30°	35°C	30°	20°	20°	20°
Dielectric breakdown —RMS, 60Hz	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Insulation resistance megohms—500 VDC	1,000	1,000	1K-10K	1K-10K	1,000	1,000	100	100	100
Capacitance—armature to coil pf, typical	9.0	9.0	9.0	9.0	9.0	7.0	12	12	14
Electrostatic shielding optional	yes	yes	yes	yes	yes	yes	yes	yes	yes
Typical operate times —MS, 2X must operate	1-3	1-3	1-3	1-3	1-3	1-3	3.5	3.5	3.0
Typical release times —MS 2X	2.5	2.5	3.0	3.0	2.8	3.0	4.5	4.5	4.2
Contact form available	C, D	C, D	2C, 2D	2C, 2D	C, D	C, D	D	D	D
Adjustments available									
Single-side-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Bi-stable	yes	yes	yes	yes	yes	yes	yes	yes	yes
Polar 1% balance	yes	yes	no	no	yes	yes	yes	yes	yes
Temperature range Operating ° C Storage ° C	All types -38.8°C to +85°C All types -65°C to +100°C								
Weight—ounces	2.0	0.5	2.3	1.6	0.5	4.0	4	4	3
Encapsulant	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Polyureth.	Wax	Wax	Wax	Polyureth.
Mounting method	PCB	PCB	PCB	PCB	PCB	Octal	Octal	Octal	PCB

REED RELAYS



The Midtex dry reed relay series offers hermetically sealed, non-position sensitive switching in a small size with rapid response and low actuate power requirements. Available contact forms include A, B, C and D with dry reeds and forms A and B with mercury wetted. Contact arrangements include 1 to 5 Form A, 1 to 4 Form C, and 1 to 3 Form B, or any combination within the 5 pole bobbin. Consult the factory for additional details.

CUSTOM CONTROL PRODUCTS & BOARD ASSEMBLIES



Midtex Relays, Inc. designs and manufactures custom control modules and board assemblies to specific customer applications. A few common applications are listed below:

- True Form D Relay
- 20–25 amp 3/4 hp time delay relay
- 12–96 Hour Timer
- Sequencing Module For Stagger Motor Start Up
- Impulse Relay That Transfers When Voltage Is Removed
- True Off Delay Timers
- Complete Control Systems (Board level, encapsulated & Cabinet)
- Wire Wrapped Relay Control Assemblies
- Interface Modules

Most designs are generated from customers requesting a "Black Box" to solve a system problem, improved performance, lower costs etc. Please call us on our Engineering Hot Line (1-800-MIDTEX1) to discuss your application directly with Midtex Engineering.

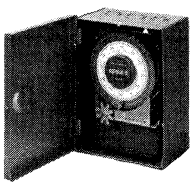
Midtex Relays, Inc.

9B2 BUTTERFIELD TRAIL/EL PASO, TEXAS 79906
PHONE 915-772-1061/FACS: 915-772-1116

FOR ENGINEERING ASSISTANCE CALL TOLL FREE

1-800-MIDTEX1

CYCLEMASTER 24-HOUR TIMER



620 SERIES

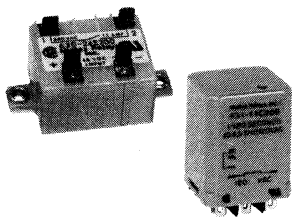
Program Time Switch—up to 48 ON-OFF operations per day with timing intervals as low as fifteen minutes. 14-day wheel, with Sunday and Holiday Skipper, provides programming for two full weeks. Eliminates operations on unwanted days.

SWITCHING ACTION
SPDT (usable three ways: SPST open; SPST closed; SP transfer)
LOAD CAPACITY
20 amps at 125, 250, or 480 VAC (1 hp at 125 VAC; 2 hp at 250 VAC) (10 amps at 125 VAC inductive)
TERMINALS
Screw terminals conveniently located
METHOD OF PROGRAMMING
Trip pin (12 supplied)
TEMPERATURE RANGE
−40 F to +140 F
Dimensions
With enclosure 8.188″ H × 6.375″ W × 4.125″ D; without enclosure 6-5/8″ H × 4-1/2″ W × 2-13/16″ D

TIMING APPLICATIONS

- Lawn sprinkling
- Greenhouse misting
- Irrigation
- Program music
- Chime system
- Oil well pumping
- Programmed heating
- Air conditioning
- Traffic systems
- Industrial processing
- Power plant exercising
- Industrial lubrication systems
- Stoker hold-fire
- Battery charging
- Paint and enamel baking
- Laboratory testing
- Oven purging
- Automatic livestock and poultry feeding systems
- Conveyors, material handling systems
- Ventilating fans
- Elevators and stairways
- Pumps and motors
- Water softening control
- Bulk, milk cooler agitation
- Laundry equipment
- Heat treating
- Plastic molding
- Bakery machinery

SOLID STATE RELAYS



630/631 SERIES

Solid State Hybrid Industrial Relay Applications are I/O interface, and switching difficult loads such as: solenoids, AC motors, lamps and other heavy industrial loads within device ratings.

Ratings are for both models, unless otherwise specified.
Current
Type 630 4, 7, 10 and 15 amps inductive or resistive.
Type 631 5 amps inductive or resistive.
Voltage drop
1.6 typical at rated current
Leakage current
6 MA max., 120 VAC/12 MA max., 240 VAC
Minimum load current
200 MA, RMS
Life
500 million operations
Contact type
1 Form A
Dielectric
1500 VAC, 60 Hz minimum between all mutually insulated terminals and mounting plate

634 SERIES

Hybrid Non Zero-Crossing Turn On PCB Relay Unit occupies less than one sq. inch of board space. This makes it ideal for applications where board space is at a premium.

Internal transient protection
Available with a snubber network to properly communicate inductive loads.
Excellent I/O isolation
Reed relay input provides input to output isolation in excess of 1500 VAC, 60 Hz dielectric breakdown.
Rapid response time
Relay will turn on in one millisecond. Turn-off occurs at the first zero amplitude current point after input power removal.
Dielectric
1500 VAC, 60 Hz minimum between input/output
Life
500 million operations
Contact type
1 Form A
Options
Input coil suppression diode; Thyristor to prevent false turn-on when transients on the line exceed the forward blocking voltage; AC input version using an internal bridge and filter capacitor.
UL Approved

640 SERIES

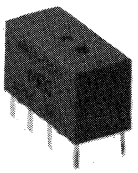
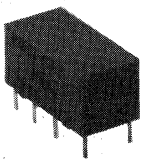
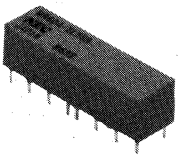
Solid-State Zero-Crossing Industrial Relay Ideally suited for frame or panel mounting, and is assembled in a sturdy, compact package that is sealed against environmental conditions. The design will withstand severe shock and vibration. Applications are I/O interface and switching difficult loads such as: solenoids, AC motors, lamps and other heavy industrial loads within device ratings.

Excellent isolation
The LED input-Triac output circuitry in this pure solid-state device exhibits in excess of 1,000 VAC, 60 Hz dielectric breakdown isolation between input and output terminals.
Rapid response time
Basic circuit used will turn on at the first zero amplitude voltage point after power input (within plus or minus 15 volts).
Turn-off occurs at the first zero amplitude current point after input removal.
Dielectric breakdown
1,000 VAC, 60 Hz minimum between all mutually insulated terminals and mounting plate.
Life
Indefinite
Contact type
1 Form A
Options
Thyristor to prevent false turn-on when transients on the line exceed the forward blocking voltage;
AC input version using an internal bridge and filter capacitor.
UL/CSA approvals.

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

World Products Inc. (North America Distributor)
19654 8th St. East, Sonoma, CA 95476 • 707/996-5201

Miniature Relay—Signal

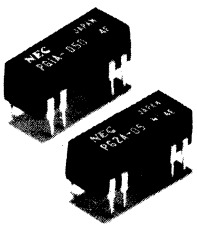
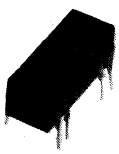
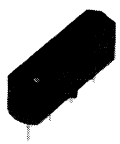
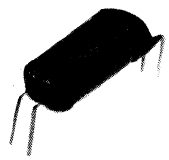
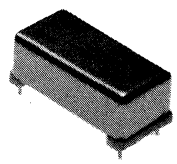
		MR62	MR62-Y MR62-X	MR602	MR612	MR604
Type of relay						
Features		• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature • 1500V FCC surge	• low power consumption • 1500V FCC surge	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available	• low power consumption • 1500V FCC surge, 1000V AC FCC breakdown voltage • latching type available
					Polarized Type	
Contact arrangement		2C	2C	2C or 2D	2C or 2D	4C
Contact material (standard)		silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)		60W/125VA 3A 2A 2.0A 1A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A
Coil voltage		5, 6, 9, 12, 24, 48V DC	5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC
Nominal operating power		500mW	400mW	200mW (latching type-single wound coil 100mW)	400mW (latching type-single wound coil 200mW)	250mW (latching type-single wound coil 125mW)
Must operate voltage		70%	70% (K type 80%)	70% (Form D type 80%)	70%	70%
Must release voltage		5%	5%	10%	10%	10%
Operate time (typ.) (Excluding bounce)		3ms	4ms	3.5ms	3.5ms	4ms (Latching 3.5ms)
Release time (typ.) (Excluding bounce)		2ms	2ms	1.5ms	1.5ms	2ms
Life (operations)	Electrical	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A
	Mechanical	50×10^6	50×10^6	50×10^6	50×10^6	50×10^6
Breakdown voltage	Between open contacts	500V AC	500V AC or 1000V AC*	1000V AC or 500V AC*	1000V AC or 500V AC*	1000V AC
	Between adjacent contacts	1000V AC	1000V AC	1000V AC	1500V AC	1000V AC
	Between contact and coil	1000V AC	1000V AC	1000V AC	1500V AC or 2000V AC**	1000V AC
Surge withstand voltage		1500V FCC*	1500V FCC*	1500V FCC	1500V FCC	1500V FCC
UL, CSA, VDE		UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL, CSA*
Option		—	—	latching type, Form D	latching type, Form D	latching type
Height (mm)		11.4	11.4	10.1	10.1	10.1
Mounting space (mm)		9.8×20.2	9.8×20.2	10.1×20.3	10.1×20.3	10.1×35.6

* 1500V FCC surge between coil and contacts and between adjacent contacts.
*X or KY type
* Form D type
* Form D type
**K type *
*applied at

NEC Electronics Inc.
401 Ellis St., Mountain View, CA 94039 • 415/960-6000

World Products Inc. (North America Distributor)
19654 8th St. East, Sonoma, CA 95476 • 707/996-5201

Reed Relay—Dry

		PG1A/PG2A	PG1C	PU	LR1A/LR2A	URA
Type of relay						
Features		• DIP terminal • high speed • glass encapsulated reed switch • 1 Form A • 2 Form A	• DIP terminal • high speed • glass encapsulated reed switch • 1 Form C	• single-in-line pin configuration (SIP) • high speed • 5.08mm pitch terminal	• compact • light weight • economy • tubular type • easy handling (plastic coated)	• high sensitivity (only 2mW) • high dielectric withstanding voltage
Contact arrangement		1A, 2A	1C	1A	1A, 2A	1A
Contact rating (resistive) (switching)		10W/100V DC	3W/30V DC	10W/100V DC	10W/100V DC	10W/100V DC
	3A	.....	.....	.....	.....	.....
	2A	.....	.....	.....	.....	.....
	1A	..... 0.5A	..... 0.2A	..... 0.5A	..... 0.5A	..... 0.5A
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 6, 12, 24V DC	(10 to 16mA)
Nominal operating power		50 to 270mW	180 to 385mW	50 to 290mW	160 to 360mW	1.5 to 2.0mW
Must operate voltage		75%	75%	75 to 80%	55 to 65%	(9 to 14.4mA)
Must release voltage		8 to 16%	8 to 10%	8 to 16%	7 to 8%	(2 to 3.2mA)
Operate time (Excluding bounce)		0.1 to 0.3ms	0.2 to 0.5ms	0.1 to 0.3ms	0.2 to 0.9ms	3.0ms
Release time (typ.) (Excluding bounce)		0.05ms (0.65ms with diode)	0.25ms (1.25ms with diode)	0.03ms (0.65ms with diode)	0.05ms (0.65ms with diode)	1.5
Life (operations)	Electrical	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	1×10^6 24V DC, 50mA	100×10^6 5V DC, 5μA 10×10^6 24V DC, 5mA 1×10^6 30V DC, 0.1A	100×10^6 5V DC, 5μA 10×10^6 12V DC, 5mA 0.5×10^6 48V DC, 0.1A	10×10^6 12V DC, 5mA 1×10^6 24V DC, 0.5A
	Mechanical	100×10^6	50×10^6	100×10^6	100×10^6	100×10^6
Breakdown voltage	Between open contacts	250V DC	200V DC	250V DC	250V DC	250V DC
	Between adjacent contacts	—	—	—	—	—
	Between contact and coil	500V DC	500V DC	1000V AC	1500V AC	1500 or 3500V AC*
Surge withstand voltage						
Insulation resistance		10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^4MΩ (at 100V DC)	10^3MΩ (at 100V DC)
UL, CSA, VDE						
Option		electrostatic shield (1A type) magnetic shield (1A and 2A type) with a diode				
Height (mm)		7.0	7.0	8.0	9.0	11.5 to 16
Mounting space (mm)		7.0×19.5	7.9×19.5	5.0×19.0	10.0×26.0/12.0×26.0	(14.0 to 16.0)×29.0

* High breakdown voltage type

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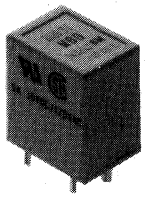
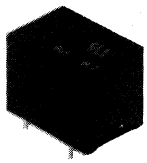
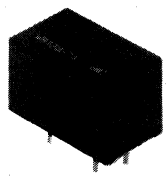
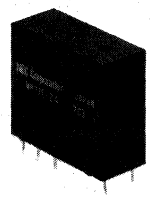
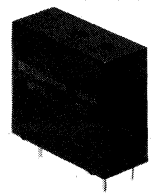
Miniature Relay—Power

Group / Type of relay	MR31	MR301	MR321A	MR71	MR72
					
Features	• large contact capacity • compact and light weight • general purpose power relay	• low profile • specially for automotive	• electric heater switching (up to 1.5KW/100V AC) • low profile • compact • flux tight	• TV-5 type available • high dielectric strength (MR71A) • withstanding 10,000V surge	• TV-3 type available • high dielectric strength (MR72A) • withstanding 10,000V surge
Contact arrangement	1A or 1C	1C	1A	1A, 1B or 1C	2A, 2B or 2C
Contact material (standard)	silver alloy	silver alloy	silver oxide complex alloy	silver oxide complex alloy	silver nickel alloy
Contact rating (resistive) (switching)	30W 120VA (G-type) 150W 600VA 300W 1200VA (H-type) 10A 8A 6A 4A 2A 1A 5A 10A	150W/600VA 300W/1200VA (H-type) 5A 10A	1200VA 1600VA (H-type) 12A 15A	300W/250VA 10A	150W/125VA 5A
Coil voltage	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 9, 12, 24 48V DC	3, 5, 6, 12, 24, 48V DC	3, 5, 6, 12, 24, 48V DC
Nominal operating power	360mW	360mW	360mW	500mW	500mW
Must operate voltage	80%	70% (48V DC: 80%)	70% (48V DC: 80%)	70%	70%
Must release voltage	10%	10%	10%	10%	10%
Operate time (Excluding bounce)	13ms	10ms	10ms	15ms	15ms
Release time (Excluding bounce)	10ms	10ms	10ms	5ms	5ms
Life (operations) Electrical	0.1×10^6 100V AC, 5A*	0.1×10^6 100V AC, 5A*	0.5×10^6 100V AC, 12A*	0.1×10^6 100V AC, 10A	0.1×10^6 100V AC, 5A
Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
Breakdown voltage Between open contacts	750V AC	750V AC	750V AC	1000V AC	1000V AC
Between adjacent contacts	—	—	—	—	3500V AC
Between contact and coil	1500V AC	1500V AC	1500V AC	5000V AC	5000V AC
Surge withstand voltage				10,000V ($1\times40\mu s$)	10,000V ($1\times40\mu s$)
UL, CSA, VDE	UL, CSA	UL		UL, CSA, Australia Telecom	UL, CSA, Australia Telecom
Option	washable type	washable type		washable type	washable type
Height (mm)	23.5	16.5	16.5	25.5	25.5
Mounting space (mm)	16.5×21.5	16.5×22.5	16.5×26.0	13.0×29.0	13.0×29.0

* G type: 1A
H type: 10A

* H type: 7A

* H type
0.3×10^6 100V AC, 15A

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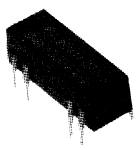
Reed Relay—Wet

		UMD	PTW	NMP	RMP-1, 2	MSP
Type of relay						
Features		• DIP terminal • compact • long life with wetted contact switch	• SIP terminal • long life with wetted contact switch	• low power consumption • low profile • high speed (200 pps) • low contact noise (20μV)	• compact • light weight • high reliability and long life	• large contact capacity • high reliability • latching type available
		Non-polarized Type		Polarized Type	Non-polarized Type	Polarized Type
Contact arrangement		1A	1A	1C	1A or 1C (RMP-1) 2A or 2C (RMP-2)	1C or 1D
Contact rating (resistive) (switching)		50W/500V DC	50W/500V DC	50W/500V DC	50W/500V DC	100W/500V DC
	3A					
	2A					2A
	1A	1A	1A	1A	1A	
Coil voltage		5, 12, 24V DC	5, 12, 24V DC	5, 12, 24V DC	5, 12, 24, 48V DC	5, 12, 24, 48V DC
Nominal operating power		250 to 300 mW	420 to 480 mW	200 to 300 mW	300 to 380 mW	320 to 380 mW
Must operate voltage		80%	80%	70%	75%	40%
Must release voltage		10%	10%	10%	8%	7%
Operate time		1.0 to 2.0ms	1.0 to 2.0ms	1.2ms Max.	1.0 to 2.0ms	1.0 to 1.5ms
Release time		1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)	1.3ms Max. (with diode)	1.0 to 2.0ms (2.5ms with diode)	1.0 to 2.0ms (2.5ms with diode)
Life (operations)	Electrical	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	200×10^6 50V DC, 1A	5×10^8 50V DC, 2A
	Mechanical	1×10^9	1×10^9	1×10^9	1×10^9	10×10^9
Breakdown voltage	Between open contacts	1000V AC	1000V AC	1000V AC	1000V AC	1000V DC
	Between adjacent contacts	—	—	—	1000 V AC (RMP-2)	—
	Between contact and coil	1000V AC	1000V AC	1000V AC	1000V AC	1000V AC
Surge withstand voltage						
Insulation resistance		10^3 MΩ (at 100V DC)	10^3 MΩ (at 100V DC)	10^3 MΩ (at 500V DC)	Between open contact: 10^2MΩ, others: 10^3MΩ (at 500V DC)	10^3 MΩ (at 500V DC)
UL, CSA, VDE					UL	
Option		magnetic shield, with a diode		latching type electrostatic shield	—	latching type electrostatic shield
Height (mm)		7.0	8.0	6.9	10.0/10.5	10.2
Mounting space (mm)		8.9×19.5	6.5×19.5	7.6×22.8	9.5×32.5/20.5×33.0	14.×40.6

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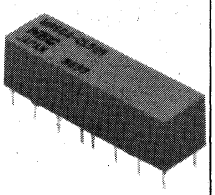
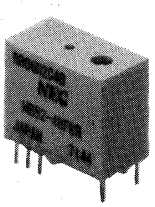
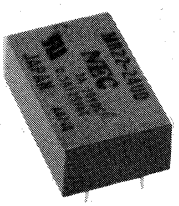
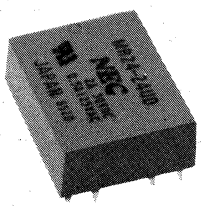
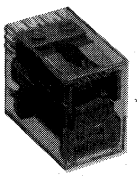
Miniature Relay—Signal

	MR614	MR52	MR22	MR24	MR10/MR11/ MR11-500
Type of relay					
Features	• low power consumption • 1500 FCC surge, 1000V AC FCC breakdown voltage • latching type available	• DIP terminal • sealed package for flow soldering • stable contact resistance at high temperature	• long life • automatic wave soldering possible • latching type available	• long life • automatic wave soldering possible • latching type available	• long life • 12-pole contacts (up to 18 contacts) • flux tight base cap available
Contact arrangement	4C	2C	2C or 2D	4C, 4D or 2C+2D	4C, 4D or 2C+2D 6C, 6D or 4C+2D 12A, 12B or 6C+6A or 6B
Contact material (standard)	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay	silver alloy with gold overlay
Contact rating (resistive) (switching)	60W/125VA 3A 2A 2.0A 1A	60W/125VA 2.0A	60W/125VA 2.0A	60W/125VA 2.0A	30W/50VA 1.25A
Coil voltage	1.5, 3, 4.5, 5, 6, 9, 12, 24, 48V DC	5, 6, 9, 12, 24, 48V DC	5, 6, 12, 24, 48 60V DC	5, 6, 12, 24, 48 60V DC	5, 6, 9, 12, 24, 48 60V DC *6, 12, 24, 48V DC
Nominal operating power	400mW (latching type-single wound coil 200mW)	580mW	Approx. 280mW	Approx. 470mW	1.0 to 1.5W
Must operate voltage	70%	80%	80% (Y type 70%)	80% (Y type 70%)	55 to 80%
Must release voltage	10%	10%	10%	10%	—
Operate time (typ.) (Excluding bounce)	4ms (Latching 3.5ms)	5ms	10ms	10ms	15ms/*20ms
Release time (typ.) (Excluding bounce)	2ms	2ms	3ms	3ms	6ms/*4ms
Life (operations) Electrical	1.5×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 24V DC, 1A 3×10^6 24V DC, 0.5A	1×10^6 30V DC, 1A	1×10^6 30V DC, 1A	50×10^6 115V AC, 0.25A with spark suppression
Mechanical	50×10^6	10×10^6	100×10^6	100×10^6	50×10^6
Break-down voltage Between open contacts	1000V AC	500V AC	1000V AC or 750V AC*	1000V AC or 750V AC*	Form C 1000V AC Form D 500V AC
Between adjacent contacts	1500V AC	1000V AC	1000V AC	1000V AC	1000V AC
Between contact and coil	1500V AC	1000V AC	1000V AC	1000V AC	1000V AC
Surge withstand voltage	1500V FCC	1500V FCC*			
UL, CSA, VDE	UL, CSA*	UL, CSA	UL, CSA	UL, CSA	
Option	latching type	—	latching type	latching type	
Height (mm)	10.1	16.7	11.5	11.5	30.0
Mounting space (mm)	10.1×35.6	11.5×20.5	19.7×29.7	24.3×29.7	19×27.2/*25.2×32.3

* applied at

* 1500V FCC surge between coil and contacts and between adjacent contacts.

* Y type (Form D type: 500V AC)

* Y type (Form D type: 360V AC)

* for 500 series

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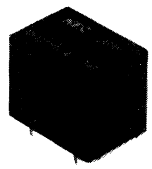
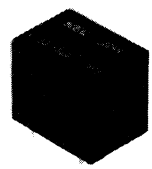
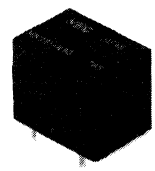
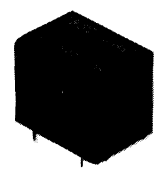
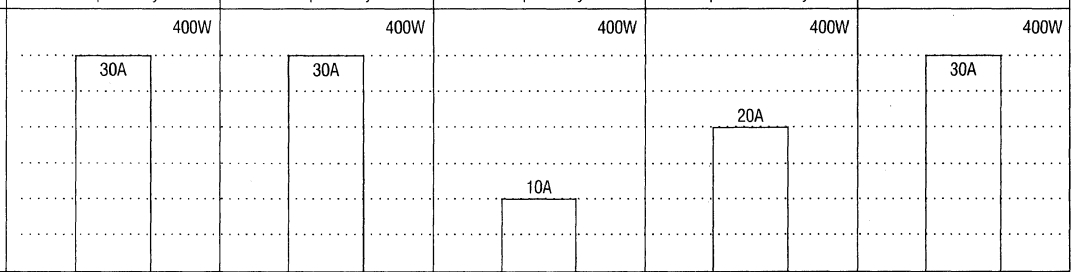
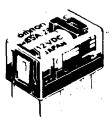
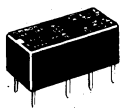
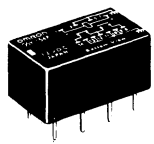
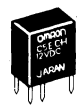
Miniature Relay—Power

	MR331-N10	MR331-N14	MR331-N20	MR331-N30	MR331-N40
Type of relay					
Features	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for inductive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for capacitive load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life	• best for lamp load of car electronics • application specific version available • powerful contact capacity • compact, light weight • long life
Contact arrangement	1C	1A	1A	1A	1A
Contact material (standard)	silver oxide complex alloy	silver oxide complex alloy	silver oxide complex alloy	silver nickel alloy to palladium alloy	silver alloy
Contact rating (resistive) (switching)					
Coil voltage	12V DC	12V DC	12V DC	12V DC	12V DC
Nominal operating power	800mW	450mW	450mW	800mW	450mW
Must operate voltage	8.0V DC	8.0V DC	8.0V DC	8.0V DC	8.0V DC
Must release voltage	1.2V DC	1.2V DC	1.2V DC	1.2V DC	1.2V DC
Operate time (Excluding bounce)	10ms	10ms	10ms	10ms	10ms
Release time (Excluding bounce)	15ms	15ms	15ms	15ms	15ms
Life (operations) Electrical	0.2×10^6 (door interlock system)	0.2×10^6 (car airconditioner)	0.1×10^6 12V DC 5A* capacitive 2200μF + 12000μF	2.0×10^6 lamp 23W/12V×5*	0.1×10^6 lamp 60W/12V×2*
Life (operations) Mechanical	10×10^6	10×10^6	10×10^6	10×10^6	10×10^6
Breakdown voltage Between open contacts	500V DC	500V DC	500V DC	500V DC	500V DC
Breakdown voltage Between adjacent contacts	—	—	—	—	—
Breakdown voltage Between contact and coil	500V DC	500V DC	500V DC	500V DC	500V DC
Surge withstand voltage					
UL, CSA, VDE					
Option					
Height (mm)	18.0	18.0	18.0	18.0	18.0
Mounting space (mm)	16.5×22.5	16.5×22.5	16.5×22.5	16.5×22.5	16.5×22.5

* Technical Data Booklet Is Available.

OMRON Signal Control PC Board Relays

Model (Dimensions in Inches)	G5A	G6A	G6E	G5Y	G5E
					
	0.31″ H x 0.63″ L x 0.39″ W	0.33″ H x 0.80″ L x 0.40″ W	0.32″ H x 0.63″ max. L x 0.39″ W	0.39″ H x 0.81″ L x 0.45″ W	0.39″ H x .39″ L x .28″ W
Features	Subminiature relay ideal for security, communications and audio equipment. Latching type also available. Flux-tight or plastic sealed.	Plastic sealed relay with high impulse withstand voltage, ideal for communication equipment. Latching type available. Plastic sealed.	Subminiatue low signal switching relay has high sensitivity. Packed in a magazine for automatic insertion and soldering. Latching type available. Plastic sealed.	Ultra-small RF relay with outstanding typical values for VSWR (1.8 max.), insertion loss (0.7 dB max.) and isolation (60 dB min.) at 900 MHz. Plastic sealed.	Subminiature relay for interface applications. Flux-tight or plastic sealed.
Contact Ratings					
Contact form	DPDT	DPDT, 4PDT	SPDT	SPDT, DPDT	SPDT
Contact type	Bifurcated crossbar, single crossbar	Bifurcated crossbar single crossbar	Bifurcated crossbar, single crossbar	Twin	Single crossbar
Contact material	AgPd with Au clad	Ag with Au clad / AgPd with Au clad	Ag with Au clad	Au clad	AgPd with Au clad
Max. operating current	1 A	2 A / 1 A	3 A	0.1 A	2 A
Maximum permissible load	0.01 mA at 10 mVDC, 1 mA at 1 VDC	0.01 mA at 10mVDC	0.1 mA at 10 mVDC	0.01 mA at 10mVDC	1 mA at 5 VDC
Rated load (under resistive load)	0.5 A at 24 VAC 1 A at 24 VDC	0.5 A at 125 VAC, 2 A at 30 VDC / 0.3 A at 125 VAC, 1 A at 30 VDC	0.4 at 125 VAC, 2 A at 30 VDC	0.01 A at 24 VAC, 0.01 A at 24 VDC 1 W at 900 MHz at VSWR 1.2	0.5 A at 110 VAC 1 A at 24 VDC
Coil Ratings					
Rated voltage	3, 5, 6, 9, 12, 24 VDC	3, 5, 6, 9, 12, 24, 48 VDC	3, 5, 6, 9, 12, 24, 48 VDC	5, 6, 9, 12, 24 VDC	3, 5, 6, 9, 12 VDC
Power consumption	200 mW (standard and latching).	200 mW (DPDT std.), 360 mW (4PDT std.), 100 mW (DPDT latch), 320 mW (4PDT latch).	200 mW (bifurcated), 400 mW (single) standard and latching.	200 mW (SPDT), 360 mW (DPDT)	280 mW (std.), 200 mW (high sensitivity)
Dielectric Strength (50/60 HZ for 1 minute)	1,000 VAC	1,000 VAC	1,500 VAC	1,000 VAC	500 VAC
Electrical Service Life (operations)	100,000 minimum	500,000 minimum	500,000 minimum	300,000 minimum	100,000 minimum
Terminal Choices	PCB	PCB	PCB	PCB	PCB
Approved Standards	UL, CSA. FCC Part 68 Available.	UL, CSA. FCC Part 68	UL, CSA. FCC Part 68	—	FCC Part 68 Available.

Note: Relay height includes standoffs

Moving Loop Relay

Specifications subject to change without notice.

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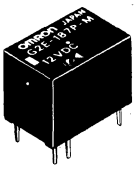
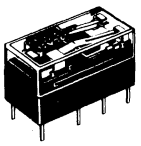
1-800-62-OMRON

OMRON Signal Control PC Board Relays

Model (Dimensions in Inches)	**G2Q**	**G2E**	**G2VN**	**LZN**	**G6G**
	0.31″ H x 0.51″ L x 0.39″ W G2Q-V 0.39″ H x 0.47″ L x 0.29″ W (not shown)	 0.45″ H x 0.61″ L x 0.43″ W	 0.43″ H x 0.80″ L x 0.40″ W	(DPDT Version) 0.45″ H x 1.20″ L x 0.83″ W LZN (4PDT) 0.45″ H x 1.20″ L x 0.96″ W (not shown)	0.32″ H x 0.63″ L x 0.39″ W
Features	Subminiature relay for interface applications. Choose low-profile or slim-line versions. High-sensitivity type available. Flux-tight or plastic sealed.	Small, low cost relay for signal control and interface applications. High-sensitivity and high dielectric types available. Flux-tight or plastic sealed.	Miniature relay for signal circuit and interface applications can be driven by an IC circuit. High sensitivity type available. Flux-tight or plastic sealed.	Low-profile relay with 3 A switching capacity. Sealed, high-capacity, latching and make-before-break contact types available. Flux-tight or plastic sealed.	Surface mount relay maintains stable operating characteristics after being subject to high heat mass soldering methods (i.e. vapor phase, IR and wave). Low profile and small size increase PC board capacity. High-temperature resistant resins and sealing agents.
Contact Ratings					
Contact form	SPDT	SPDT	DPDT	DPDT, 4PDT	DPDT
Contact type	Single crossbar	Bifurcated crossbar, single crossbar	Bifurcated crossbar, single crossbar	Bifurcated corssbar	Bifurcated crossbar
Contact material	AgPd with Au clad	AgPd with Au clad	AgPd with Au clad	AgPd with Au clad (std) / Ag with Au clad (high cap.)	Ag (Au clad)
Max. operating current	1 A	1 A	2 A	2 A (std.), and 1 A (make-before-break), 3 A (high capacity).	2 A
Maximum permissible load	1 mA at 5 VDC	1 mA at 5 VDC (single) 0.1 mA at 0.1 VDC (bif.)	0.01 mA at 0.1 VDC (bif.), 1 mA at 1 VDC (single)	0.1 mA at 0.1 VDC (std), 1 mA at 5 VDC (high capacity)	10 μA, 10 mV DC
Rated load (under resistive load)	0.5 A at 110 VAC, 1 A at 24 VDC	0.5 A at 110 VAC 1 A at 24 VDC	0.3 A at 110 VAC, 1 A at 24 VDC	0.5 A at 110 VAC, 1 A at 24 VDC (std. and make-before-break), 2 A at 110 VAC, 3 A at 24 VDC (high capacity)	1 A, 24 VDC 0.2 A, 110 VAC
Coil Ratings					
Rated voltage	5, 6, 9, 12, 24 VDC	1.5, 3, 5, 6, 9, 12, 24 VDC	3, 5, 6, 9, 12, 24, 48 VDC	5, 6, 12, 24, 48 VDC	5, 6, 9, 12, 24, 48 VDC
Power consumption	280 mW (standard), 200 mW (high sensitivity)	450 mW (standard), 200 mW (high sensitivity)	360 mW (standard), 150 mW (high sensitivity)	300 mW (DPDT) 480 mW (4PDT)	200 mW, 360 mW at 48 VDC
Dielectric Strength (50/60 HZ for 1 minute)	500 VAC	500 VAC	1,000 VAC	1,200 VAC (std. and high capacity) 1,000 VAC MBB	2,000 VAC
Electrical Service Life (operations)	90,000 minimum	200,000 minimum	100,000 minimum	70,000 minimum (std.) 90,000 minimum (HC)	100,000 minimum
Terminal Choices	PCB	PCB	PCB	PCB	"L" or "J" modified gullwing leads
Approved Standards	FCC Part 68 Available	UL, CSA. FCC Part 68 Available.	UL, CSA. FCC Part 68	UL, CSA. FCC Part 68	UL and CSA approvals pending. FCC Part 68

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OMRON ELECTRONICS, INC.
One East Commerce Drive
Schaumburg, IL 60173
TWX 910-291-0426

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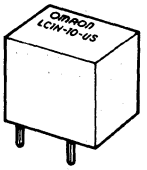
OMRON Power PC Board Relays

Model (Dimensions in Inches)	G5L	LC1M	G6B	G6C
				
	0.75″ H x 0.89″ L x 0.65″ W	0.93″ H x 0.89″ L x 0.65″ W	0.39″ H x 0.79″ L x 0.39″ W	0.39″ H x 0.79″ L x 0.59″ W
Features	Low-profile relay for switching up to 5 A in appliances, security equipment, and environment control systems. Flux-tight or plastic sealed.	Subminiature relay for appliance applications. For power applications requiring high resistance to voltage surges. Flux-tight.	Subminiature relay with 5 A switching capability for output applications in consumer and commercial equipment. Latching type available. Plastic sealed.	High-capacity, subminiature relay switches 10 A loads with SPST-NO and 8 A loads with SPST-NO and SPST-NC. Flux-tight or plastic sealed.
Contact Ratings				
Contact form	SPDT, SPST-NO	SPDT, SPST-NO (DC) SPDT (AC)	SPST-NO, SPST-NO + SPST-NC, DPST-NO, DPST-NC	SPST-NO, SPST-NO + SPST-NC
Contact type	Single button	Single button	Single button	Single button
Contact material	AgCdO	AgCdO	AgCdO	AgCdO
Max. operating current	5 A	5 A (AC), 10 A (DC)	5 A	10 A, 8 A
Minimum permissible load	100 mA at 5 VDC	100 mA at 5 VDC	10 mA at 5 VDC	10 mA at 5 VDC
Rated load (under resistive load)	5 A at 120 VAC 5 A at 30 VDC	5 A at 110 VAC 24 5 VDC (AC Coil) 10 A at 110 VAC/24 VDC (DC Coil)	5 A at 250 VAC 5 A at 30 VDC	10 A at 250 VAC, 10 A at 30 VDC / 8 A at 250 VAC, 8 A at 30 VDC
Coil Ratings				
Rated voltage	3, 5, 6, 12, 24 VDC	6, 12, 24 VDC 100, 120 VAC	3, 5, 6, 12, 24 VDC	3, 5, 6, 12, 24 VDC
Power consumption	400 mW	360 mW (DC) .74 VA (AC)	200 mW 1-pole 300 mW 2-pole	200 mW
Dielectric Strength (50/60 HZ for 1 minute)	2,000 VAC	1,500 VAC	3,000 VAC	2,000 VAC
Electrical Service Life (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
Terminal Choices	PCB	PCB	PCB	PCB
Approved Standards	UL, CSA	UL, CSA	UL, CSA, FCC Part 68	UL, CSA

Moving Loop Relay

Specifications subject to change without notice.

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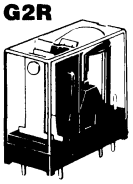
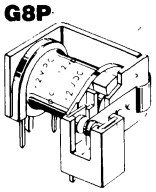
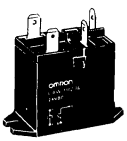
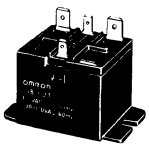
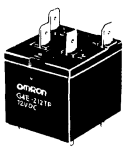
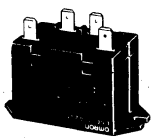
OMRON Power PCB and Power Relays

Model (Dimensions in Inches)	G2R	G8P	G4W	G4B	G4E	G5D
	 1.00"H x 1.14"L x 0.51"W	 0.66"H x 1.20"L x 0.95"W	 1.22"H x 1.77"L x 0.79"W	 1.14"H x 2.00"L x 1.28"W	 1.18"H x 1.40"L x 1.20"W	 1.83"H x 2.70"L x 1.32"W
Features	Slim-styled power relay. 16 A high-capacity, bifurcated contact, sealed, Class B insulation. Latching types available.	Power relay breaks up to 30A load. Class B insulation, dust cover and sealed versions available.	Offers high impulse withstand voltage and dielectric strength. Ideal for power switching. Sealed type and Class B insulation available.	Breaks 15 A, carries 20 A and withstands 55 A inrush. 25 A high capacity and Class B insulation types available.	Double-pole power relay that breaks 15 A and withstands 55 A inrush.	Power relay has double-break contact arrangement. Class B insulation available.
Contact Ratings						
Contact form	SPDT, SPST-NO, SPST-NC, DPDT, DPST-NO, DPST-NC	SPST-NO, SPST-NC, SPDT	SPST-NO, DPST-NO	SPST-NO SPDI	DPST-NO	SPST-NO DPST-NO
Contact material	AgCdO or AgInSn	AgCdO, AgInSn, or Ag	AgCdO	AgCdO or AgInSn	AgCdO	AgCdO
Max. operating current under resistive load	16 A (high-capacity 1-pole) 10 A (general-purpose 1-pole) 5 A (general-purpose 2-pole) 5 A (bifurcated, 1-pole) 5 A (high sensitivity 1-pole) 3 A (high sensitivity 2-pole)	30 A (SPST-NO) 15 A (SPST-NC) 20 A (SPDT-NO), 10 A (SPDT-NC)	15 A (SPST-NO) 10 A (DPST-NO)	15 A 25 A (high capacity)	15 A	30 A (SPST-NO) 20 A (DPST-NO)
Max. operating voltage	380 VAC, 125 VDC	250 VAC, 28 VDC	250 VAC	250 VAC, 125 VDC	250 VAC	250 VAC
Number of poles	1 2	1	1 2	†	2	1 2
Max. switching capacity under resistive load	2,500 VA 1,250 VA 300 W 150 W	7,500 VA 560 W	3,750 VA 2,500 VA	3,300 VA 360 W	3,750 VA	7,500 VA 5,000 VA
Minimum permissible load (reference value)	100 mA at 5 VDC 10 mA at 5 VDC	500 mA at 5 VDC	100 mA at 5 VDC	100 mA at 5 VDC	100 mA at 5 VDC	100 mA at 5 VDC
Rated load (under resistive load)	10 A at 250 VAC, 30 VDC 5 A at 250 VAC, 30 VDC	30 A at 250 VAC 20 A at 28 VDC	15 A at 220 VAC 10 A at 220 VAC	15 A at 220 VAC, 24 VDC 25 A at 220 VAC, 24 VDC	15 A at 220 VAC	30 A at 250 VAC 20 A at 250 VAC
Coil Ratings						
Rated voltage	6, 12, 24, 50, 100/110, 120, 200/220, 240 VAC 3, 5, 6, 12, 24, 48, 100, 110 VDC	5, 6, 9, 12, 15, 18, 24, 48 VDC	12, 24, 100 VDC	6, 12, 24, 50, 100, 120 VAC 6, 12, 24, 48, 100, 110 VDC	12, 24 VDC	6, 12, 24, 50, 100, 110, 120, 200, 220, 240 VAC 6, 12, 24, 48, 100, 110 VDC
Power consumption	0.9 VA, 0.53 W	0.9 W	800 mW	1.3 VA, 1.2 W	1.1 W	3 VA, 1.9 W
Dielectric Strength (50/60 Hz for 1 minute)	5,000 VAC	1,500 VAC	4,000 VAC	2,000 VAC	2,000 VAC	4,000 VAC
Electrical Service Life (operations)	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum	100,000 minimum
Terminal Choices	PCB terminal, plug-in and quick-connect	PCB terminal	PCB terminal, quick-connect, solder, combination PCB + QC	Quick-connect, combination PCB + QC	Combination PCB & QC	Quick-connect
Approved Standards	UL, CSA, SEV, SEMKO, VDE, TUV	UL, CSA	UL, CSA, VDE, SEMKO, SEV	UL, CSA	UL, CSA	UL, CSA, VDE, TUV

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One East Commerce Drive
Schaumburg, IL 60173
TWX 910-291-0426

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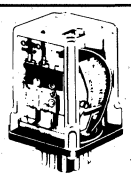
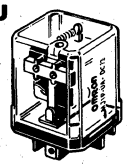
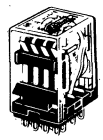
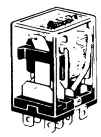
OMRON General Purpose Relays

Model (Dimensions in Inches)	MK	MJ	MY	LY
				
	2.07″ H x 1.36″ L x 1.36″ W	1.89″ H x 1.52″ L x 1.40″ W	1.42″ H x 1.10″ L x 0.85″ W	1.40″ H x 1.10″ L x 0.85″ W
Features	Exceptionally reliable power relay plugs into convenient octal pin sockets. Latching type and operation indicator versions available.	Power relay for exclusive use in control panels. Operation indicator and test button versions available.	Versatile relay, ideal for power and sequence control applications, meets many other application requests.	Compact, general-purpose relay suitable for a wide range of applications up to 15 A. Latching, operation indicator, test button versions.
Contact Ratings				
Contact form	SPDT, DPDT, 3PDT	SPDT, DPDT, 3PDT	DPDT, 3PDT, 4PDT	SPDT, DPDT, 3PDT, 4PDT
Contact material	Ag, AgCdO	Ag	Ag or AgCdO	AgCdO
Max. operating current under resistive load	5 A (SPDT, DPDT; Ag contacts) 3 A (3PDT; Ag contacts) 10 A (SPDT, DPDT, 3PDT with AgCdO contacts	10 A	5 A (DPDT, 3PDT unsealed) 3 A (4PDT unsealed) 3 A (4PDT hermetically sealed) 1 A (4PDT sealed)	15 A (SPDT) 10 A (DPDT, 3PDT, 4PDT) 5 A (bifurcated contacts, DPDT and 4PDT)
Max. operating voltage	500 VAC, 250 VDC	500 VAC, 250 VDC	250 VAC, 125 VDC	250 VAC, 125 VDC
Number of poles	1 and 2 | 3	1 and 2 | 3	2 and 3 | 4	1 | 2, 3 and 4
Max. switching capacity under resistive load	1,100 VA, 72 W (Ag contacts) 2,300 VA, 280 W (AgCdO) | 660 VA, 48 W (Ag contacts) 2,300 VA, 280 W (AgCdO)	1,600 VA 280 W | 1,600 VA 280 W	1,100 VA 120 W | 660 VA 72 W	1,700 VA 360 W | 1,100 VA 240 W
Related load (under resistive load)	5 A at 220 VAC 3 A at 24 VDC 10 A at 230 VAC 10 A at 28 VDC | 3 A at 220 VAC 2 A at 24 VDC 10 A at 230 VAC 10 A at 28 VDC	10 A at 110 VAC, 24 VDC	5 A at 220 VAC, 24 VDC | 3 A at 220 VAC, 24 VDC	15 A at 110 VAC, 24 VDC | 10 A at 110 VAC, 24 VDC
Minimum permissible load (reference value)	10 mA at 1 VDC (Ag) 100 mA at 5 VDC (AgCdO)	10 mA at 1 VDC	1 mA at 5 VDC | 1 mA at 1 VDC	100 mA at 5 VDC
Coil Ratings				
Rated voltage	6, 12, 24, 50, 120, 240 VAC 6, 12, 24, 48, 110 VDC	6, 12, 24, 50, 120, 240 VAC 6, 12, 24, 48, 110 VDC	6, 12, 24, 50, 110/120, 220/240 VAC 6, 12, 24, 48, 100/110 VDC	6, 12, 24, 50, 110/120, 220/240 VAC 6, 12, 24, 48, 100/110 VDC
Power consumption at 60 Hz for AC	2.3 VA, 1.5 W	2.1 VA 1.2 W | 2.5 VA 1.2 W	Approx. 1.2 VA, 0.9 W	1.2 VA, 0.9 W | 1.2 VA, 0.9 W (DPDT) 1.6 VA, 1.4 W (3PDT) 1.95 VA, 1.5 W (4PDT)
Dielectric Strength (50/60 Hz for 1 minute)	1,500 VAC	2,000 VAC	2,000 VAC, unsealed 1,500 VAC, sealed	2,000 VAC
Electrical Service Life (operations)	250,000 minimum	500,000 minimum	500,000 minimum (4P-200,000 min.)	200,000 minimum (LY2-500,000 min.)
Terminal Choices	Octal pin	Quick connect, plug-in	PCB terminal, plug-in	PCB terminal, plug-in
Approved Standards	UL, CSA, SEV	UL, CSA	UL, CSA, SEV	UL, CSA, SEV

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

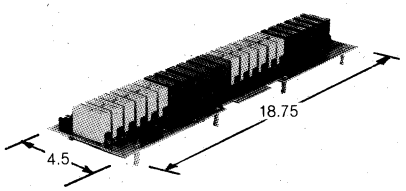
Z
ZIF zero insertion force

Opto 22

Power I/O Systems

The original and most versatile I/O system available. Over 10,000,000 trouble-free installations prove our reliability.

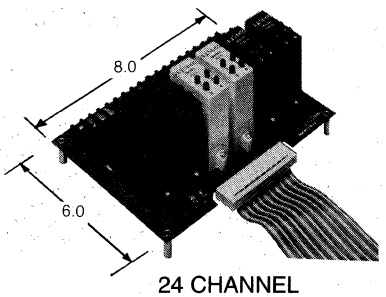
Mounting Racks



24 CHANNEL
SINGLE CHANNEL MOUNTING RACK

Channels	Control Connection*			
	EC	Term	Head	SPCL
4		PB4	PB4H	PB4Rxx
8	PB8		PB8H	
16	PB16A	PB16T	PB16H	PB16Cxxx
24	PB24			

xx = Isolated Control
xxx = Extra Barrier Strip



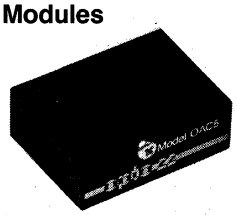
24 CHANNEL
QUAD PAK™ MOUNTING RACK

Channels	Control Connection*	
	EC	Head
16	—	PB16HQ
24	PB24Q	PB24HQ
32	PB32DEC	PB32HQ

*E.C. = Edge Connector
Term = Terminal Strip
Head = 50 Pin Header

I/O Modules

Single Channel Modules



- ☐ 4000V Optical Isolation
- ☐ U.L. & CSA Recognized
- ☐ Plug-in Transient Immune

OUTPUT MODULES

Rating	Model
120 VAC	OAC5*
240 VAC	OAC5A*
240 VAC (N.C.)	OAC5A5
60 VDC	ODC5*
200 VDC	ODC5A

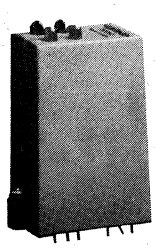
5V Logic Modules Listed

INPUT MODULES

Rating	**Model**
120 VAC/DC	IAC5*
240 VAC/DC	IAC5A*
10-32VAC/DC	IDC5*
35-60VAC/DC	IDC5G
4-16 VDC	IDC5B**

** Fast Switching
* = Also Available for 15 & 24 Volt Logic

4 Channel Quad Pak™ Modules



- ☐ 4000 V Optical Isolation
- ☐ U.L. & CSA Recognized
- ☐ Plug-in
- ☐ Built-in Status Light

OUTPUT MODULES

Rating	Model
120/240 VAC	OAC5Q
60 VDC	ODC5Q
200 VDC	ODC5AQ

All Modules: 5VDC Logic

INPUT MODULES

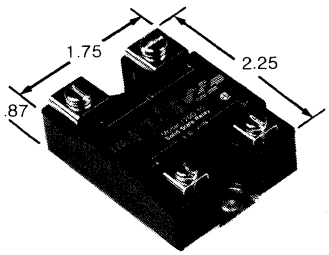
Rating	Model
120 VAC DC	IAC5Q
240 VAC DC	IAC5AQ
10-32 VAC DC	IDC5Q
4-16 VDC	IDC5BQ**

** Fast Switching

Optically Isolated SSRs

- ☐ TTL Compatible Control
- ☐ 4000 V Optical Isolation
- ☐ UL Recognized, CSA Certified
- ☐ Zero Cross Switching for low noise
- ☐ Intergal snubber–tested twice at Rated & Surge Current for both resistive load & 0.5 power factor inductive load.

Power Series–AC Load†

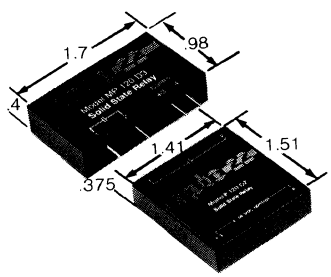


Chassis mount, heavy duty power relays utilizing twin SCRs & the most advanced heat transfer design.

Output Current Rating Amps	Output Voltage Rating* 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
3	120D3	240D3	55	3-32 VDC
10	120D10	240D10	110	3-32 VDC
25*	120D25	240D25	250	3-32 VDC
45*	120D45	240D45	650	3-32 VDC
10	120A10	240A10	110	85-280 VAC
25*	120A25	240A25	250	85-280 VAC
45*	120A45	240A45	650	85-280 VAC

*Also available with 380 VAC rating

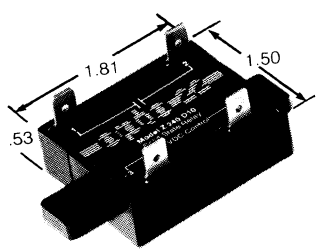
PC Board Series–AC Load†



Two optimized configurations–the thin P series for edge stacked cards and the MP series where a small footprint is required.

Output Current Rating Amps	Output Voltage Rating 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
2	MP120D2	MP240D2	20	3-24 VDC
4	MP120D4	MP240D4	85	3-24 VDC
2	P120D2	P240D2	20	3-32 VDC
4	P120D4	P240D4	85	3-32 VDC

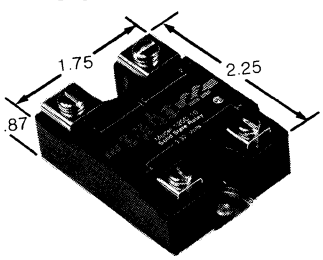
Z Series



Designed for high volume the best buy in solid state relays.
Proof that quality does not have to cost more.

Output Current Rating Amps	Output Voltage Rating 120 VAC	240 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
10	Z120D10	Z240D10	110	3-32 VDC

480 Volt Transient Proof High Voltage Power Series



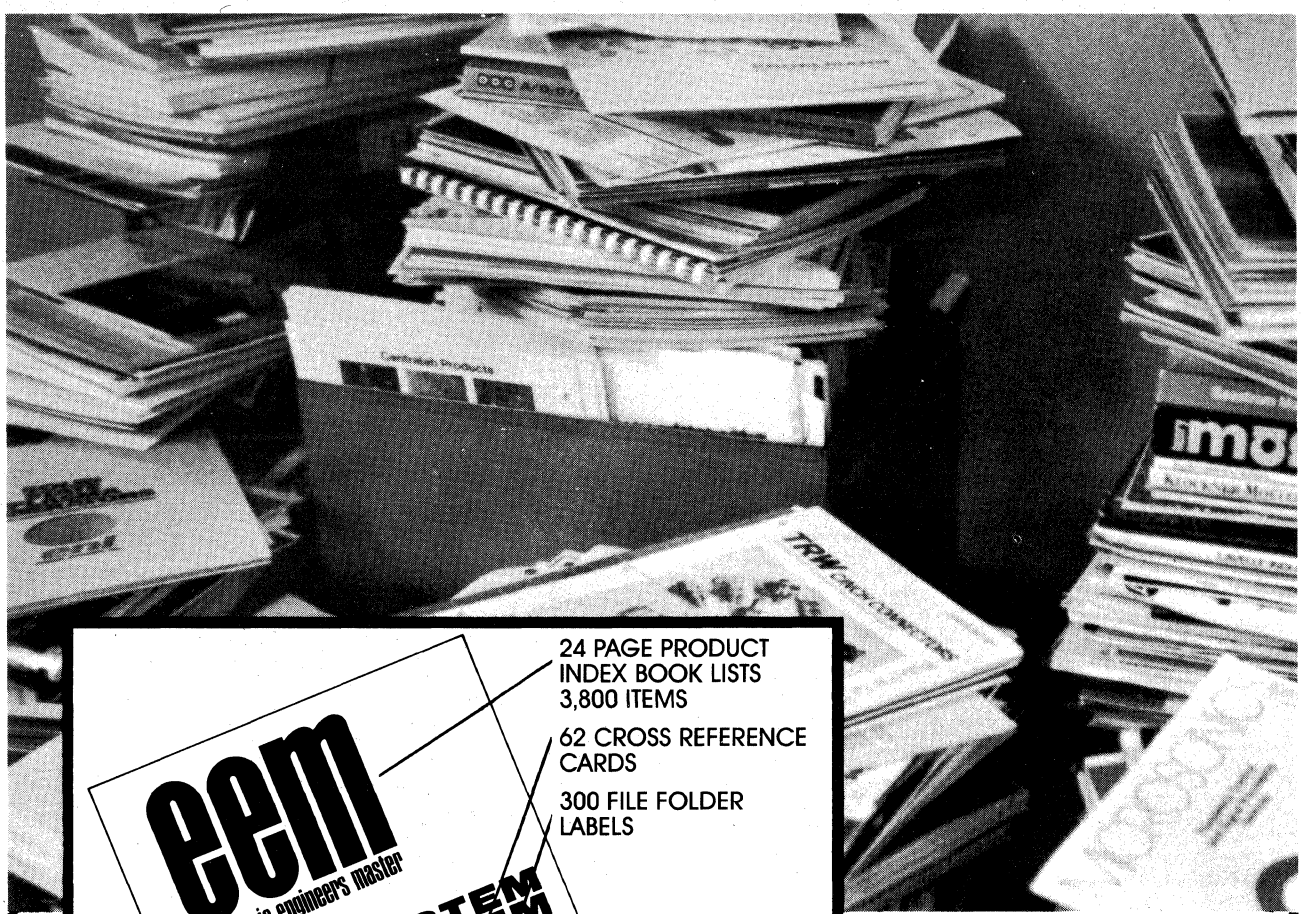
Advanced design provides transient immunity to 2000 volts!

Current Rating Amps	Output Voltage Rating 480 VAC	1 Cycle Surge (Amps) Peak	Control Voltage
10	480D10-12	110	3-32 VDC
15	480D15-12	150	3-32 VDC
10	480A10-12	110	85-280 VAC

D.C. SWITCHING RELAYS ALSO AVAILABLE

opto 22

15461 Springdale Street, Huntington Beach, CA 92649 / (714) 891-5861 / Telex 692386



24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

ALL NEW with this edition of EEM

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You say you want to file catalogs by type of product? That's easy to do with The System. But, what are you going to do when there are multiple products in one catalog? Take Mallory for example. There are all kinds of products in the Mallory Short Form Catalog. With the EEM File System all you do is file the catalog under "M" for Mallory and refer to it on all of the cross reference cards that apply.

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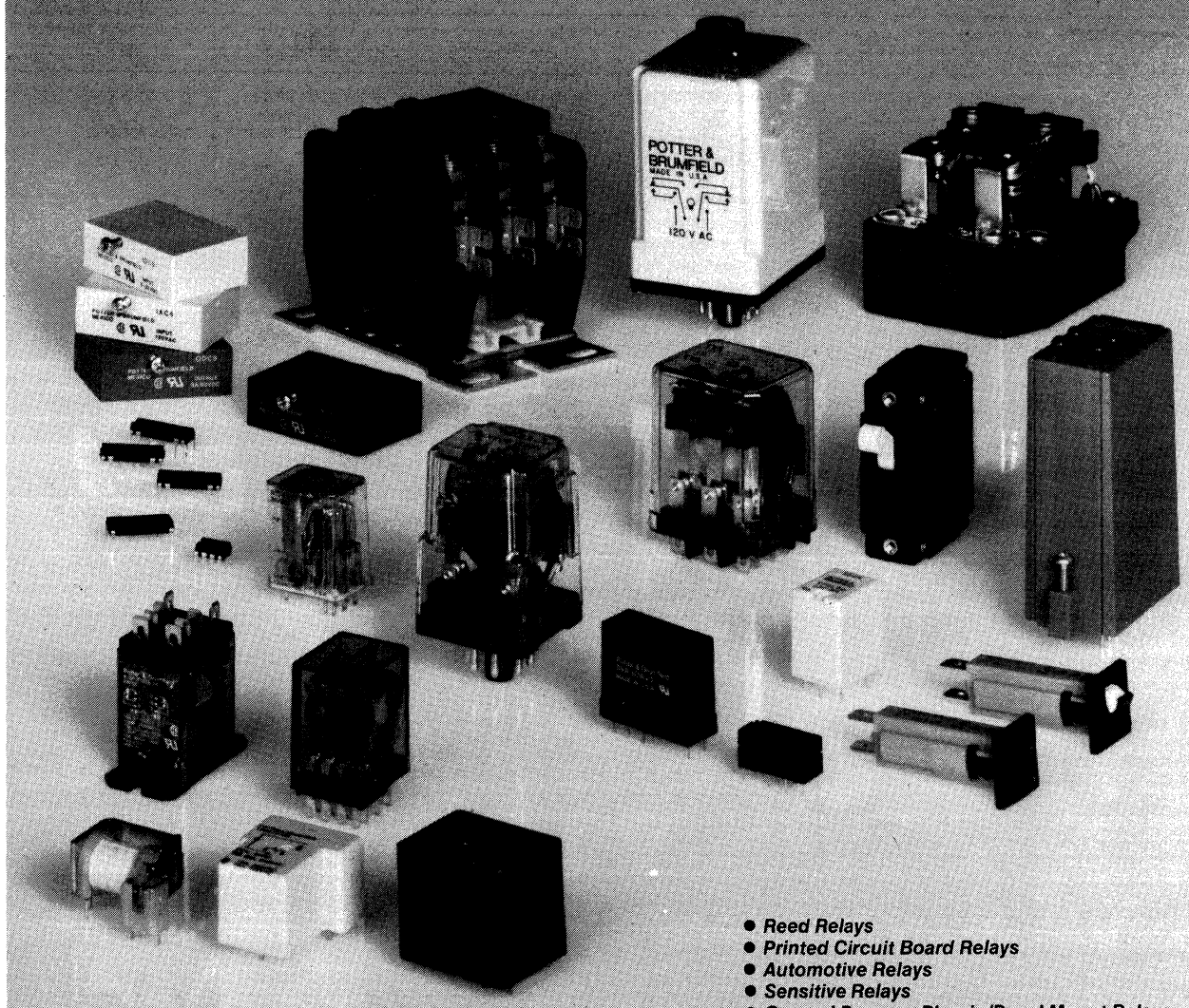
Relays, Contactors and I/O Modules



The following pages provide an overview of stock items in Potter & Brumfield's extensive product line. For more information on any P&B product, contact your nearest authorized P&B distributor or sales representative. Call toll free ***800/255-2550*** *for the name of one near you. Note: Specifications and/or agency recognitions do not necessarily apply to all models within a particular series.*

- *Reed Relays*
- *Printed Circuit Board Relays*
- *Automotive Relays*
- *Sensitive Relays*
- *General Purpose Plug-in/Panel Mount Relays*
- *Impulse and Latching Relays*
- *Power Relays*
- *Contactors*
- *High Reliability Relays*
- *Buzzer*
- *Time Delay Relays*
- *Solid State Relays*
- *Solid State Input/Output Modules*

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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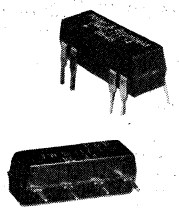
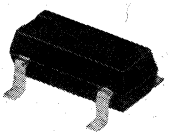
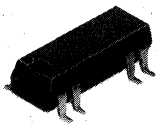
Reed Relays

					
Series	**JWD-JWS**	**JS1**	**JS2**	**JS3**	**JHV**
Features	• Low profile reed relay • DIP and SIP terminations • Immersion cleanable • Optional transient suppression diode	• Miniature, surface mount reed relay • Side terminated with "gull-wings"	• Surface mount reed relay • Side terminated with "J" hooks or "gull-wings"	• Shielded, surface mount reed relay • End terminated with "J" hooks or "gull-wings"	• High voltage dry reed relay • High dielectric strength
Approx. Dimensions Inch (mm)	.77 x .30 x .28h (19.6 x 7.6 x 7.0h)	.55 x .24 x .22h (14 x 6 x 5.6h)	.77 x .29 x .23h (19.6 x 7.4 x 5.9h)	.76 x .24 x .18h (19.3 x 6.1 x 4.6h)	4.5 x .88 x .75h (114 x 22.3 x 19.1h)
Contact Arrangement	1 Form A, 1 Form C 1 Form B, 2 Form A	1 Form A	1 Form A	1 Form A	1 Form A, 1 Form B
Contact Material	Rh	Rh	Rh	Rh	—
Contact Rating	(1A) 10W, 0.5A 200 VDC (1B)10W, 0.5A 100 VDC (1C)5W, 0.5A 100VDC (2A)10W, 0.5A 100 VDC	5W or 5VA, 0.5A, 200VDC or VAC	10W or 10VA, 0.5A, 100VDC or VAC	10W or 10VA, 0.5A, 100VDC or VAC	50W or 50VA, 3A, 5,000 VDC 50W or 50VA, 1A, 10,000 VDC
Minimum Mechanical Life (Operations)	—	—	—	—	—
Minimum Electrical Life at Rated Load (Operations)	10^6	—	—	—	—
Coil Voltage	5-24 VDC	5-24 VDC	5-24 VDC	5-24 VDC	6-24 VDC
Nominal Coil Power	50-480mW	66-288mW	As low as 67mW	As low as 167mW	200-1,500mW
Mounting	PC board	Surface mount	Surface mount	Surface mount	Panel mount
Sockets	Fits 14-pin IC socket	—	—	—	Solder terminals

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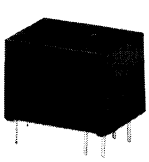
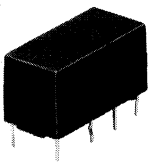
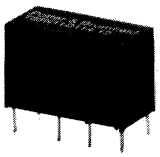
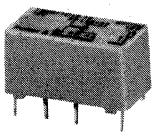
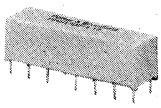
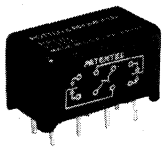
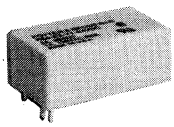
Printed Circuit Board Relays

						
T81	**T82**	**T85**	**T83**	**T84**	**HP**	**R50**
• Miniature, high density package • Immersion cleanable case • Sensitive coil available • DIP terminal arrangement • High dielectric model available • ᵁᴸ	• Miniature, low profile package • Immersion cleanable case • DIP terminal arrangement • ᵁᴸ	• Miniature, DIP relay • High sensitivity coil • Sealed case for immersion cleaning • ᵁᴸ ᶜˢᴬ	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching and non-latching types • Sealed case • Sensitive coil available	• Miniature, telecom relay • Meets FCC Part 68 isolation • Latching and non-latching types • Sealed case • Sensitive coil available • ᵁᴸ ᶜˢᴬ	• Low profile • High density mounting • Immersion cleanable • Half-size crystal case • Hermetically sealed version available	• Switches to 5 amps • Economical • Low profile package • Immersion cleanable case • ᵁᴸ ᶜˢᴬ
.61 x .45 x .43h (15.4 x 11.4 x 11.0h)	.83 x .42 x .47h (21.1 x 10.7 x 11.9h)	.79 x .39 x .49h (20.1 x 10 x 12.4h)	.79 x .39 x .40h (20.1 x 10 x 10.2h)	1.4 x .40 x .40h (35.4 x 10.1 x 10.1h)	.88 x .48 x .49h (22.4 x 12.2 x 12.5h)	1.09 x .60 x .46h (27.7 x 15.7 x 11.7h)
1 Form C	2 Form C	2 Form C	2 Form C	4 Form C	2 Form C	1 Form C 2 Form C
Au overlay, Ag Pd	Au overlay, Pd Ag	Au overlay Pd Ag & Pd Ag	Au overlay, Ag	Au overlay, Pd Ag	Au plated Ag Mg Ni	Ag Ag Cd 0
1A @ 24 VDC 0.5A @ 120 VAC	(Single Contact) 2A AC or DC 150 VDC, 125 VAC 30W or 60VA (Bifurcated Crossbar) 1.25A AC or DC 100 VDC or 90 VDC 30W or 50 VA	1.25A, AC or DC 150 VDC or 200 VAC 24W or 60VA	2A, AC or DC 150 VDC or 125 VAC 35W or 60VA	2A, AC or DC 250 VDC or 220 VAC 35W or 60 VA	0.3-2A @ 28 VDC 0.1-0.5A @ 120 VAC	2A @ 28 VDC or 1A @ 120 VAC 5A @ 28 VDC or 2.5A @ 120 VAC
5×10^6	2×10^7	2×10^7	2×10^7	2×10^7	3×10^6	10^7
1.5×10^5 @ 1A, 24 VDC 10^5 @ 0.5A, 120 VAC	5×10^5 @ 1.25A, 24 VDC or 0.4A, 120 VAC (Single Contact)	5×10^5 @ 1A, 24 VDC 2×10^5 @ .5A, 120 VAC	3×10^5 @ 1.5A, 24 VDC 1×10^5 @ 1A, 120 VAC	5×10^5 @ 1A, 24 VDC 2×10^5 @ 0.5A, 120 VAC	10^5	10^5 @ 2A, 28 VDC and 1A, 120 VAC 6×10^5 @ 5A, 28 VDC and 2.5A, 120 VAC
1.5-24 VDC	5-48 VDC	4.5-48 VDC	5-48 VDC	3-48 VDC	5-48 VDC	5-48 VDC
(standard) 450mW (sensitive) 200mW	516-560mW	150-300mW	75-400mW	90-400mW	700mW	0.75-1.3W
PC board	PC board Plug-in	PC board	PC board	PC board	PC board Plug-in	PC board
Fits 12-pin IC socket	Fits 16-pin IC socket	Fits 16-pin IC socket	Fits 16-pin IC socket	Fits 28-pin IC socket	Solder terminal	—

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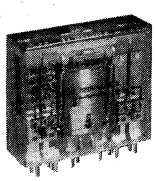
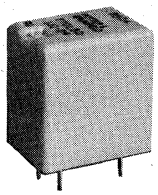
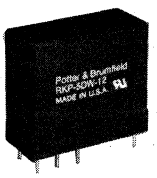
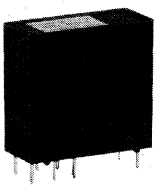
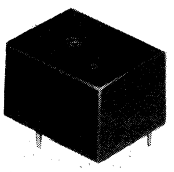
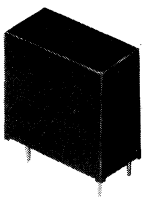
Printed Circuit Board Relays

						
Series	**R40**	**T70**	**RKP/RKS**	**RKA**	**T73**	**T74**
Features	• Flat pack case style • 0.450″ (11.43mm) maximum thickness • IC logic compatible with TTL, HTL and CMOS • ᵁᴸ ᶜˢᴬ	• Low cost • Load switching to 10A • TV5 contact rating • 1,500 VRMS coil-to-contacts breakdown • Dust cover or immersion cleanable case • ᵁᴸ ᶜˢᴬ	• 0.6 cubic inch (10 cm³) package • Dust cover or immersion cleanable case • 8mm contact to coil spacing • 4,000 VRMS insulation breakdown • ᵁᴸ ᶜˢᴬ ᵛᴰᴱ	• 0.6 cubic inch (10cm³) package • Immersion cleanable case • Meets 8mm spacing and 4kV isolation • TV-3 and TV-5 ratings • ᵁᴸ	• Low-profile relay • Less than .59″ (14.7mm) tall • Sealed case • Ratings to 10A • UL478 and UL508 • ᵁᴸ	• Requires only .33 square inch (2.15cm²) of PC board area • High sensitivity coil • Sealed PBT case • DIP terminal configuration • 4kV surge strength • ᵁᴸ
Approx. Dimensions (mm) Inch	1.42 x .45 x 1.25h (36.1 x 11.4 x 31.6h)	.88 x .65 x .95h (22.4 x 16.4 x 24.0h)	1.18 x .51 x 1.07h (30.0 x 13.0 x 27.1h)	1.15 x .51 x 1.03h (29.2 x 13 x 26.2h)	.84 x .65 x .58h (21.3 x 10.7 x 14.7h)	.81 x .41 x .81h (20.6 x 10.4 x 20.6h)
Contact Arrangement	2 Form C 4 Form C	1 Form C	1 Form C 2 Form C	1 Form A, 2 Form A 1 Form C, 2 Form C	1 Form A 1 Form C	1 Form A 1 Form C
Contact Material	Ag Ag Cd 0 Au Ag Pt	Au plated Ag Ag Cd 0	Ag Cd 0	Ag Ni Ag Cd 0	Au overlay, Pd Ag Au overlay, Ag Ni Ag Sn	Ag Sn Ag Cd 0
Contact Rating	Dry circuit to 7.5A @ 28VDC or 115 VAC	5A @ 28 VDC or 120 VAC 10A @ 28VDC or 120 VAC 5A tungsten @ 120 VAC 5A @ 240 VAC 1/4 HP @ 120 VAC	5A @ 30 VDC or 277 VAC 10A @ 30 VDC or 277 VAC 20A @ 24 VDC or 277 VAC	5 to 10A @ 24 VDC or 240 VAC UL TV-3 and TV-5	1A to 10A @ 30 VDC or 120 VAC 10A @ 24 VDC or 120 VAC	2 to 5A @ 250 VAC
Minimum Mechanical Life (Operations)	5×10^7	10^7	10^6	5×10^6	2×10^7	1×10^7
Minimum Electrical Life at Rated Load (Operations)	7.5×10^4 to 5×10^5	7.5×10^4 @ 5A, 28 VDC, 120 VAC or 240 VAC 5×10^4 @ 10A, 28 VDC or 120 VAC 2.5×10^4 @ 5A tungsten	10^5 @ 5A, 30 VDC or 277 VAC 10^5 @ 10A, 30 VDC or 277 VAC 2×10^4 @ 20A, 277 VAC	1×10^5	1×10^5	1×10^5
Coil Voltage	6-48 VDC	3-48 VDC	4.5-48 VDC	3-48 VDC	3-48 VDC	5-48 VDC
Nominal Coil Power	450-720mW	360mW	524mW	530-720mW	450-600mW	360mW
Mounting	PC board Plug-in	PC board	PC board	PC board	PC board	PC board
Sockets	Solder terminal PC terminal	—	—	—	—	—

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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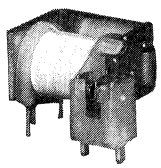
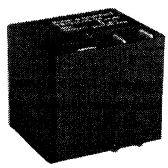
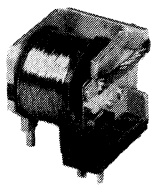
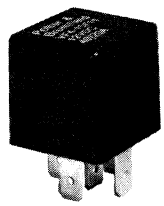
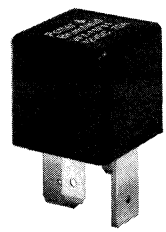
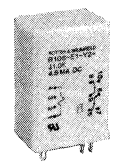
PC Board Relays		Automotive Relays			Sensitive Relay
					
T90	**T91**	**VKP**	**VF4**	**VF7**	**R10S**
• Switch loads up to 30A • Less than 1 watt coil power • Class B insulation • Class F available • Economically priced • Open, dust cover or immersion cleanable case • ᵁᴸ ⓒᶠ	• Both quick connects and PC terminals for contacts • PC terminals for coil • Meet UL 873 and UL 508A spacings • Sealed or unsealed enclosure • Class B insulation • Class F available • Optional flanged case for panel mounting • ᵁᴸ	• Compact package for PC board mounting • Open-frame design • Switches up to 40 amps • Internationally proven design	• Plastic enclosed relay • Various mounting options • Swithces to 40 amps • Standard design for many U.S. autos	• Plastic enclosed relay • Various mounting options • Switches to 70 amps • Standard design for many U.S. autos	• Highly sensitive • 10mW coil power per pole • Opaque dust cover • Driven directly by TTL, CMOS, HTL and ECL • ᵁᴸ
1.20 x .95 x .67h (30.5 x 24.1 x 16.9h)	1.27 x 1.07 x 1.10h (32.1 x 27.2 x 27.9h)	.91 x .75 x .72h (23.1 x 19 x 18.3h)	1.03 x 1.03 x .99h (26.2 x 26.2 x 25.1h)	1.03 x 1.03 x .99h (26.2 x 26.2 x 25.1h)	1.01 x .74 x 1.50h (25.7 x 18.7 x 38.1h)
1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A 1 Form C	1 Form A	1 Form C 2 Form C 4 Form C
Ag Ag Cd 0	Ag Cd 0	Ag	Ag	Ag	Ag
30A @ 28 VDC or 240 VAC 6A @ 277 VAC 2 HP @ 240 VAC	30A @ 28 VDC or 240 VAC 6A @ 277 VAC 2 HP @ 240 VAC	40A @ 14 VDC (NO) 20A @ 14 VDC (NC)	40A @ 14 VDC (NO) 30A @ 14 VDC (NC)	70A @ 14 VDC	Dry circuit to 3A @ 28 VDC or 115 VAC
10^7	10^7	1×10^6	1×10^6	1×10^6	10^8
10^5	10^5	1×10^5	1×10^5	1×10^5	5×10^5
5-110 VDC	5-110 VDC	6-24 VDC	6-24 VDC	6-24 VDC	6-12 VDC
870-930mW	870-930mW	1.6W	1.6W	2W	(1C) 10mW (2C) 20mW (4C) 40mW
PC board	PC board Panel mount	PC board	PC board, Plug-in Mtg. Bracket	PC board, Plug-in Mtg. Bracket	Plug-in PC board
—	—	—	Sockets available	Socket available	Screw terminal Solder terminal PC terminal

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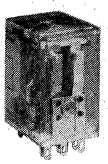
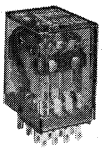
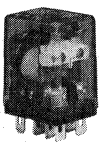
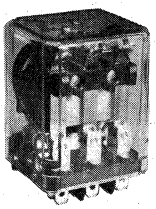
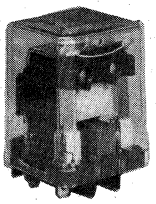
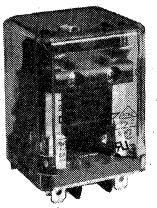
General Purpose Plug-in/Panel Mount Relays

						
Series	**R10**	**KHA**	**K10**	**KUP**	**KUEP**	**KUIP-KUGP**
Features	• Up to 8 pole contacts • Dust cover or immersion cleanable case • Sensitive coils available • Optional indicator lamp • Optional octal plug base (up to 3 pole) • ᴿᵁᴸ Ⓢ	• Approx. one cubic inch (16 cm³) package • AC and DC coils • Smoked dust cover • Optional flange-top case for panel mounting • Indicator lamp available • ᴿᵁᴸ Ⓢ	• Small, compact relay • DPDT, 13 amp switching capability • Smoked dust cover • Optional flange-top case for panel mounting • AC and DC coils • ᴿᵁᴸ Ⓢ	• Open or enclosed • Plain and bracket mount dust covers • Optional flange-top case for panel mounting • Optional indicator lamp and push-to-test button • Several socket styles • ᴿᵁᴸ Ⓢ	• Switches DC currents • Magnetic blow-outs • Clear dust cover • Optional flange-top case for panel mounting • Several socket styles • ᴿᵁᴸ Ⓢ	• VDE approved design • Class B insulation • 8mm coil-to-contact spacing (KUIP) • 3mm open contact gap (KUGP) • Plain and bracket mount dust covers • Optional flange-top/panel mount case • ᴿᵁᴸ Ⓢ △ Ⓒ
Approx. Dimensions inch (mm)	1.17 x .74 x 1.18h (29.6 x 18.7 x 30.2h)	1.11 x .85 x 1.36h (28.2 x 21.6 x 34.5h)	1.11 x .86 x 1.38h (28.2 x 21.8 x 34.9h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)
Contact Arrangement	1 Form C to 8 Form C	2 Form C 4 Form C	2 Form C	1 Form C, 2 Form C 3 Form C, 4 Form C	1 Form X 2 Form A 2 Form C	1 Form C, 2 Form A 2 Form C, 3 Form C
Contact Material	Au overlay, Ag Ag Ag Cd O	Ag Ag Cd O Au Ag Ni Au overlay, Ag Au diffused Ag	Ag Cd O	Ag Ag Cd O	Ag Cd O	Ag Cd O
Contact Rating	Dry circuit to 7.5A @ 28 VDC or 115 VAC ⅛ HP @ 110-120 VAC ⅙ HP @ 220-240 VAC	Low level to 2A @ 28 VDC or 120 VAC 3A @ 28 VDC or 120 VAC 5A @ 28 VDC or 120 VAC	10A @ 30 VDC or 277 VAC 13A @ 120 VAC	5A @ 28 VDC or 240 VAC 10A @ 28 VDC or 240 VAC	(1X) 10A @ 150 VDC (2A) 5A @ 150 VDC (2C) 3A @ 150 VDC	5A tungsten @ 120 VAC 10A @ 28 VDC or 240 VAC ½A @ 120 VDC
Minimum Mechanical Life (Operations)	10^8	10^7	10^7	10^7	10^7	10^7
Minimum Electrical Life at Rated Load (Operations)	2×10^4 to 6×10^5	10^5	10^5	10^5	10^5	10^5
Coil Voltage	3-115 VDC 24-115 VAC	5-120 VDC 6-120 VAC	6-110 VDC 6-120 VAC	5-110 VDC 6-240 VAC	12-110 VDC 24-120 VAC	12-24 VDC 120 VAC
Nominal Coil Power	(DC) 0.036-1.6W (AC) 1.5VA	(DC) 900mW (AC) 1.2VA	(DC) 900mW (AC) 1.2VA	(DC) 1.2-1.8W (AC) 2.0-2.75VA	(DC) 1.2W (AC) 2.0VA	(DC) 1.2-1.8W (AC) 2.0-2.7VA
Mounting	Plug-in Panel mount PC board	Plug-in Panel mount	Plug-in Panel mount	Plug-in Panel mount	Plug-in Panel mount	Plug-in Panel mount
Sockets	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal

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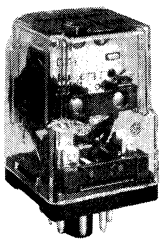
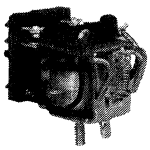
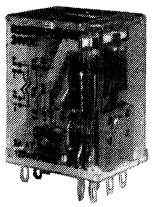
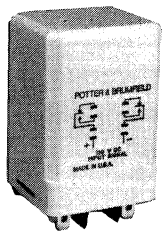
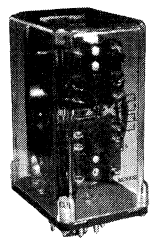
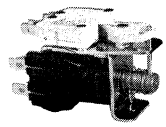
Impulse & Latching Relays

						
KRPA	**KA**	**R30D**	**KUR**	**KUL**	**KBP**	**S89R-S90R**
• Octal-type plug termination • AC and DC coils • Optional indicator lamp • Clear dust cover • Hermetically sealed available • ᵁᴸ Ⓒᵁᴸ	• Small package • Ruggedly constructed • Cost effective • AC or DC operation • Highly efficient for switching light power loads • ᵁᴸ Ⓒᵁᴸ	• Dual coil magnetic latching • Fast operate and reset time • Low level contacts available • 4 pole switching capability • ᵁᴸ Ⓒᵁᴸ	• Permanent memory • Holds mode with or without power • Hybrid latching circuitry • Pulse or alternate action operation • Dust cover is standard	• Magnetic latching • Single or dual coil input • Good memory stability • Low power requirement • Various sockets available • ᵁᴸ Ⓒᵁᴸ	• Dual coil mechanical latching • Coils operate on same or different voltages • Up to 5 pole switching • Clear dust cover with octal plug base • Sockets available for all configurations • ᵁᴸ	• Bistable, impulse operation • Cost effective • Conserves power • Optional dust cover with octal plus base • ᵁᴸ Ⓒᵁᴸ
1.41 x 1.41 x 2.00h (35.7 x 35.7 x 50.8h)	1.92 x 1.47 x 1.38h (48.8 x 37.3 x 34.9h)	.95 x .74 x 1.19h (24.1 x 18.7 x 30.2h)	1.53 x 1.41 x 2.13h (38.9 x 35.7 x 54.0h)	1.53 x 1.41 x 2.16h (38.9 x 35.7 x 54.8h)	1.78 x 2.41 x 3.56h (45.2 x 61.1 x 90.4h)	2.70 x 2.00 x 2.42h (68.6 x 50.8 x 61.5h)
1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C	2 Form C 4 Form C	2 Form C	1 Form C 2 Form C	2 Form C 4 Form C 5 Form C	1 Form C 2 Form C 4 Form C
Ag Ag Cd O	Ag Ag Cd O	Ag Ag Cd O	Ag	Ag Cd O	Ag Ag Cd O	Ag Cd O
5A @ 120 VAC (1C & 2C) 10A @ 250 VAC (3C) 10A @ 120 VAC	5A @ 120 VAC 10A @ 120 VAC 6A @ 240 VAC	Low level to 5A @ 28 VDC or 115 VAC	5A @ 28 VDC or 240 VAC	10A @ 28 VDC or 240 VAC	5A @ 120 VAC 10A @ 120 VAC	(S89R) 15A @ 250 VAC ½ HP @ 250 VAC (S90R) 20A @ 277 VAC 2 HP @ 250 VAC
10^7	10^7	10^7	10^7	10^7	5×10^5	10^5
10^5	10^5	10^5	10^5	10^5	5×10^4	5×10^4
6-110 VDC 6-240 VAC	6-110 VDC 12-240 VAC	12-24 VDC	12-24 VDC 120 VAC	12-24 VDC 12-120 VAC	12-24 VDC 120 VAC	6-24 VDC 6-240 VAC
(DC) 1.2W (AC) 2.0VA	(DC) 1.2W (AC) 2.0VA	0.36-1.44W	—	(DC single coil) 1.2W (DC dual coil) 2.4W	(DC) 2.7W (AC) 5.0-7.8VA	(DC) 6.33W (AC) 9.0VA
Plug-in	Panel mount	Plug-in Panel mount	Plug-in	Plug-in	Plug-in	Panel mount Plug-in (w/dust cover)
Screw terminal	—	Screw terminal Solder terminal PC terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	Solder terminal Screw terminal	Screw terminal (w/dust cover)

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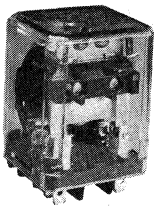
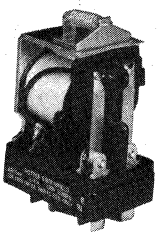
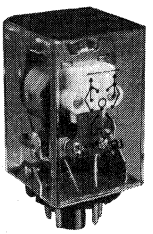
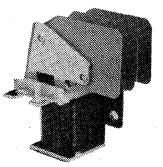
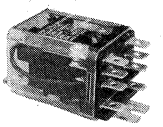
Power Relays

						
Series	**K20**	**KUMP**	**AB**	**KRP-3-H**	**S86R-S87R**	**KUHP**
Features	• Identical to K10 except contacts rated to switch 20A • Plain and bracket mount dust covers • Optional flange-top case for panel mounting • AC and DC coils • Sockets available	• KUP package with 15A contact rating • Plain or bracket mount dust cover • Optional flange-top case for panel mounting • Several socket types • ᴿᴸ Ⓒ	• Durable construction • AC or DC operation • Screw terminal adapters available • Optional heavy metal dust cover • ᴿᴸ Ⓒ	• 20A switching capacity • Enclosed with octal-type plug • Heavy duty construction • Small space requirement • Optional open version • ᴿᴸ	• Economical • 20A switching capacity in compact package • Optional sensitive DC coil • Two mounting styles • ᴿᴸ Ⓒ	• 20A and 30A switching in bracket mount KUP package • 3,750 VRMS coil-to-contacts breakdown • Meets VDE and BSI requirements • Optional flange-top case for panel mounting • ᴿᴸ Ⓒ
Approx. Dimensions inch (mm)	1.11 x .86 x 1.38h (28.2 x 21.8 x 34.9h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.38 x 2.72 x 1.91h (35.1 x 69.1 x 48.5h)	1.53 x 1.41 x 2.28h (38.9 x 35.7 x 57.9h)	2.42 x 2.07 x 1.31h (61.5 x 52.6 x 33.3h)	1.97 x 1.53 x 1.41h (50.0 x 38.9 x 35.7h)
Contact Arrangement	1 Form C	2 Form C 3 Form C	2 Form C	1 Form X	1 Form C 2 Form C	1 Form C 2 Form C
Contact Material	Ag Cd O	Ag Cd O	Ag	Ag Cd O	Ag Cd O	Ag Cd O
Contact Rating	20A @ 240 VAC	15A @ 277 VAC ⅓ HP @ 120 VAC	10A @ 120 VAC 15A @ 277 VAC ¾ HP @ 240 VAC	20A @ 120 VAC ¾ HP @ 120 VAC	20A @ 277 VAC 1 HP @ 125 VAC 2 HP @ 250 VAC	(1C) 30A @ 120/240 VAC 1 HP @ 120 VAC 25A @ 28 VDC (2C) 20A @ 120/240 VAC ¾ HP @ 120 VAC 20A @ 28 VDC
Minimum Mechanical Life (Operations)	10^7	10^7	3×10^6	2.5×10^6	10^6	10^7
Minimum Electrical Life at Rated Load (Operations)	10^5	10^5	10^5	10^5	5×10^4	(DC) 5×10^4 (AC) 10^5
Coil Voltage	6-110 VDC 6-120 VAC	5-110 VDC 6-240 VAC	12-110 VDC 24-240 VAC	12-110 VDC 12-120 VAC	12-24 VDC 24-240 VAC	6-110 VDC 6-120 VAC
Nominal Coil Power	(DC) 900mW (AC) 1.2VA	(DC) 1.2W (AC) 2.75VA	(DC) 2.0W (AC) 6.4VA	(DC) 1.2W (AC) 2.0VA	(DC) 1.13-4.5W (AC) 4.0VA	(DC) 1.2W (AC) 2.7VA
Mounting	Plug-in Panel mount	Plug-in Panel mount	Panel mount	Plug-in (w/dust cover) Panel mount	Panel mount	Panel mount
Sockets	Screw terminal	Screw terminal Solder terminal PC terminal Quick connect terminal	—	Screw terminal	—	—

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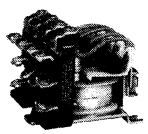
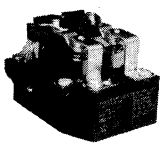
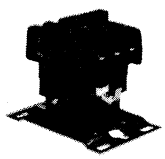
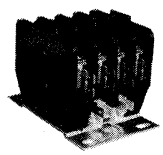
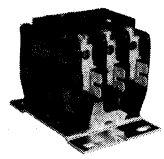
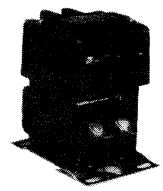
Power Relays			Contactors			
						
PM	**PRD**	**MS**	**P25**	**P41**	**P31**	**P30-P40**
• 4 pole, 25A contacts • High dielectric strength • Screw or quick connect terminals • Dust cover available • Adaptable to PRD mounting holes • ᔑᒪ Ⓢ Ⓤ	• 30A contact rating • High inrush capacity • IC logic compatible • Available with magnetic blowouts • Optional auxiliary switch • ᔑᒪ Ⓢ Ⓤ	• Disconnects starting capacitor on induction run motors • Operates on back emf of start windings • Metal dust cover available • ᔑᒪ Ⓢ	• 25A magnetic contactor • Control 3ϕ motor loads • Field replaceable contacts • Optional auxiliary switch and universal mounting plate • ᔑᒪ Ⓢ	• Four pole magnetic contactor • Control 1ϕ and 3ϕ circuits • Switch motor loads to 25A • Class B coil • Universal mounting plate • Dual quick connects for auxiliary wiring • ᔑᒪ Ⓢ	• Two and three pole magnetic contactor • Control 1ϕ and 3ϕ circuits • Switch motor loads up to 40A • Class B coil • Universal mounting plate • Dual quick connects for auxiliary wiring • ᔑᒪ	• Heavy duty magnetic contactors • P30 switches to 40A • P40 switches to 50A • Field replaceable contacts • Universal mounting plate • Optional auxiliary switch • ᔑᒪ Ⓢ
3.39 x 2.66 x 2.72h (86.2 x 67.5 x 69.1h)	3.38 x 2.51 x 2.50h (85.7 x 63.8 x 63.5h)	3.06 x 2.06 x 2.13h (77.8 x 52.4 x 54.0h)	2.55 x 3.80 x 3.47h (64.8 x 96.5 x 88.1h)	2.63 x 3.80 x 2.73h (66.8 x 96.5 x 69.3h)	2.55 x 3.80 x 2.87h (64.8 x 96.5 x 72.9h)	2.65 x 3.80 x 3.98h (67.3 x 96.5 x 101.1h)
4 Form C	1 Form A, 1 Form X 1 Form C, 2 Form A 2 Form C	1 Form B 1 Form Y	3 Form X	4 Form X	2 Form X 3 Form X	3 Form X 4 Form X
Ag Cd O	Ag Ag Cd O	(1B) Ag (1Y) Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O	Ag Cd O
25A @ 277 VAC 10A @ 28 VDC 1 HP @ 240 VAC	30A @ 277 VAC 2 HP @ 250 VAC 20 A @ 125 VDC	(1B) ¾ HP (1Y) 3 HP	25 FLA, 150 LRA @ 240 VAC 30A res. @ 600 VAC	25 FLA, 150 LRA @ 240 VAC 35A res @ 600 VAC	40 FLA, 240 LRA @ 240 VAC 50A res. @ 600 VAC	(P30) 30 FLA, 180 LRA @ 240 VAC; 40A res. @ 600 VAC (P40) 40 FLA, 240 LRA @ 240 VAC; 50A res. @ 600 VAC
10^7	(1A, 1C, 1X) 2 x 10^6 (2A, 2C) 10^7	5 x 10^5	(DC) 5 x 10^6 (AC) 2 x 10^6	5 x 10^5	5 x 10^5	(DC) 10^7 (AC) 2 x 10^6
10^5	10^5	10^5	5 x 10^5	2 x 10^5	2 x 10^5	2 x 10^5
6-110 VDC 6-480 VAC	6-110 VDC 6-480 VAC	120-240 VAC	12-120 VDC 24-240 VAC	24-480 VAC	24-240 VAC	12-120 VDC 24-240 VAC
(DC) 4.4W (AC) 18.0VA	(DC) 2.0W (AC) 9.8VA	5.9VA	(DC) 4.8W (AC) 10VA	10VA	10VA	(DC) 7.5W (AC) 12VA
Panel mount	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount
–	–	–	–	–	–	–

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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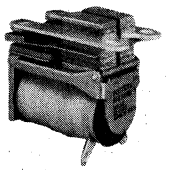
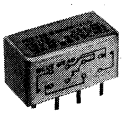
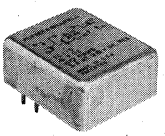
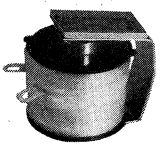
Contactors		High Reliability Relays			Buzzer
					
Series	**MB**	**HC-HL**	**SC-SL**	**FC-FL**	**BU**
Features	• Miniature DC contactor • 60A, double-make switching • Heavy duty construction	• Half-size crystal case • Withstand 150g shocks and 20g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-39016 • Less than 4 millisecond operate time • HL is latching version	• Crystal case • Withstand 200g shocks and 30g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-5757 • Less than 4 millisecond operate time • SL is latching version	• Flat crystal case • Withstand 150g shocks and 30g vibrations to 2,000 Hz • Hermetically sealed • Meet MIL-R-5757 and MSFC-SPEC-339 • Less than 4 millisecond operate time • FL is latching version	• AC operated buzzer • Small, lightweight package • 75 dB sound level minimum • ℛ Ⓢ
Approx. Dimensions inch (mm)	1.41 x .88 x 1.53h (35.8 x 22.4 x 38.9h)	.81 x .41 x 41h (20.6 x 10.4 x 10.4h)	.80 x .36 x .90h (20.3 x 9.1 x 22.9h)	1.10 x .93 x .49h (27.9 x 23.5 x 12.3h)	1.03 x 1.03h (26.2 x 26.2h)
Contact Arrangement	1 Form X	2 Form C	2 Form C	2 Form C	—
Contact Material	Ag	Au plated Ag Mg Ni	Triclad Au	Au plated Ag Mg Ni	—
Contact Rating	60A @ 28 VDC	Dry circuit to 2A @ 28 VDC 0.3A @ 120 VAC	2A @ 30 VDC 1A @ 120 VAC	Dry circuit to 3A @ 28 VDC Dry circuit to 5A @ 28 VDC	—
Minimum Mechanical Life (Operations)	10^6	3×10^6	3×10^6	3×10^6	—
Minimum Electrical Life at Rated Load (Operations)	5×10^4	10^5	10^5	10^5	—
Coil Voltage	6-110 VDC	12-24 VDC	12-24 VDC	12-24 VDC	6-240 VAC
Nominal Coil Power	2.7W	720mW	(SC) 1.0W (SL) 0.9W	650mW	4.6 VA
Mounting	Panel mount	PC board Plug-in Panel mount	PC board Plug-in Panel mount	PC board	Panel mount
Sockets	—	Solder terminal	Solder terminal	—	—

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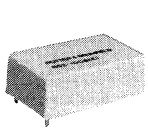
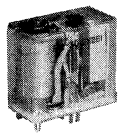
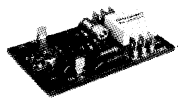
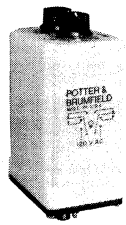
Time Delay Relays

						
Series	**R52**	**R12**	**R16**	**CR**	**CW**	**CB**
Features	• Makes TDR of most DC coil relays • Immersion cleanable • Cost effective	• Small, R10-type package • Choice of mountings	• Open board time delay relay • Economically priced	• Independent ON and OFF delays • Time as low as 0.1 second • ᵁᴸ Ⓒᵁᴸ	• Field programmable • Precision timer • LED "ON" indicator • ᵁᴸ Ⓒᵁᴸ	• Economical for volume applications • Various timing ranges • ᵁᴸ Ⓒᵁᴸ
Approx. inch Dimensions (mm)	1.29 x .80 x .50h (32.6 x 20.2 x 12.7h)	1.38 x .74 x 1.19h (34.9 x 18.7 x 30.2h)	3.63 x 2.13 x .55h (92.2 x 54.1 x 14.0h)	2.43 x 1.78 x 3.56h (61.7 x 45.2 x 90.4h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)
Contact Arrangement	1 Form A	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	0.35A	5A @ 28 VDC or 115 VAC	2A @ 28 VDC 1A @ 120 VAC	10A @ 240 VAC	10A @ 30 VDC or 240 VAC	10A @ 240 VAC
Mode of Operation	Delay on operate	Delay on operate	Delay on operate	Recycle timer	Switch programmable: Delay on operate Delay on release Interval on	Delay on operate Delay on release Interval on
Delay Time	0.2 sec. to 100 sec.	0.1 sec. to 120 sec.	2 sec. to 100 sec.	0.1 sec. to 180 sec.	0.5 sec. to 100 min.	0.1 sec. to 100 min.
Type of Control	External resistor adjustable	Potentiometer adjustable	Potentiometer adjustable	Potentiometer adjustable	Four toggle switches and adjustable potentiometer	Fixed Potentiometer adjustable External resistor adjustable
Maximum Repeatability	±3%	±3%	±3%	±2%	(AC) ±0.5% (DC) ±0.1%	±2%
Maximum Delta Time	±10%	±10%	±10%	±10%	±5%	±10%
Tolerance	±25% plus the tolerance of the fixed external timing resistor	Min. specified or less @ min. setting +60%, −0 @ max. setting	Set to any range within specified range	Min. specified or less @ min. setting +20%, −0 @ max. setting	+0, −20% @ min. setting +10%, −0 @ max. setting	±10% (fixed only)
Temperature Range	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C
Input Voltage	4.5-30 VDC	12-24 VDC	24-120 VAC	24 VDC 24-120 VAC	12-110 VDC 24-240 VAC	12-110 VDC 24-240 VAC
Mounting	PC board	Plug-in Panel mount Sockets available	Panel mount	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available

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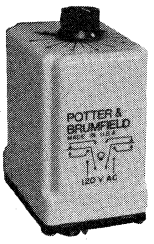
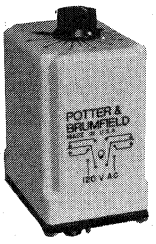
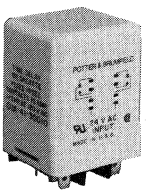
Time Delay Relays

						
Series	**CK**	**CH**	**CG**	**CD**	**CL**	**CU**
Features	• Broad line • Wide choice of functions • Extremely versatile • ᴿᵁ Ⓢ	• Wide range of industrial applications • Dependable timing cycles • ᴿᵁ Ⓢ	• Top of the line • Encapsulated electronics • Extended timing ranges • ᴿᵁ Ⓢ	• Encapsulated electronics • Ideal for many demanding applications • ᴿᵁ Ⓢ	• No timing cycle interrupt transfer • Quick-connect terminals • Two case styles • ᴿᵁ Ⓢ	• Contacts may transfer momentarily • Quick-connect terminals • Two case styles • ᴿᵁ Ⓢ
Approx. inch Dimensions (mm)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	2.41 x 1.78 x 2.94h (61.1 x 45.2 x 74.6h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)	1.53 x 1.41 x 1.91h (38.9 x 35.7 x 48.4h)
Contact Arrangement	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C	2 Form C
Contact Rating	10A @ 240 VAC	10A @ 240 VAC	10A @ 240 VAC	10A @ 240 VAC	10A @ 28 VDC or 240 VAC	10A @ 28 VDC or 240 VAC
Mode of Operation	Delay on operate Delay on release Delay on dropout Interval on	Delay on operate Delay on release Interval on	Delay on operate Delay on release Interval on	Delay on operate Delay on release	Delay on operate	Delay on operate
Delay Time	0.1 sec. to 180 sec.	1 sec. to 180 sec.	0.5 sec. to 100 min.	0.1 sec. to 180 sec.	0.1 sec. to 120 sec.	1 sec. to 120 sec.
Type of Control	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable	Potentiometer adjustable	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable External resistor adjustable	Fixed Potentiometer adjustable External resistor adjustable
Maximum Repeatability	±2%	±2%	(AC) ±0.5% (DC) ±0.1%	±1%	±3%	±3%
Maximum Delta Time	±10%	±10%	±5%	±5%	–	–
Tolerance	±5% (fixed only)	±5% (fixed only)	+0, −10% @ min. setting +10%, −0 @ max. setting	±5% (fixed only)	±5% (fixed only)	±5% (fixed only)
Temperature Range	−10°C to +55°C	−10°C to +55°C	−10°C to +55°C	−40°C to +55°C	−10°C to +40°C	−10°C to +40°C
Input Voltage	12-24 VDC 24-120 VAC	24 VDC 24-240 VAC	24 VDC 120 VAC	24-48 VDC 24-120 VAC	24 VDC 24-120 VAC	24 VDC 24-120 VAC
Mounting	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available	Plug-in Sockets available	Plug-in Panel mount Sockets available	Plug-in Panel mount Sockets available

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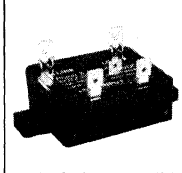
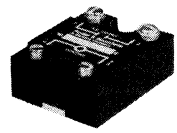
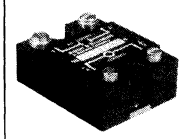
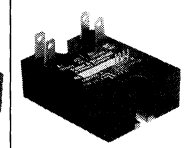
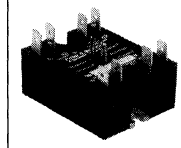
Solid State Relays

						
Series	**OZ16**	**EOTZ**	**SSR**	**SSRT**	**SSRD**	**SSRQ**
Features	• Relay in 16 pin IC package • DIP, auto insertable termination • High transient noise immunity • Current or voltage operation • Logic compatible • ᵁᴸ ⓒˢᴱ	• Low profile package • Economically priced • High transient noise immunity • Logic compatible • High inrush current capability • Internal dv/dt snubber • Zero voltage turn-on • ᵁᴸ	• "Hockey puck" package • Inverse parallel SCR output • AC & DC input • Ratings from 25 to 110 amps • ᵁᴸ ⓒˢᴱ	• "Hockey puck" package • Lost cost, triac output • AC & DC input • 25 & 50A ratings • ᵁᴸ ⓒˢᴱ	• Two independent units in one package • Inverse parallel SCR outputs • Ratings of 25 and 40 amps/output • ᵁᴸ ⓒˢᴱ	• Four independent units in one package • Triac outputs • Each output rated 20 amps • ᵁᴸ
Approx. Dimensions Inch (mm)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	1.81 x 1.50 x .66h (46.0 x 38.1 x 16.8h)	(25 & 50A models) 1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .8h (44.4 x 57.2 x 21h)	1.75 x 2.25 x .93h (44.4 x 57.2 x 23.6h)
Switch Arrangement	1 Form A	1 Form A	1 Form A	1 Form A	2 Form A	4 Form A
Coupling	Optical	Optical	Optical	Optical	Optical	Optical
Input	5 VDC 5mA DC 10mA DC	3-32 VDC	3-32 VDC 3.5-26 VDC 90-280 VAC	3-32 VDC 90-280 VAC	4-15 VDC	4-15 VDC
Output Switching	Zero	Zero	Zero & Random	Zero	Zero	Zero
Minimum Output Current	.005A	.020A	.050A	.050A	.050A	.050A
Maximum Output Current	1A	15A	110A	50A	40A	20A
Minimum Output Voltage	12V	24V	24V	24V	24V	24V
Maximum Output Voltage	280V	280V	280V	280V	280V	280V
Output Type	AC	AC	AC	AC	AC	AC
Terminals	Printed circuit	Quick connect	Screw	Screw	Quick connect	Quick connect
Mounting	PC board Plug-in	Panel mount	Panel mount	Panel mount	Panel mount	Panel mount

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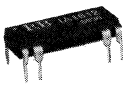
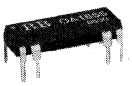
Solid State Input/Output Modules

					
Series	**IA8**	**IA16**	**OA16**	**IAC**	**OAC**
Features	• Mini-DIP, AC/DC input module • 8 pin IC-type package • Also function as DC output module • Auto insertable • High transient noise immunity • Exceeds FCC Part 68 surge test • ᵠᵠ	• DIP AC/DC input module • 16 pin IC package • Auto insertable • High transient noise immunity • TTL compatible • Meets VDE spacing and voltage requirements • ᵠᵠ	• DIP AC output module • 16 pin IC package • Auto insertable • Zero voltage turn-on • High transient noise immunity • TTL compatible • Meets VDE spacing and voltage requirements • ᵠᵠ	• AC input module • High transient noise immunity • Series operation compatible • ᵠᵠ	• AC output module • High transient noise immunity • Series operation compatible • Internal dv/dt snubber • ᵠᵠ
Approx. Dimensions Inch (mm)	.38 x .30 x .18h (9.5 x 7.6 x 4.5h)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	.77 x .30 x .17h (19.4 x 7.6 x 4.3h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)
Switch Arrangement	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A
Coupling	Optical	Optical	Optical	Optical	Optical
Input	2mA AC/DC 5mA AC/DC	2mA AC/DC 5mA AC/DC	5 VDC 5mA DC 10mA DC	10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC 15 VDC 25 VDC
Output Switching	Random	Random	Zero	Random	Zero
Minimum Output Current	>0	>0	.005A	.0001A	.020A
Maximum Output Current	.200A	.200A	1A	.100A	3A
Minimum Output Voltage	>0	>0	12V	.400V	24V
Maximum Output Voltage	60V	30V	280V	30V	280V
Output Type	DC	DC	AC	DC	AC
Terminals	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting	PC board Plug-in	PC board Plug-in	PC board Plug-in	Mounting board	Mounting board

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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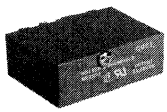
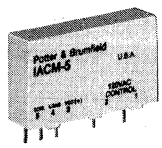
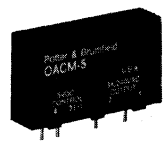
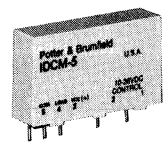
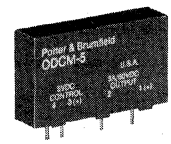
Solid State Input/Output Modules

					
IDC	**ODC**	**IACM**	**OACM**	**IDCM**	**ODCM**
• DC input module • High transient noise immunity • Series operation compatible • UL CSA	• DC output module • High transient noise immunity • Series operation compatible • UL CSA	• Slim line AC intput module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • UL	• Slim line AC output module • Only .4" (10.2mm) thick package • Zero voltage turn-on • Series operation compatible • High transient noise immunity • UL	• Slim line DC input module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • UL	• Slim line DC output module • Only .4" (10.2mm) thick package • Series operation compatible • High transient noise immunity • UL
1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.70 x .60 x 1.28h (43.2 x 15.2 x 32.5h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)	1.7 x .4 x 1.0h (43.2 x 10.2 x 25.4h)
1 Form A	1 Form A	1 Form A	1 Form A	1 Form A	1 Form A
Optical	Optical	Optical	Optical	Optical	Optical
3-32 VDC	5 VDC 15 VDC 24 VDC	90-140 VAC/VDC 180-280 VAC/VDC	5 VDC	10-36 VDC	5 VDC
Random	Random	Random	Zero	Random	Random
.0001A	.020A	>0	.020A	>0	.020A
.100A	3A @ 60 VDC 1A @ 200 VDC	.100A	3A	.100A	3A
.400V	5V; 10V	>0	12V	>0	5V
30V	60V; 200V	30V	280V	30V	60V
DC	DC	DC	AC	DC	DC
Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting board	Mounting board	PC board Plug-in	PC board Plug-in	PC board Plug-in	PC board Plug-in

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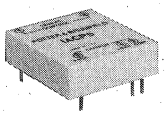
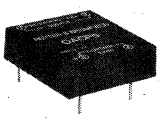
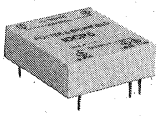
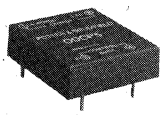
Solid State Input/Output Modules

				
Series	**IACP**	**OACP**	**IDCP**	**ODCP**
Features	• Flat pack AC input module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint • ᖰᑌ	• Flat pack AC output module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • Zero voltage turn-on • High transient noise immunity • Competitive footprint • ᖰᑌ	• Flat pack DC input module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint • ᖰᑌ	• Flat pack DC output module • Permits .500" (12.70mm) PC board spacing • Series operation compatible • High transient noise immunity • Competitive footprint • ᖰᑌ
Approx. Dimensions **Inch (mm)**	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)	1.41 x 1.51 x .43h (35.8 x 38.4 x 10.8h)
Switch Arrangement	1 Form A	1 Form A	1 Form A	1 Form A
Coupling	Optical	Optical	Optical	Optical
Input	10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC	10-36 VDC 18-60 VDC	5 VDC
Output Switching	Random	Zero	Random	Random
Minimum Output Current	>0	.020A	>0	.020A
Maximum Output Current	.100A	3A	.100A	3A @ 60 VDC 1A @ 200 VDC
Minimum Output Voltage	>0	12V	>0	5V; 10V
Maximum Output Voltage	30V	280V	30V	60V; 200V
Output Type	DC	AC	DC	DC
Terminals	Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting	PC board Plug-in	PC board Plug-in	PC board Plug-in	PC board Plug-in

Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

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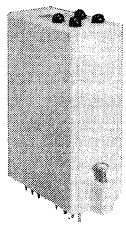
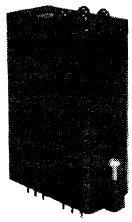
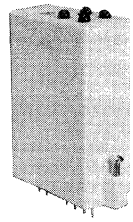
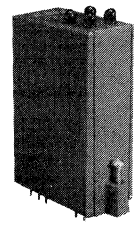
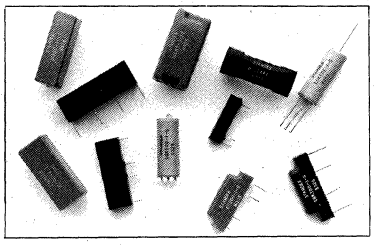
			
IACQ	**OACQ**	**IDCQ**	**ODCQ**
• Quad AC input module • Four I/O channels in one package • Series operation compatible • High transient noise immunity	• Quad AC output module • Four I/O channels in one package • Series operation compatible • Internal dv/dt snubber • High transient noise immunity	• Quad DC input module • Four I/O channels in one package • Series operation compatible • High transient noise immunity	• Quad DC output module • Four I/O channels in one package • Series operation compatible • High transient noise immunity
1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)	1.87 x 1.06 x 2.88h (47.5 x 26.9 x 73.2h)
(4) x 1 Form A	(4) x 1 Form A	(4) x 1 Form A	(4) x 1 Form A
Optical	Optical	Optical	Optical
10-36 VAC/VDC 90-140 VAC/VDC 180-280 VAC/VDC	5 VDC	4-16 VDC 10-36 VDC	5 VDC
Random	Zero	Random	Random
.0001A	.020A	.0001A	.020A
.100A	3A	.100A	3A @ 60 VDC 1A @ 200 VDC
.400V	24V	.400V	5V; 10V
30V	280V	30V	60V; 200V
DC	AC	DC	DC
Printed circuit	Printed circuit	Printed circuit	Printed circuit
Mounting board	Mounting board	Mounting board	Mounting board

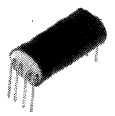
Call toll-free 800-255-2550 for the name and telephone number of your nearby P&B sales representative or authorized stocking distributor.

STANDEX REED RELAYS

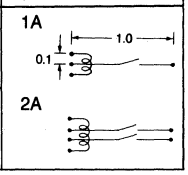


- ☐ Widest range of pin-outs, contact configurations and contact ratings
- ☐ Versions to meet UL, CSA, FCC and European Standards — up to 5000 VDC contact to coil breakdown voltages
- ☐ Standex relays use our own reed switches with contact ratings for dry circuit and power switching applications
- ☐ Competitive pricing & delivery from stock

Series LG Form A

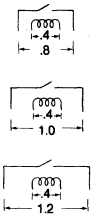


P/N	Coil VDC	Coil Res (ohms) @20°C	Max Pick-up VDC @20°C	Min. Drop Out VDC @20°C	
LG100-1-5	5	500	3.5	.5	1A
LG100-1-6	6	125	4.0	.5	
LG100-1-12	12	500	8.0	1.0	
LG100-1-24	24	2000	16.0	2.0	
LG100-2-5	5	500	3.5	.5	2A
LG100-2-6	6	125	4.0	.5	
LG100-2-12	12	500	8.0	1.0	
LG100-2-24	24	2000	16.0	2.0	

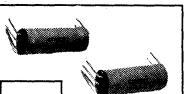


Series EG Form A

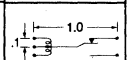
P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
EG200-1-5	5	500	3.5	0.5	1A
EG200-1-6	6	125	4.0	0.5	
EG200-1-12	12	500	9.0	1.0	
EG200-1-24	24	2000	18.0	2.0	
EG300-1-5	5	500	3.5	0.5	1A
EG300-1-6	6	125	4.0	0.5	
EG300-1-12	12	500	9.0	1.0	
EG300-1-24	24	2000	18.0	2.0	
EG400-1-5	5	500	3.5	0.5	1A
EG400-1-6	6	125	4.0	0.5	
EG400-1-12	12	500	9.0	1.0	
EG400-1-24	24	2000	18.0	2.0	



Series LC Form C

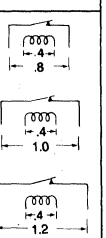


P/N	Coil VDC	Coil Res (ohms)	Max Pull-up	Min. Drop Out	Contact Form
LC100-1-5	5	500	3.5	0.5	1C
LC100-1-6	6	125	4.0	0.5	
LC100-1-12	12	500	9.0	1.0	
LC100-1-24	24	2000	18.0	2.0	



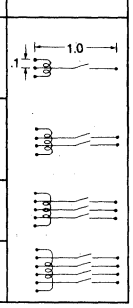
Series EB Form B

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
EB200-1-5	5	500	3.5	0.5	1B
EB200-1-6	6	125	4.0	0.5	
EB200-1-12	12	500	9.0	1.0	
EB200-1-24	24	2000	18.0	2.0	
EB300-1-5	5	500	3.5	0.5	1B
EB300-1-6	6	125	4.0	0.5	
EB300-1-12	12	500	9.0	1.0	
EB300-1-24	24	2000	18.0	2.0	
EB400-1-5	5	500	3.5	0.5	1B
EB400-1-6	6	125	4.0	0.5	
EB400-1-12	12	500	9.0	1.0	
EB400-1-24	24	2000	18.0	2.0	



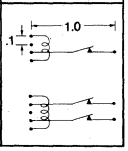
Series JG Form A

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
JG100-1-5	5	500	3.5	0.5	1A
JG100-1-6	6	125	4.0	0.5	
JG100-1-12	12	500	9.0	1.0	
JG100-1-24	24	2000	18.0	2.0	
JG100-2-5	5	250	3.5	0.5	2A
JG100-2-6	6	110	4.0	0.5	
JG100-2-12	12	440	9.0	1.0	
JG100-2-24	24	1760	18.0	2.0	
JG100-3-6	6	85	4.0	0.5	3A
JG100-3-12	12	340	9.0	1.0	
JG100-3-24	24	1360	18.0	2.0	
JG100-4-6	6	62	4.0	0.5	4A
JG100-4-12	12	250	9.0	1.0	
JG100-4-24	24	1000	18.0	2.0	



Series JB Form B

P/N	Coil VDC	Coil Res (ohms)	Pull-in Max.	Drop Out Min.	Contact Form
JB100-1-5	5	500	3.5	0.5	1B
JB100-1-6	6	125	4.0	0.5	
JB100-1-12	12	500	9.0	1.0	
JB100-1-24	24	2000	18.0	2.0	
JB100-2-6	6	110	4.0	0.5	2B
JB100-2-12	12	440	9.0	1.0	
JB100-2-24	24	1760	18.0	2.0	



Standex Electronics

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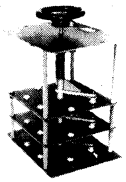
HIGH VOLTAGE DEVICES

RELAYS
SWITCHES
MEASUREMENT
CONTROL UNITS

AC
DC
PULSE
FIBER OPTICS

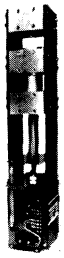
208V TO 900 KV
ENERGY STORAGE
ELECTRONIC AND POWER
SAFETY AND ACCESSORIES

HV ROTARY SWITCHES



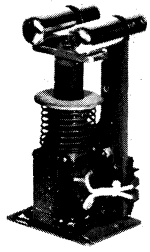
Ratings from 5 to 150KV, 1 to 200 amps. Either manual or electrical operators, depending upon requirements. Position detents and interlocks to prevent opening under load.

HIGH CURRENT SWITCHES



Models are available up to 20,000 amps continuous, and over 500,000 amps pulse, with voltage ratings of 6 volts to 300 KV peak test. Many are air cylinder or motor operated for high contact force.

HV RELAYS

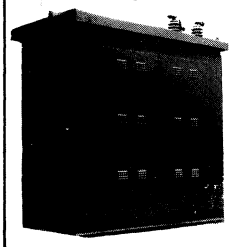


HV relays of the air insulated type both for low and high current. This series has ratings from 1 to 200 amps continuous, 100 to 100,000 amps momentary and capacitor discharge. Peak test voltages from 5 to 300KV. Single or Multipole. NO, NC, and DT. Auxiliary contacts optional on all types. Extended life and tungsten contacts also available for high current closing. Also usable in oil or insulating gas.

HV GROUNDING RELAYS

Extra high voltage low corona grounding relays of the air insulated type. Ratings up to 600 KV peak at 100 amps continuous. Solenoid, motor or air cylinder operated and spring or gravity return.

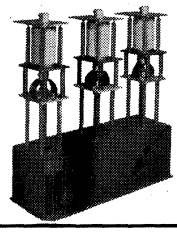
HIGH POWER



HIGH SPEED HIGH VOLTAGE CONTROL AND STEP-START SYSTEMS

½ to 1 cycle sensing and interrupt vacuum circuit breakers. Metal enclosed for indoor or outdoor applications. 5KV-38KV.

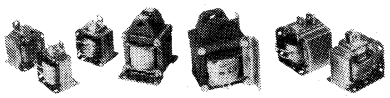
VACUUM CONTACTORS & 1 CYCLE CIRCUIT BREAKERS



Vacuum switches, single phase, three phase, upright or low profile, for high reliability sealed arc interrupting or crobar shorting. 208V to 200 KV RMS operate. 50 to 4,000 amps continuous, 2,000 to 35,000 amps AC, 10 to 20,000 amps DC interrupt, 5,000 to 100,000 amps momentary and capacitor discharge.

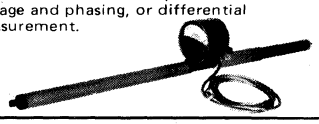
QUIET AC PRECISION SOLENOIDS

To 36 lbs. continuous hold and to 126 lbs. intermittent. Class H coils with 180°C insulation. 1" stroke, or, with special stainless steel guides, extendable to several inches. Corrosion resistant. Coil voltages offered are: 115V, 208V, 240V, and 480V, 60Hz; 50Hz optional. Other voltages and frequencies including DC are available.

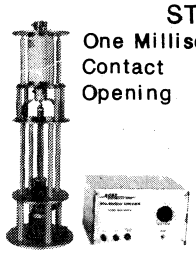


Hi-Z™ HV VOLTMETERS SAFE POWER LINE USE AC/DC

Fully safe portable, all solid state, 2% to 5% accuracy. Taut band shielded high voltage measurement with minimum circuit loading. 0.0001 V to 50 KV AC and DC. Ideal for use with Elbow capacitance tap voltage test points. For cable test point or direct line voltage and phasing, or differential measurement.

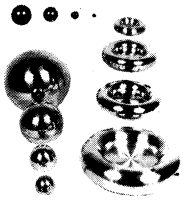


SOLENOID DRIVERS ENERGY STORAGE UNITS



For high speed or loss of power automatic circuit breaker trip and for high speed activation of contactor or circuit breaker solenoids. Energy storage up to 400 joules or more at 150 to 700 volts or more, 100 to 4,000 microfarad or more. Instantaneous SCR control available.

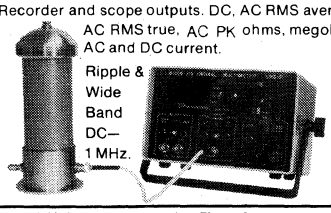
TOROIDS, SPHERES, CORONA SHIELDS, NUTS



Geometrically designed to avoid excessive voltage gradients at connecting points and other areas needing shielding or balancing of electrostatic fields to increase withstand voltage and minimize corona. Diameters are to international standard metric sizes.

HV DIGITAL MULTIMETERS

Easy to read, 4½-digit display; 0.05% basic accuracy. 0.0001 volt to 900 KV. Battery/AC with charger. Recorder and scope outputs. DC, AC RMS average, AC RMS true, AC PK ohms, megohms, AC and DC current.

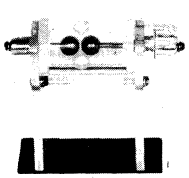


WIDE BAND HV VOLTAGE DIVIDERS DC–10 MHz

Precision compensated resistance-capacitance voltage dividers for 1 KV to 900 KV, DC up to 10 MHz or to 0.02μ Sec rise time pulse. 1,000/1 ratio matched to 1 megohm, 20 to 50 pf display or recorder. Other ratios and loads as required.

Accuracy and stability:
0.01% to 0.1% DC
0.2% to 1% AC 3% DC-1MHz

HV ADJUSTABLE SPARK GAPS



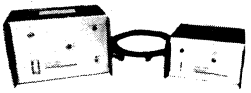
Non-melting carbon spheres, 1 cm to 10 cm and heavy wall aluminum spheres, 10 cm and above. Dust tight transparent covers used 1 KV to 88 KV. Open style to 670 KV. Direct reading micrometer type calibrating device.

HV DIGITAL PROBES

HV DC, AC, & Wideband DC-1 MHz Safety Probes for any scope or digital display or VTVM. Also available complete with large 4½-digit display 0.1% to 5% AC/DC accuracy, safety handle digital voltmeter. Battery/AC with charger. Removable Digital Display or Multimeter. 0.0001 volt to 200 KV. 0.05% accuracy basic, with DCV, ACV, ohms, megohms, AC and DC current.

WIDE BAND FIBER OPTIC TRANSMISSION DC–1 MHz

AC or rechargeable battery/AC operated. DC to 1 MHz. System has a maximum output of 10V PK (20V PK to PK) and maximum input of 1V to 1,000V PK direct from signal source. Useful from 0.1V to over 900KV when used with Ross HV wideband dividers.



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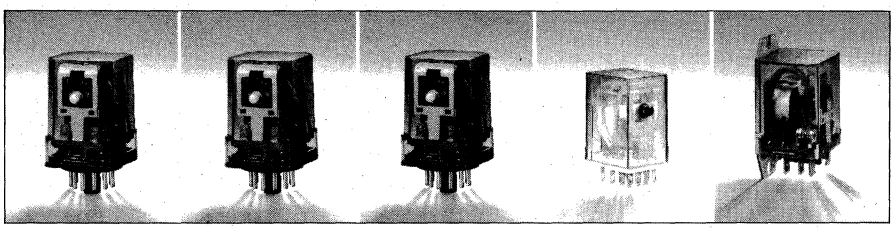

TYPE OF RELAY		CAD (5 A)	CAD (10 A)	CRD (5 A)	CRD (10 A)	CMD / CSD	RA		RM 1, 2, 7, (3)
CONTACTS:									
NUMBER	2	1, 2, 3		2, 3		1, 2, 3	2/4	3	1, 2, 3
CONFIGURATION		Form C (DT)		Form C (DT)		Form C (DT)	Form C (DT)		Form C (DT)
VOLTAGE RATING	V AC	250		250		250	250	250	380
RATED CURRENT (CONT.)	A	5	10	5	10	2	3	5	16 (10)
MAKE CURRENT (MAX.)	A	10	20	10	20	10	6	10	40
RATED BREAKING CAPACITY	VA	1250	2500	1250	2500	500	350	1250	6000 (3800)
MATEREIAL		AgCu	AgCd0+AgCu	AgCu	AgCd0+AgCu	Ag (gold flashed)	Ag (gold fl)	AgCd0	AgCd0
COIL:									
RATED VOLT. (DC RANGE) (VN)	V DC	6...220		12...110		5...100	6...220		6...220
RATED VOLT. (AC RANGE) (VN)	V AC	6...240		24...220		5...200	6...240		6...380
POWER CONS. AT RAT. VOLT. (DC)	APPR. W.	1.2		2.6		0.04...0.3	0.9		1.2...1.6
POWER CONS. AT RAT. VOLT. (AC)	APPR. VA	2		5.3		0.2	1.65		2...2.8
OPERATING RANGE	AT 25°C	DC: 0.75...1.1 VN AC: 0.8 ...1.1 VN		DC: 0.75...1.1 VN AC: 0.8 ...1.1 VN		SEE FULL DETAIL CAT.	DC: 0.75...1.1 VN AC: 0.8 ...1.1 VN		DC: 0,75...1,1 VN AC: 0.8 ...1.1 VN
DROP-OUT VOLTAGE	AT 25°C	DC: ≥ 0.1 VN AC: ≥ 0.4 VN		SEE FULL DETAIL CAT.		≥ 0.1 Vmin	DC: ≥ 0.05 VN AC: ≥ 0.4 VN		DC: ≥ 0.15 VN AC: ≥ 0.4 VN
GENERAL DATA:									
MECHANICAL LIFE	OP. CYCL.	≥ 20 x 10⁶		≥ 20 x 10⁶		≥ 20 x 10⁶	≥ 100 x 10⁶		≥ 20 x 10⁶
MAX. OPERATING RATE MECHANICAL FULL LOAD	OP. CYCL./H OP. CYCL./H	6000 1000		6000 1000		6000 1000	6000 1000		6000 1000
OPERATE (PICK-UP) TIME	APPR. MS	10		IMPULS 30/5		10...30	10		15
DROP-OUT TIME	APPR. MS	8		IMPULS 10/6		8...25	8		10
BOUNCET TIME	APPR. MS	3		4		4	2		3
AMBIENT TEMPERATURE RANGE	°C	-40...+60	-45...+50	-40...+60	-45...+50	-45...+60	DC -45..+70 AC -45..+60	-45..+55 -45..+45	DC: -45...+70 (+60) AC: -45...+55 (+45)
DIELECTR. STRENGTH (TEST V. AT 50 HZ)	VEFF	2500		2500		2500	2500/2000	2500	2500
INSULATION RESISTANCE	MΩ	≥ 1500		≥ 1500		≥ 1500	≥ 1500		w 1500
VDE 0110 VOLT. RATING GROUP		C 250		C 250		C 250	B 125/B 60	C 250	C 380
SOLDER BATH TEMPERATURE	MAX. °C	-		-		-	-		-
SOLDER DURATION	MAX., SEC.	-		-		-	-		-
STANDARD PACKAGE UNIT	PIECES	5		5		5	5		5
MODIFICATIONS AVAILABLE		OPEN RELAY - CA, TWIN CONTACTS, NEON/LED INDICATOR		-		-	TWIN CONTACTS, MAGNETIC LATCHING, NEON/LED INDICATOR		NEON/LED, INDICATOR

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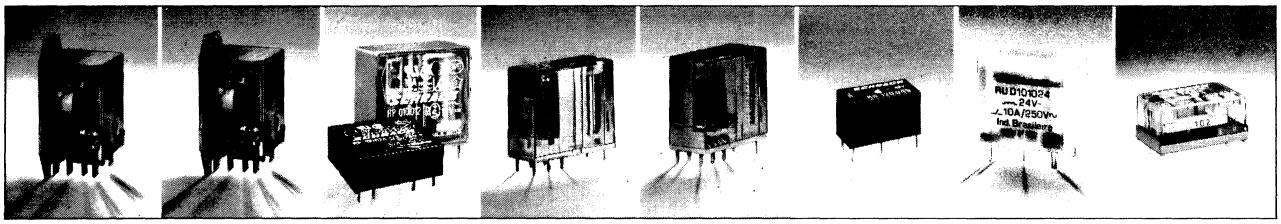

RM 4,5,(6)	RM 8	RP 010/110	RP 310/410/411	RP 420	RS	RU. 101	RU 110
1, 2, 3	2	1	1	2	2	1	1
Form A (NO)	Form C (DT)	Form C (DT), A (NO), B (NC)	Form C (DT), A (NO), B (NC)	Form C (DT), A (NO), B (NC)	Form C (DT)	Form C (DT); A (NO)	Form C (DT)
380	380	250	250	250	125	120 / 250	250
16 (10)	25	10	16 / 12 / 10	10	1.25	15 / 10	6
40	60	16	25 / 20 / 16	10		20 / 15	10
6000 (3800)	6000	2000	4000 / 3000 / 2000	2000	60	1800 / 2200	1320
AgCdO	AgCdO	AgCdO, Ag (gold flashed)	AgCdO, Ag (gold flashed)	AgCdO, Ag (gold flashed)	AgPd (Gold pl.)	AgNi	AgCdO
6 ... 220	6 ... 220	5 ... 110	5 ... 110	5 ... 110	5 ... 48	3 ... 110	5 ... 110
6 ... 380	6 ... 380	-	-	-	-	6 ... 220	-
1.6	1.2	0.5	0.5	0.5	0.55	0.5	0.8
2.8	2.8	-	-	-	-	1.6	-
DC: 0.75 ... 1.1 VN AC: 0.8 ... 1.1 VN	DC: 0.75 ... 1.1 VN AC: 0.8 ... 1.1 VN	0.75 ... 1.8 VN	0.75 ... 1.85 VN	0.75 ... 1.9 VN	0.75 ... 1.55 VN	DC: 0.75 ... 1.3 VN AC: 0.8 ... 1.15 VN	0.75 ... 1.2 VN
DC: ≥ 0.15 VN AC: ≥0.4 VN	DC: ≥ 0.15 VN AC: ≥0.4 VN	≥ 0.15 VN	≥ 0.15 VN	≥ 0.15 VN	≥ 0.05 VN	DC: ≥ 0.1 VN AC: ≥ 0.4 VN	≥ 0.15 VN
≥20 x 10^{16}	≥ 10 x 10^{6}	≥ 20 x 10^{6}	≥ 20 x 10^{6}	≥ 20 x 10^{6}	≥ 20 x 10^{6}	≥ 10 x 10^{6}	≥ 10 x 10^{6}
6000 1000	6000 1000	72000 3000	72000 / 72000 1200 / 1800	72000 3000	72000 10800	144000 1000	36000 3600
15	15	7	9	8	6	≤ 15	8
10	15	3	3	3	3	≤ 10	3
4	3	2	2	2	1	≤ 5	1
DC: −45 ... +70 (+60) AC: −45 ... +55 (+45)	DC: −45 ... +65 AC: −45 ... +60	−40 ... +70	−40 ... +70	−40 ... +70	−25 ... +75	−45 ... +70	−40 ... +55
2500	2500	2500	4000	4000	1000	1500	2000
≥ 1500	≥ 1500	≥ 10000	≥1000000	≥ 1000000	≥1000000	≥ 1500	≥ 10000
C 380	C 250	stand. B 250, sealed C 250	C 250	C 250	Ao 125	B 250	B 250
-	-	260	260	260	250	260	260
-	-	5	5	5	3	5	5
5	5	25	25	25	25		25
NEON/LED INDICATOR	FORM A CONTACT NEON/LED INDICATOR	SEALED RELAY, TWIN CONTACTS, MAGNETIC LATCHING	SEALED RELAY, MAGNETIC LATCHING	SEALED RELAY, TWIN CON-TACTS, MAGNETIC LATCHING	SENSITIVE RELAY, MAGNETIC LATCHING TWIN CONTACTS	SENSITIVE RELAY, SEALED RELAY FORM A CONTACT	-

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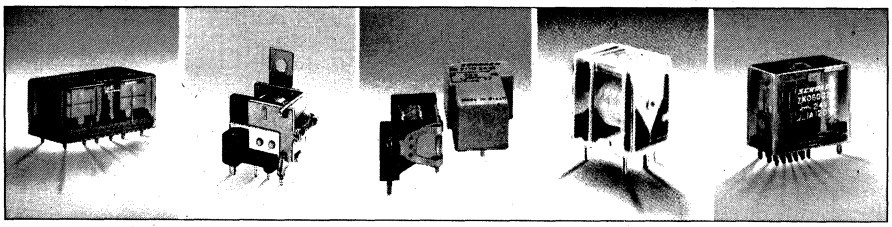

RX 2, 3 (0,1)	ZC	ZD	ZF	ZKU/ZLU		TYPE OF RELAY
						CONTACTS:
4 (2) 8 (4)	1	1	1	2, 4, 6		NUMBER
2A + 2B (2C) 4A + 4B (4C)	NO / DT (NO/NC) / NO NC	NO / DT / NC / DT	Form C (DT), A (NO), B (NC)	Form C (DT)		CONFIGURATION
250	120	250	250	115 / 220	V AC	VOLTAGE RATING
16 10	40 / 20/12 / 12	30/10 / 20 / 15/5 / 5	10	2 / 5	A	RATED CURRENT (CONT.)
70 50	50 / 30/15 / 15	40/45 / 25 / 20/10 / 10	15	3 / 7.5	A	MAKE CURRENT (MAX.)
4000 2500	2400 / 1200/720 / 720	7500/2500 / 5000 / 3750/1250 / 1250	1200	50 / 500	VA	RATED BREAKING CAPACITY
AgCdO (AgSnO)	AgNi	AgNi, AgCdO, Ag (gold fl.)	AgNi, AgSnO, Ag (gold fl.), AgCdO	Ag (gold fl.), AgCdO		MATERIAL
						COIL:
3 ... 60 (48)	3 ... 110	5 ... 110	3 ... 60	6 ... 110	V DC	RATED VOLT. (DC RANGE) (VN)
-	-	-	-	-	V AC	RATED VOLT. (AC RANGE) (VN)
0.3	1.3	1.1	0.5	0.3 ... 1.2	W	POWER CONS. AT RAT. VOLT. (DC)
-	-	-	-	-	VA	POWER CONS. AT RAT. VOLT. (AC)
0.7 ... 2.65 VN	0.75 ... 1.3 VN	0.75 ... 1.25 VN	0.75 ... 1.3 VN	0.75 ... 1.3 VN	AT 25°C	OPERATING RANGE
0.1 VN	≥ 0.1 VN	≥ 0.1 VN	≥ 0.1 VN	≥ 0.05	AT 25°C	DROP-OUT VOLTAGE
						GENERAL DATA:
≥ 50×10^6	≥ 10×10^6	≥ 10×10^6	≥ 10×10^6	≥ 100×10^6	OP. CYCL.	MECHANICAL LIFE
6000 1000	72000 1000	72000 1200	72000 1000	72000 3600	OP. CYCL./H OP. CYCL./H	MAX. OPERATING RATE MECHANICAL FULL LOAD
20 22	≤ 10	9	≤ 15	≤ 15	APPR. MS	OPERATE (PICK-UP) TIME
13	≤ 10	7	≤ 10	≤ 10	APPR. MS	DROP-OUT TIME
1	4	4	≤ 4	≤ 6	APPR. MS	BOUNCE TIME
-50 ... +60	-45 ... +60/90	-55 ... +85/105	-40 ... +80	-40 ... +75	°C	AMBIENT TEMPERATURE RANGE
3000	750	2000	2000	500 / 1000	VEFF	DIELECTR. STRENGTH (TEST V. AT 50 HZ)
≥ 1000	≥ 1000	≥ 10000	≥ 100	≥ 1000	MΩ	INSULATION RESISTANCE
C 250 (B 125)	A 125/B 60	C 250	C 250	B 125 / B 250		VDE 0110 VOLT. RATING GROUP
260	260	260	260	260	MAX. °C	SOLDER BATH TEMPERATURE
5	5	5	5	5	MAX. SEC.	SOLDER DURATION
	25 (100)	25	25 (100)	100	PIECES	STANDARD PACKAGE UNIT
BISTABLE RELAY SEALED RELAY	BUZZER RELAY	SEALED RELAY DUST COVER SPADE TERMINALS	SENSITIVE RELAY SEALED RELAY	SENSITIVE RELAY, AC RELAY (DIODE RECTIFIED)		MODIFICATIONS AVAILABLE

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SCHRACK RELAYS CROSS REFERENCE CHART

SCHRACK	CA	CAD	CMD/CSD	RA	RM	RM 8	RP 010/110	RP 310	RP 410	RP 420	RS	RU 101	RX	ZC	ZD	ZF	ZK/ZL
AA		AAEA/D 1-2-300			AAEKUP 11/14												
AIRPAX												281-313AE					
ALLIED		TMDO		GY-400													T154/ T163
AMER. ZETTLER	AZ 482 AZ 483	AZ 480, 481 TEC1210		AZ1309 TEC1300 1400			AZ693 AZ694	AZ735	AZ735L	AZ 731 AZ 732	AZ 802 AZ 820 AZ 830	AZ 3				AZ 4	AZ 420
AROMAT				HC	HP					JR2	DS		SP				K
BOSCH														0332			
CLARE	GP3R2			GP1R-11, 12	GP3R2												VP
C-D		301, 2, 3, 11, 12, 23		A104/ A114	200							603 623/662					
DELTROL	203	20,000	201	280/290	206												250
EAGLE/BLISS		22/25															
ESSEX/RBM		93 P			93 Q							MS 64					
FUJITSU		FRL 256		FRL 263/ 264	FRL 250					FBR 621	FBR 244					FBR 111	
GLOBE		2WC															
GRANGER	5X814-821	3X7-5X7			5X834-5X842												
GUARDIAN		1200/1410	1215	1300	1510/1515						1495	1345				1575	1555
HART		GHP															67DP
IDEC		RR2P/ RR3P		RY4	RR1B-2B-3B		RG				RD	RE				RCN	
ITT (Takamisawa)		RM80		2Z/4ZS	ITT-2,4					VB	RA, RY, RZ						24, 25, 26
KURMAN		PAP															
LINE	HP-31	MK/MD	MKF/MKC	SRJ/SRE	CRH					OM1	OMF					SR	
MAGNECRAFT	WX88	WX88	W88CPX	W78	W388	389	65			76							W 67
MIDTEX	155	155		156/158	157	187					190						
NEC											MR62					MR31	
OHMITE		GPRTPX															
OMRON	MK	MK		MY4	MJ		G2L113P			G2R-212PV	G2V				G8P	LC1	MHS
PHILIPS/ADVANCE		GHB/GHP		39	12												GP
PHILIPS NA		13			12							28				27	
P & B	KA	KAP/KRP/ KRPA	KC/KCP	KHP/KHU KHC/KHX	KUP/ KUMP	KUHP		RK5W	RK5X	RK11-Z	T82				T90	T71	R10
SIEMENS		V23100-V9		V23100-V7			V23027	V23056	V23056	V23037	D2			V23033			V23154
SIGMA	50F	5ORO	5ORO SENS.	67R	68R	45						49 RE					62R/70R
S-D	A 283	4214/314		B/C 281	A283					277							

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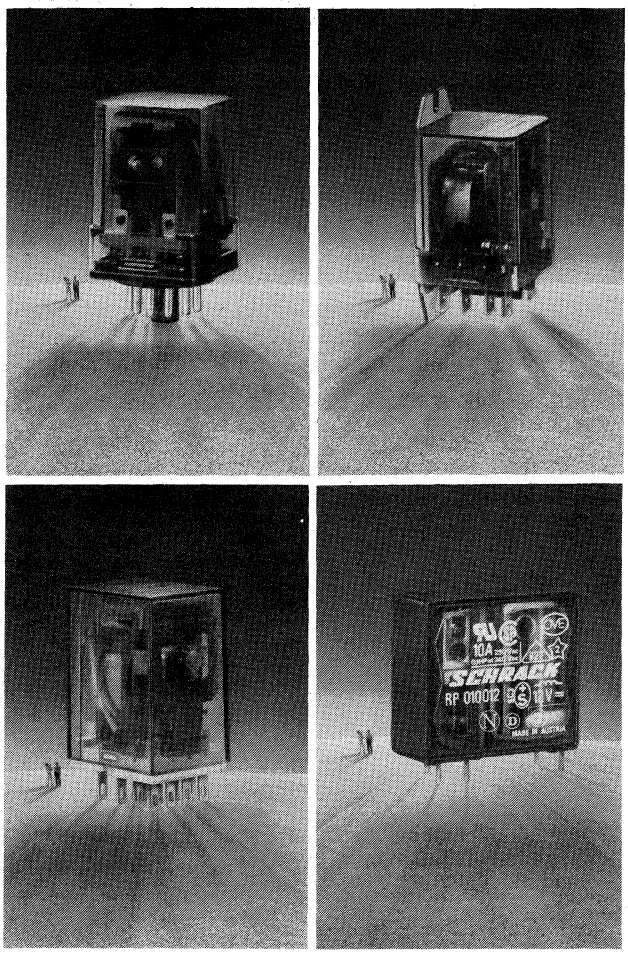


SCHRACK RELAYS ARE READILY AVAILABLE FROM STOCK THROUGHOUT THE U.S. AND OFFER MANY UNIQUE ADVANTAGES!

Schrack Relays are available off-the-shelf from our U.S. headquarters in New York, as well as through stocking distributors nationwide. Engineering and application assistance is also available locally if needed.

But equally important, when you select a Schrack Relay, you get advantages not found in conventional models. For example, the visual indicator is purely mechanical and does not incorporate any live components that can burn out or fail. It always shows the "real" state (open or closed) of the relay, which may not be the case with a lamp or LED. A lamp or LED only indicates that there is potential at the coil; in fact, the coil may be open or the contacts welded, and a lamp or LED may still light, causing erroneous indication. The visual on/off indicator locates such faults immediately without having to check individual relays and without having to apply an external voltage to the relay coils. A built-in orange flag moves with the relay armature and is seen through a window in the frosted top face of the dust cover. One glance is sufficient to tell you if the relay is working as well as the position of the contacts.

For more information, call or write us:
We'll try to help, and also give you the name of your nearest Schrack distributor.

Schrack Relays are recognized and/or certified by testing laboratories around the world.

Underwriters Laboratories

Canadian Standards Association

927 VDE Production monitoring

RELAYS

SCHRACK NORTH AMERICA, INC.
1995 Pond Rd. • Ronkonkoma, NY 11779-7209
(516) 737-0099 • Telex: 646149
Fax: (516) 737-2550
(800) 722-0049 (Except N.Y. State)

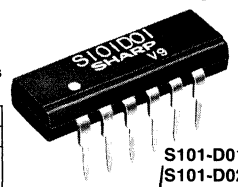
SHARP Optoelectronics

Solid State Relays

Sharp has a wide product line-up, such as multi-channel types suited for high density mounting, DIP type, SIP type, and TO-220 package type as solid state relays for medium power control of on-state current ranging from 0.6 to 16A.

Type	Model No.	Internal connection diagram	Features	Approved by overseas safety standard UL	Approved by overseas safety standard CSA	Package	Absolute maximum ratings: On-state current I_T (Arms)	Absolute maximum ratings: Repetitive peak off-state voltage V_{DRM} (V)	Absolute maximum ratings: Isolation voltage (AC) Viso (Vrms)	Electrical characteristics: Minimum trigger current I_{FT} (mA) MAX.	Electrical characteristics: Minimum trigger current V_D (V)	Electrical characteristics: Minimum trigger current R_L (Ω)
For Medium Power Control	S101DD2		120V line	○		DIP 9-pin	1	280	1,500	25	6	R_G = 20kΩ
	S201DD2		240V line	○			1	600	1,500	25	6	R_G = 20kΩ
	S101DD3		120V line, high noise resistivity (built-in CR)			DIP 8-pin	1	400	1,500	25	6	100
	S102DS2		120V line	○	○	*2 TO-220 4-pin	*1 8	400	1,8000	8	12	30
	S202DS2		240V line	○	○		*1 8	600	2,000	8	12	30
	S101D01		120V line, low-priced			DIP 16-pin	0.6	400	2,500	10	6	—
	S201D01		240V line, low-priced				0.6	400	2,500	10	6	—
	S101D02		120V line, low-priced (built-in zero-cross circuit)				0.6	600	4,000	10	6	—
	S201D02		240V line, low-priced (built-in zero-cross circuit)				0.6	600	4,000	10	6	—
	S202DS4		240V line (built-in zero-cross circuit)	○	○	*1 TO-220 4-pin	5	600	2,000	8	6	30
	S103D4S		120V line (4 channels)	○	○	DIP 10-pin	3	500	1,800	8	12	30
	S203D4S		240V line (4 channels)	○	○		3	600	2,000	8	12	30
	S202D81		240V line, 2A control (8 channels)			Resin mold type with radiation fin (8-ch)	2	600	2,500	—	—	—
	S201DX1		240V line, 1A control (16 channels)			Resin mold type with radiation fin (16-ch)	1	600	2,500	—	—	—
	S102DS1		120V line, high noise resistivity (built-in snubber circuit)	○	○	SIP 4-pin	2	400	1,800	8	12	30
	S103DS1			○	○		3	400	1,800	8	12	30
	S202DS1		240V line, high noise resistivity (built-in snubber circuit)	○	○		2	600	2,000	8	12	30
	S203DS1			○	○		3	600	2,000	8	12	30
	S102DS3		120V line, high noise resistivity (built-in zero-cross circuit and snubber circuit)	○	○		2	400	1,800	8	6	30
	S103DS3			○	○		3	400	1,800	8	6	30
	S116DS1			○	○	Metal Case	16	400	1,800	8	6	30
	S202DS3		240V line, high noise resistivity (built-in zero-cross circuit and snubber circuit)	○	○	SIP 4-pin	2	600	2,000	8	6	30
	S203DS3			○	○		3	600	2,000	8	6	30
	S216DS1					Metal Case	16	600	2,500	8	6	30
	S116P21		120V line, compact 2-output (built-in zero-cross circuit)			Resin mold type with radiation fin (2-ch)	16,3	400	2,000	—	—	—
	S216P21		240V line, compact 2-output (built-in zero-cross circuit)				16,3	600	4,000	—	—	—
	S116P41		120V line, 4-output (built-in snubber circuit)			Resin mold type with radiation fin (4-ch)	16,5 3,3	400	1,500	10	6	30
	S216P41		240V line, 4-output (built-in snubber circuit)				16,3 3,3	600	4,000	15	6	30
	S101S01		120V line, compact low-priced, high rush current resistant type	○	○	SIP 4-pin	1,5	400	4,000	15	6	30
	S201S01		240V line, compact low-priced, high rush current resistant type				1,5	600	4,000	15	6	30
	S101S02		120V line, compact low-priced, high rush current resistant type (built-in zero-cross circuit)	○	○		1,5	400	4,000	15	6	30
	S201S02		240V line, compact low-priced, high rush current resistant type (built-in zero-cross circuit)				1,5	600	4,000	15	6	30
	S101S03		120V line, compact low-priced, built-in input resistor, high rush current resistant type	○	○		1,5	400	4,000	15	6	30
	S201S03		240V line, compact low-priced, built-in input resistor, high rush current resistant type				1,5	600	4,000	15	6	30
	S101S04		120V line, compact low-priced, built-in input resistor, high rush current resistant type (built-in zero-cross circuit)	○	○		1,5	400	4,000	15	6	30
	S201S04		240V line, compact low-priced, built-in input resistor, high rush current resistant type (built-in zero-cross circuit)				1,5	600	4,000	15	6	30

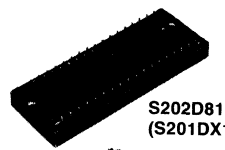
*1 Tc≤95°C *2 Lead forming type is also available.



S101-D01
(S101-D02
S201-D01
S201-D02

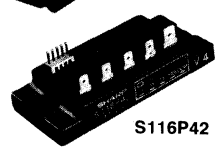
S101DD2
(S201DD2)

S102DS2
(S202-DS2, S202DS4)



S202D81
(S201DX1)

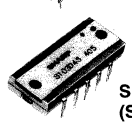
S116P21
(S216P21)



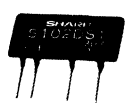
S116P42

S101S01
(S101S02 ~ 4
S201S01 ~ 4)

S101DD

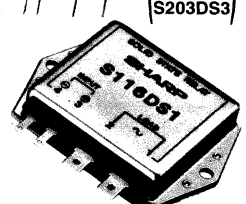


S103D4S
(S203D4S)

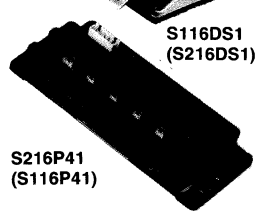


S102DS1
S102DS3
S202DS1
S202DS3

S103DS1
S103DS3
S203DS1
S203DS3



S116DS1
(S216DS1)



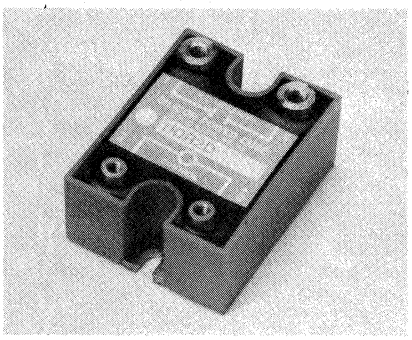
S216P41
(S116P41)

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

SILICON POWER CUBE

SOLID STATE AC POWER RELAYS

UL Recognized/CSA Certified



FEATURES:

- SPC's Inverse-Parallel SCR Power Hybrid Technology provides highly efficient thermal management for greatly increased cyclic life.
- High performance/low cost circuit design.
- Logic compatible inputs.
- "Zero voltage", phase controllable "random switching", and peak switching versions.
- High voltage (1200 Vpk) versions for 480 V_{RMS} service.
- Industry standard "hockey puck" package.
- 4000 V_{RMS} optical isolation.

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	PRV	AC Switching Mode (Input)
SCR OUTPUT	480D10SP	10	180-530	1200	Zero Voltage (4-32 VDC Input)
	480D25SP	25			
	480D45SP	50			
	480D80SP	80			
	480D110SP	110			
	480A10SP	10	180-530	1200	Zero Voltage (90-140 VAC Input)
	480A25SP	25			
	480A45SP	50			
	480A80SP	80			
	480A110SP	110			
	240D10SP	10	24-280	600	Zero Voltage (3-32 VDC Input)
	240D25SP	25			
	240D45SP	50			
	240D80SP	80			
	240D110SP	110			
	240D10-10SP	10	24-280	600	Random (Phase Controllable) (3.5-26 VDC Input)
	240D25-10SP	25			
	240D45-10SP	50			
	240D80-10SP	80			
	240D110-10SP	110			
	240A10SP	10	24-280	600	Zero Voltage (90-280 VAC Input)
	240A25SP	25			
	240A45SP	50			
	240A80SP	80			
	240A110SP	110			
	120D10SP	10	24-140	400	Zero Voltage (3-32 VDC Input)
	120D25SP	25			
	120D45SP	50			
	120D80SP	80			
	120D110SP	110			
	120A10SP	10	24-140	400	Zero Voltage (90-280 VAC Input)
	120A25SP	25			
	120A45SP	50			
	120A80SP	80			
	120A110SP	110			
	120D10-10SP	10	24-140	400	Random (Phase Controllable) (3.5-26 VDC Input)
	120D25-10SP	25			
	120D45-10SP	50			
	120D80-10SP	80			
	120D110-10SP	110			
TRIAC OUTPUT	MR240D10	10	24-280	600	Zero Voltage (3-32 VDC Input)
	MR240D25	25			
	MR240A10	10			Zero Voltage (90-280 VAC Input)
	MR240A25	25			
	MR120D10	10	24-140	400	Zero Voltage (3-32 VDC Input)
	MR120D25	25			
	MR120A10	10			Zero Voltage (90-280 VAC Input)
	MR120A25	25			

SILICON POWER CUBE CORP.

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SILICON POWER CUBE

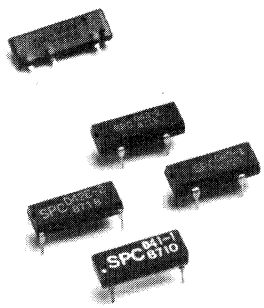
SPECIAL PURPOSE SOLID STATE AC POWER RELAYS

	Model Number	Output Current Rating Amps (RMS)	Output Voltage Rating VRMS	PRV	Type	AC Switching Mode
SPECIAL PURPOSE REPLAYS	25DR1D	25	24-280	600	Dual SSR	Zero Voltage
	40DR1D	40				
	25DR2D	25				Random
	40DR2D	40				
	20QR1D	20	24-280	600	Quad SSR	Zero Voltage
	20QR2D					Random
	25R2SSD	25	24-280	500	Soft Start/Stop	
	40R2SSD	40				

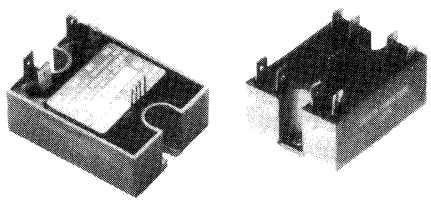
BOARD LEVEL SOLID STATE RELAYS

TO-116 DIP and 4-pin SIP packages employing thick film hybrid circuitry. Includes AC and DC switching versions from signal level to 1 amp output, with switching speeds as low as 1 μsec.

Three industry standard encapsulated PCB mount packages with AC output current ratings of 2.5 to 4 amps. Featuring 4000 Vrms optical isolation, logic compatible 3-32 Vdc input range, and either zero crossing or random phase controllable turn-on.



BOARD LEVEL RELAYS



SPECIAL PURPOSE RELAYS

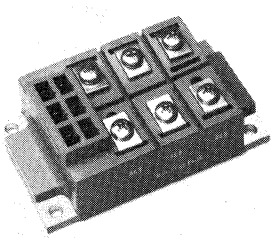
Part Number	Input Specifications Voltage (VDC)	Current (mA at 5V)	Output/Load Ratings (max.) Current	Voltage	AC/DC
D40-1	3.8–10	20	80mA	50V pk	AC or DC
D41-1, -2, -2H	4–12	15	0.75A	140, 280VRMS	AC
D42E-2*	3.5–15	8	1A	280VRMS	AC
D42E-11*	N/A	5**	1A	280VRMS	AC
D42E-4*	3–32	10	1A	280VRMS	AC
S42V-2*	3.5–15	8	1A	280VRMS	AC
S42V-11*	N/A	5**	1A	280VRMS	AC
S42V-4*	3–32	10	1A	280VRMS	AC
D43-1, -2	3.8–12	15	500mA, 250mA	60V, 250V	DC
S322 SP	3.5–8.0	22	2.5A	280VRMS	AC
MP240D3SP	3–32	1	3A	280VRMS	AC
MP240D4SP	3–32	1	4A	280VRMS	AC

* Add "H" suffix to P/N for 600V pk output voltage rating
** Guaranteed turn-on at 5mA dc. No internal current limiting or regulation.
*** Part numbers shown are zero switching versions. Add suffix N for random turn-on.

100-250 AMP POWER SCR/DIODE MODULES—M80 SERIES

FEATURES:

- Seven Standard Circuit Configurations Available.
- High Terminal to Base Isolation of 2500V RMS.
- SCR Output Ratings of up to 180 Amps.
- Rectifier Output Ratings of up to 250 Amps.
- UL Recognized (File No. E 72446)



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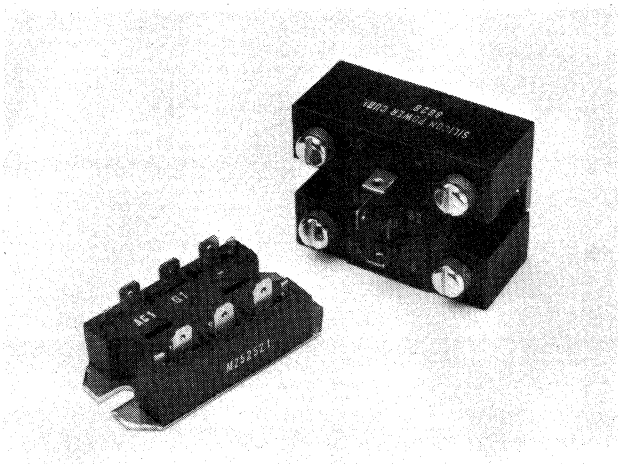
SILICON POWER CUBE

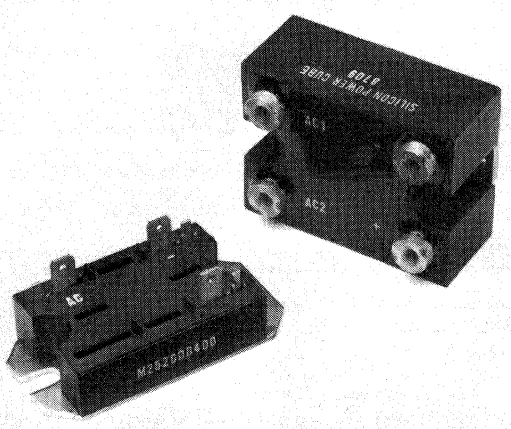
25-100 AMP POWER SCR/DIODE MODULES M25/M50 SERIES



FEATURES

- Eight Standard Circuit Configurations Available.
- Ultra-High Surge Current Capabilities Assures Long Lifetime and Reliable Performance.
- 2500VAC RMS Terminal-to-Base Iisolation.
- Proprietary SPC Unitized Power Circuit Structures Result in Very Efficient Thermal Management for Greatly Extended Cyclic Life.
- UL Component Recognition (File No. E72445).
- Available in standard 120VAC, 240VAC, 320VAC, 440VAC, and 480VAC Ratings (Higher voltages are available. Consult Factory.)

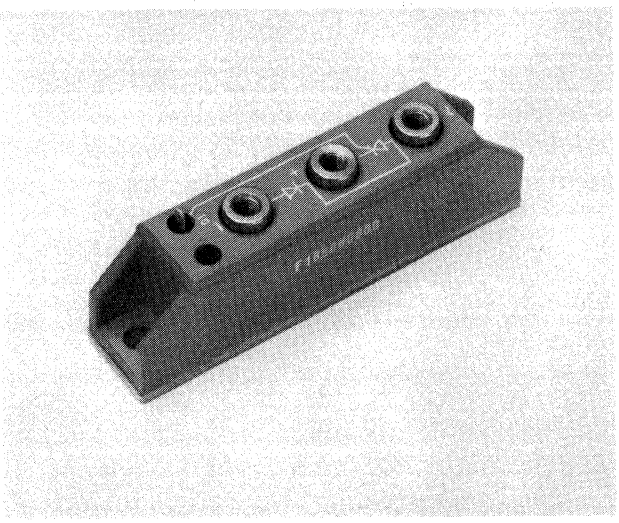
35-100 AMP POWER DIODE MODULES M25/M50 SERIES



FEATURES

- Seven Standard Diode Circuits are Available—Single-Phase Bridge; 3-Phase Bridge; Diode Doubler; Center Tap Common Cathode; Center Tap Common Anode; 3-Phase Common Cathode Half Wave Bridge and 3-Phase Common Anode Half Wave Bridge.
- SPC's Unique Unitized Power Rectifier Structures Provide Highly Efficient Thermal Management for Vastly Expanded Cyclic Lifetime.
- High Terminal-to-Base Isolation of 2500VAC RMS
- UL Component Recognition (File No. E72445).

25-90 AMP POWER SCR/DIODE MODULES F18 SERIES



FEATURES

- Thirteen Standard Module Configurations Available.
- Standard Voltages of 200 Volts to 1400 Volts. Average Device Current Output Ratings of 25 Amps to 90 Amps.
- Ultra-High Surge Current Capabilities.
- SPC's Rugged Unitized Power Circuit Structures Afford Optimally Efficient Thermal Management to Assure Extended Cyclic Life and Reliability.
- UL Component Recognition (File No. E72445).
- 2500VAC RMS Terminal-to-Base Isolation.
- All Units Are 100% Tested at Both 25°C and 125°C Temperature Levels—for Assured Quality.
- Available with Isolation Barriers

SILICON POWER CUBE CORP.

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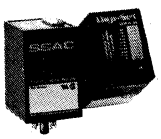
SOLID STATE TIMERS

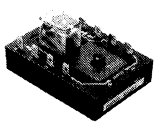
TIME DELAY RELAYS

TUD Series
- Direct Reading Switches
- LED Indication
- 0.1 to 9990 Seconds or Minutes
- Range Selector Switch
- 3 Modes Operation in One Unit
- 10 Amps Output Contacts, DPDT
- Panel Mount Kit Available

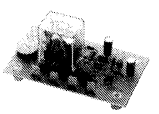


TD Series
- Switch Setable Time Delay
- 0.1 Seconds to over 2.8 Hours
- LED Indication
- All Modes of Operation
- 10 Amps Output Contacts
- Panel Mount Kit Available

PR Series
- Low Cost
- All Modes of Operation
- Popular Operating Voltage
- 50 Milliseconds to 8 Minutes
- Panel Mount Kit Available

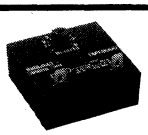


ER Series
- Surface Mount
- Onboard Adjust, Fixed, External
- 0.1 Second to over 8 Hours
- Encapsulated Circuitry
- 3 Modes of Operation
- 10 Amps Output Contacts



OR Series
- Low Cost
- Open Construction
- Onboard Adjust, Fixed, External
- 50 Milliseconds to 5 Minutes
- 3 Modes of Operation
- 10 Amps Output Contacts

UNIVERSAL TIMERS

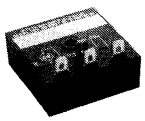


TMV8000 Series
- Operates: 19 to 288 volts AC,DC
- Adjustable: 0.1 to 8 Minutes
- Totally Solid State
- Encapsulated
- 2 Terminal Series Connection

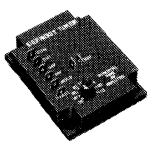
CMV8000 Series
- Unique Conduit Mounting
- Operates: 19 to 288 volts AC,DC
- Adjustable: 0.1 to 8 Minutes
- Encapsulated Circuitry
- 2 Wire Series Connection

TDU Series
- 2 Universal Voltages
- Delays from 0.1 to 2.8 Hours
- Switch Setable Delays
- Totally Solid State/Encapsulated
- 2 Terminal Series Connection

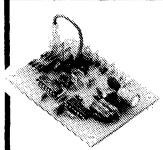
HVAC CONTROLS



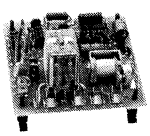
TA/TL Series
- Lockout Timer
- Prevents Rapid Recycling of Compressor
- Low Voltage Protection
- Totally Solid State/Encapsulated
- No Contactor Chatter



DTS Series
- DEFROST TIMER
- Accumulates Compressor Run Times
- Time and Temperature Terminate
- Knob Adjustable or Pin Selectable Time Intervals
- Reduced Test Times
- Encapsulated Circuitry

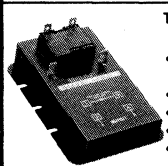


DTO Series
- DEFROST TIMER
- Low Cost Open Construction
- Accumulates Compressor Run Times
- Time and Temperature Terminate
- Knob Adjustable or Pin Selectable Time Intervals
- Reduced Test Times

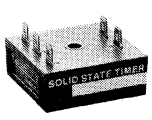


DTR Series
- DEFROST TIMER
- Includes All Relays to Operate Fan, Reversing Valve, Heat Relay
- Multiple Interval Selection
- Accumulates Compressor Run Times
- Time and Temperature Terminate
- Reduced Test Times

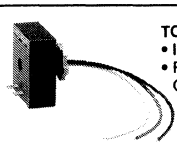
CT Series
- FAN DELAY
- Increases Efficiency by Providing an OFF delay for Circulating Fan
- Also Used for Sequencing (ON and OFF) Electric Heat Elements
- 1 to 600 Seconds Fixed



TLV Series • LOW VOLTAGE/ SHORT CYCLE PROTECTION
- Disconnects Compressor on Low Voltage
- Provides Random Starting
- Prevents Rapid Cycling
- Relay or Solid State Output
- Available in Plug Type Model

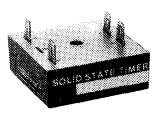


TAC Series
- Random Start or Sequencing
- Bypass Timing
- Anti-Short Cycle
- Part Winding Start
- 50 Milliseconds to 10 Minutes
- UL Recognized for Anti-Chatter

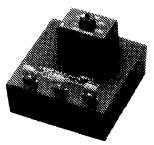


TOS/COS Series
- ISOLATOR
- Replaces Relay and Transformer Combination
- 1500 Volts RMS Isolation
- Rated at 1 Ampere Steady State
- Totally Solid State/Encapsulated

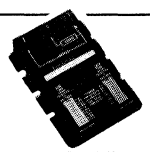
TIMING MODULES



TS Series
- All Operating Modes Available
- 50 Milliseconds to 10 Minutes
- Fixed, External Adjust (optional add-on adjustment module)
- Totally Solid State
- Encapsulated Circuit

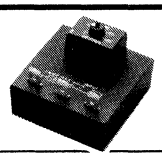


TSD Series
- All Operating Modes Available
- Digital Circuitry
- Delays to 166 Hours
- Fixed, Adjustable (shown with VR adjustment module)
- Encapsulated
- Totally Solid State

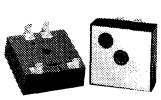


RS Series
RECYCLE TIMER SSAC offers a number of recycling timers: knob adjustable, switch setable, fixed and external. Solid State or Relay outputs. Contact SSAC by phone or letter.

HIGH POWER



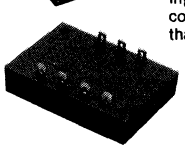
TH Series
- Analog Circuitry
- Up to 20 Amps steady state, 200 inrush • 0.1 to 600 Seconds
- External Adjust, Fixed or VR add-on Adjustment Module
- Totally Solid State/Encapsulated



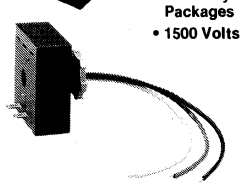
THD Series
- Digital Circuitry
- Up to 20 Amps Steady State, 200 Inrush • 0.1 Sec to 16 Hours
- External Adjust, Fixed, or VR add-on Adjustment Module
- Totally Solid State/Encapsulated

OPTO ISOLATION

ISO-TIMERS
ISO-Timers offer an unusual feature; inputs are electrically isolated from the output by means of optically coupled circuits. The input may be operated from a completely separate source than that of the load (output) source.

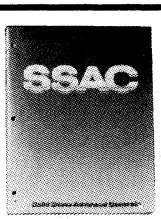


- **Digital and Analog Circuits**
- **All Modes of Operation**
- **A Variety of Encapsulated Packages**
- **1500 Volts RMS Isolation**



FREE Controls Catalog

Solid State Timers, Time Delay Relays, HVAC Timers and Controls, Relays, Flashers, Liquid Level Controls, Vending Controls, and more. 368 pages of product, applications, terms, and other useful information.



SSAC incorporated

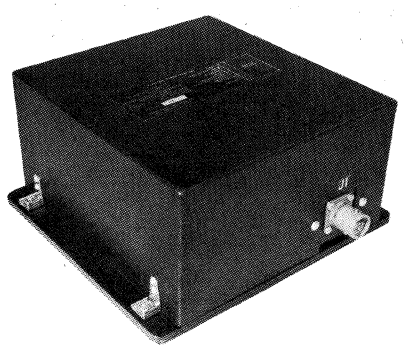
Telephone (315) 638-1300

Telex 64-6221 • FAX (315) 638-0333

P.O. Box 1000 **Baldwinsville, NY 13027**

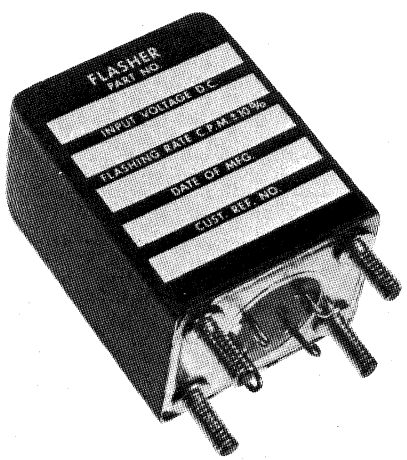
SCIENTIFIC TECHNOLOGIES INCORPORATED

ELECTRIC POWER MONITOR



SPECIFICATIONS
INPUT VOLTAGE: 115 VRMS line to neutral ± 5.8 VRMS, 400 Hz ± 20 Hz, 3 phases plus neutral, phase sequence A-B-C (pins 1, 2, 3 & 8)
NORMAL OUTPUT: 28 VDC ± 2.8V, 4.5 to 5.0 AMP max. (pin 5), voltage regulation and ripple: 10% and 1V peak-to-peak max.
ALARM OUTPUT: 28 VDC nominal, 1.8 to 2.0 AMP max. (pin 7)
RESET SWITCH: Customer will supply a momentary normally open switch to permit normal operation when the switch is activated providing none of the fault conditions exist and the input voltage is applied (switch across pins 6 & 4)
MATERIAL AND FINISH: Housing is aluminum with black anodized finish.
OPERATING TEMP. RANGE: 0°C to +85°C
DIELECTRIC STRENGTH: 1250V, 60 Hz between contacts and case and between isolated circuits
VIBRATION: 5 to 55 CPS with DA of .06 in along any axis.
SHOCK: 20G'S for 11 MS
FAULT CONDITIONS: The monitor will supply the alarm output when any of the following conditions exist:
OVER/UNDER VOLTAGE SENSOR; Voltage is above 126.5 VAC ± 1.5V or below 105.5 VAC ± 1.5V across any one or more of the phases with respect to neutral.
PHASE SENSOR: Improper phase sequence (C-B-A) or if any one phase is open with the remaining phases closed.
FREQUENCY SENSOR: Frequency is above 420 Hz +0 Hz/–5 Hz or below 380 Hz +5 Hz/–0 Hz
VOLTAGE DROP: Any one or more of the phases drop to 95 VAC, the voltage regulation and ripple will be 10% and 1 volt peak-to-peak max. Any one or more of the phases drop to 80 VAC, the voltage regulation and ripple will be 30% and 3 volt peak-to-peak max. Any one phase is open while these conditions exist, the voltage regulation and ripple will be 30% and 6 volt peak-to-peak max.

FLASHERS



FEATURES:
- High reliability
- Rugged
- Hermetically sealed
- Compact and lightweight
- Solid state and relay outputs
- Long life

SPECIFICATIONS
SOLID STATE FLASHER
INPUT VOLTAGE: 18 to 32 VDC
POWER CONSUMPTION: 3 Watts (Not Including Lamp Power).
FLASHER OUTPUT: 200 ma, 500 ma, 2 AMP, or 5 AMP Lamp or Relay Load.
OUTPUT POLARITY: Positive or Negative Types.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON:OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 10,000 Hours Min.
SHOCK: 100 G's for 11 Milliseconds
VIBRATION: 10 G's at 10 to 500 CPS.
HERMETICALLY SEALED.
MOUNTING: Stud or Flange.
SOLDER HOOK TEMINALS.
WEIGHT: 4 Ounces Nominal.
VOLTAGE DROP: 1.5 Volts Maximum.

RELAY TYPE FLASHER
INPUT VOLTAGE: 18 to 32 VDC.
POWER CONSUMPTION: 4 watts (not including lamp power).
FLASHER OUTPUT: 500 ma, 2 AMP, 5 AMP, lamp or relay load.
CONTACTS ARE S.P.S.T. normally open.
NOT DAMAGED BY REVERSE POLARITY.
FLASHING RATES: AS SPECIFIED.
ON: OFF RATIOS ARE: AS SPECIFIED
OPERATING TEMPERATURE RANGE: –55 C to +71 C.
OPERATING LIFE EXPECTANCY: 500,000 cycles
minimum at rated load.
SHOCK: 15 G's for 11 milliseconds.
VIBRATION: 10 G's at 10 to 500 CPS
UNIT: Hermetically sealed.
MOUNTING: Studs or flange.
SOLDER HOOK TERMINALS.
WEIGHT: 8 ounces nominal.

PHASE SEQUENCE INDICATORS

DESCRIPTION
A unique passive element circuit within the housing allows the indicator to illuminate only when the phase sequence of power being monitored is A-B-C. The phase sequence indicator will not illuminate when any one or more of the power inputs are opened or if the phase sequence is C-B-A.

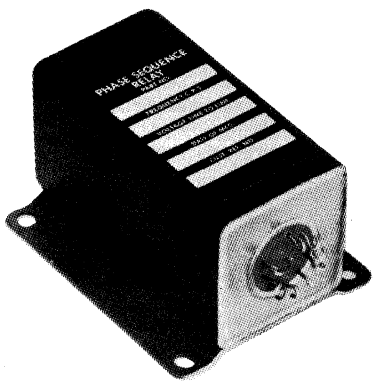
The indicator will provide trouble-free instantaneous indication with no warm-up time required. The units are potted in an aluminum housing with no moving parts. Designed to meet severe environmental requirements of military applications.

SPECIFICATIONS
POWER CONSUMPTION: 2 watts
OPERATING TEMPERATURE: –55 to +125 C
WEIGHT: 2 ounces
MOUNTING: 5/8 inch dia. hole, panel thickness to 3/4 inch
LEADS: 18 inches long, teflon insulated
HOUSING MATERIAL: aluminum, black anodized
FREQUENCY AND VOLTAGE: per customer specifications
INDICATOR: lights up when all input leads are energized and phase sequence is A-B-C

CONTROL COMPONENTS DIVISION 9520 Black Mountain Road, San Diego, CA 92126-4507 USA
Phone 800/826-5053 (Continental U.S. except CA) 619/566-7680 FAX: 619/549-9691 TELEX: 9105951797 STI IRIN

SCIENTIFIC TECHNOLOGIES INCORPORATED

PHASE SEQUENCE RELAYS



FEATURES

- Designed for use in severe environmental conditions
- Automatic monitoring of phase sequence
- Solid state sensing circuit
- Hermetically sealed
- Light weight, small size
- Many voltages and frequency combination available

SPECIFICATIONS

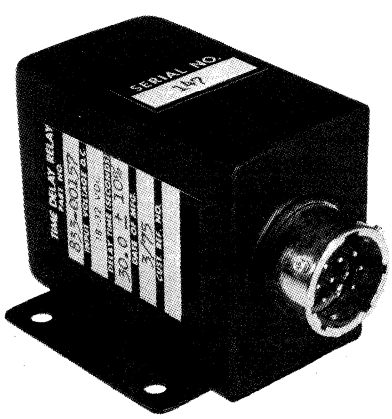
Relay picks up when all input terminals are energized and phase sequence is A-B-C.
Relay drops out if one or more power leads are grounded, opened or if the phase sequence is C-B-A.
POWER CONSUMPTION: 10 watts maximum.
OPERATING TEMPERATURE: –55 C +71 C
CONTACT RATINGS: (Per MIL-C-5757)

28 VDC	Resistive (Form C)	Inductive
2 AMP	2.0 AMPS	1.0 AMPS
3 AMP	3.0 AMPS	1.0 AMPS
10 AMP	10.0 AMPS	5.0 AMPS

115 VAC	Resistive (Form A&B)	Resistive (Form C)
2 AMP	2.0 AMPS	0.2 AMPS
3 AMP	3.0 AMPS	0.2 AMPS
10 AMP	10.0 AMPS	2.0 AMPS

VIBRATION: 10 G's to 500 Hz.
SHOCK: 30 G's for 11 milliseconds stud mount.
100 G's for 11 milliseconds flange mount.
SEAL: Hermetically sealed.
CONTACT RESISTANCE: .08 ohm maximum.
INSULATION RESISTANCE: 100 megohms minimum between terminals and case, between open contacts.
DIELECTRIC STRENGTH: 1000 Vrms 60 Hz, between terminals and **CASE;** 500 Vrms 60 Hz, between open contacts.
LIFE: 100,000 operations minimum.
WEIGHT: 11 ounces maximum.
Relays per MIL-R-5757.
Environmental testing per MIL-E-5272.
Test methods per MIL-STD-202.
Marking per MIL-STD-130.

TIME DELAY RELAYS



FEATURES

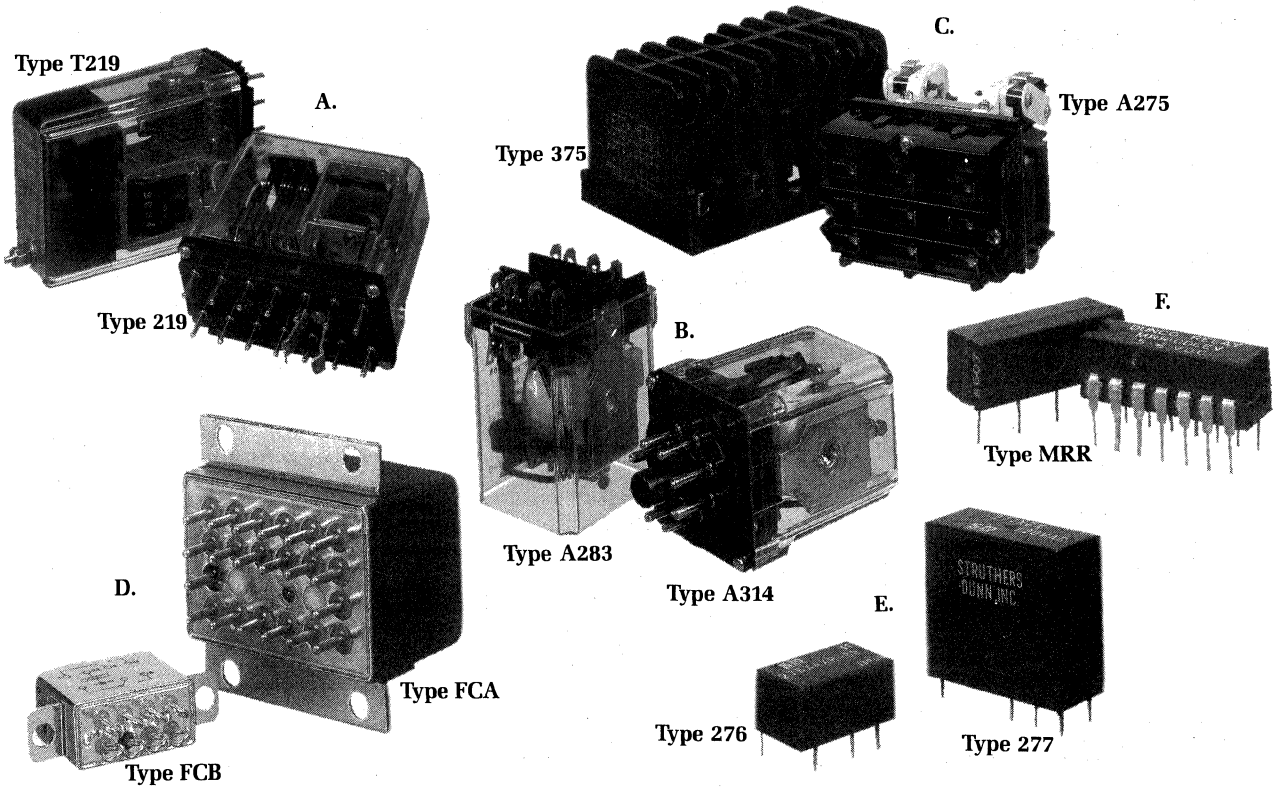
- Solid state sensing circuit
- Transient protected
- 2 amp, 3 amp, and 10 amp relay contacts, dpdt.
- Hermetically sealed.
- Light weight (3.5 to 9 oz).
- Choice of 3 operating modes.
- Designed for use in severe environmental conditions.

SPECIFICATIONS

INPUT VOLTAGE: 18 to 32 vdc
POWER REQUIREMENTS AT 28 VDC: 5 watts max, 2 amp relays
6.5 watts max, 10 amp relays
TEMPERATURE RANGE: –65 F to +185 F
VIBRATION: 20 G's, 10 to 2000 Hz
SHOCK: 100 G's for 11 milliseconds
CONTACTS: DPDT
LIFE: 100,000 cycles minimum at rated load
DROP-OUT TIME: 10 milliseconds max.
DROP-OUT VOLTAGE: 1 volt min.
PULL-IN VOLTAGE: 18 volts max.
INSULATION RESISTANCE: 100 megohms min.
DIELECTRIC STRENGTH: 500 volts 60 Hz case to terminals and across open contacts
CONTACT RATING:
2 amp & 3 amp unit: 2 amp & 3 amp resistive at 32 vdc
1 amp inductive at 32 vdc
10 amp unit: 10 amp resistive at 28 vdc or 115 vac
5 amp inductive at 28 vdc or 115 vac
CONTACT RESISTANCE: 0.050 ohms at rated current
RESET-TIME: 0.050 sec. max.
TRANSIENT PROTECTION: Will not be damaged by transients per Mil-Std-704
INTERNAL RELAYS: Per MIL-R-5757

CONTROL COMPONENTS DIVISION 9520 Black Mountain Road, San Diego, CA 92126-4507 USA
Phone 800/826-5053 (Continental U.S. except CA) 619/566-7680 FAX: 619/549-9691 TELEX: 9105951797 STI IRIN

Struthers-Dunn... when you need the right relay, at the right price, right on time.



No relay application is more special than your own. And when the specs are strict, the deadline is tight, and reliable performance is mandatory, it pays to see a specialist. Nobody can match Struthers-Dunn for experience, service and a selection to meet your every cost/performance requirement.

A. Hi-Rel Industrial Relays. Complete line of plug-in relays from low level to 10 amp for general purpose, timing, latching, sequencing and over/under-voltage switching. Polycarbonate housings with either 12- or 14-pin industrial-style sockets and plugs. AC or DC coils.

B. Compact, General Purpose/Time Delay Plug-In Relays. Quality, cost-efficient relays with plug-in, solder and fast-on terminals with rectangular or octal base; 1, 3, 5, 10, 15, or 20 amp; 1, 2, 3 or 4 poles; AC or DC coils; open or enclosed. Time delay relays are available in the same configurations and ratings. Available time delays range from .1 sec to 300 sec. Various timing functions available.

C. Reversing Contactors. Definite purpose contactors for up to 7½ HP motor loads. With mechanical and electrical interlocks (the latter is optional). Suitable for industrial door control and many similar applications. UL listed and CSA certified versions available as standard.

D. Aerospace/Military Relays. Hermetically sealed relays in both miniature and power types as well as time delay versions to meet most applicable Mil specs. Low level to 25 amp; 1 to 6 PDT; AC or DC operation.

E. Miniature PC Board Relays. High-performance relays from low level to 30 amp for PC board mounting in industrial/commercial applications. Sealed and flux-tight enclosures, with contacts from 1 Form A to 2 Form C. AC or DC coil. UL recognized, CSA certified, TV-5 ratings and VDE spacing.

F. Reed Relays. Miniature and standard size reed relays in DIP, SIP and end pin termination packages with .100″ and .150″ grid spacing. U.L. recognized or Mil approved. Mercury-wetted reed contact relays available in PC and plug-in mounting models for long-life, no-bounce switching. To industrial or Mil specs.

All Available Locally From Your Reliable S-D Distributor. All the most popular Struthers-Dunn relays are immediately available from the shelves of more than 100 S-D distributors across the country. For the name of the S-D distributor or representative near you (and a copy of our comprehensive catalog), just call or write.

STRUTHERS-DUNN, INC.
A subsidiary of Nytronics, Inc.
Lambs Rd., Pitman, NJ 08071-0901 Tel. 609-589-7500
TWX 510-686-7510 FAX (24 HRS.) 609-589-2619
Right relay, right price, right on time!

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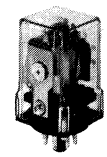
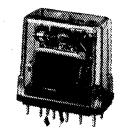
GENERAL PURPOSE PLUG-IN RELAYS

SENSITIVE PLUG-IN RELAYS

								
SERIES	**219**	**C281**	**A283**	**A314**	**284**	**292**	**392**	**112XAXPGF**
FEATURES	• Up to 6 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator • 12 pin or 14 pin plug	• 2 or 4 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator • Optional flange mounting	• Up to 3 poles • Open styles • Polycarbonate cover styles • Optional flange mountings • Optional indicator lamp • Optional manual actuator	• Octal plug-in or open style • Up to 3 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator	• 4 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator	• Up to 3 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator • Optional flange mountings • DC coil only	• Up to 3 poles • Polycarbonate cover • Optional indicator lamp • Optional manual actuator • Octal plug • DC coil only	• One pole • Polycarbonate cover • 12 pin plug-in • AC or DC coils
APPROXIMATE DIMENSIONS (inches)	2.59 × 1.47 × 2.625/3.06	1.11 × .85 × 1.36	1.531 × 1.41 × 1.91	1.375 × 1.375 × 2.25	1.5 × 1.937 × 1.875	1.531 × 1.41 × 1.91	1.375 × 1.375 × 2.25	2.625 × 1.03 × 2.594
CONTACT ARRANGEMENT	2/4 Form C 6 Form A & B Combined	2 Form C 4 Form C	1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C	4 Form C	1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C	1 Form C
CONTACT MATERIAL	AC-CD-0	AG AG-CD-0 AG-PA	AG AG-CD-0	AG AG-CD-0	AG-CD-0	AG	AG	AG
CONTACT RATING	10A at 28VDC or 125VAC	1 to 10Amp at 28VDC or 120VAC	5A/10A at 28VDC or 240VAC	5A/10A at 28VDC or 240VAC	10A at 28VDC or 240VAC	5A at 28VDC or 120VAC	5A at 28VDC or 120VAC	2A at 28VDC or 120VAC 1A at 240VAC
COIL VOLTAGE	6–240VAC 6–125VDC	6–220VAC 6–110VDC	6–240VAC 6–125VDC	6–240VAC 6–125VDC	6–240VAC 6–125VDC	15VDC to 144VDC	15VDC to 144VDC	1VAC to 225VAC .08VDC to 21VDC min.
NOMINAL COIL POWER	5VA-AC 1.8W-DC	1.2VA-AC 1.2W-DC	2-2.75VA-AC 1.2W-DC	2.1VA-AC 1.2W-DC	3.4VA-AC 1.2/1.9W-DC	125MW per pole	125MW per pole	200MW-AC (approx.) 13MW-DC (approx.)
MOUNTING	Plug-in	PC Mount Plug-in	Panel Mount Plug-in	Panel Mount Plug-in	Plug-in	Panel Mount Plug-in	Plug-in	Plug-in
SOCKETS	Screw term. Quick Connect Studs	Screw term. Solder term. PC term.	Screw term. Solder term. PC term. Quick Connect	Screw term. Solder term.	Screw term. Solder term. PC term. Quick Connect	Screw term. Solder term. PC term. Quick Connect	Screw term. Solder term.	Screw term.
APPROVALS	UL, CSA	UL, CSA	UL, CSA	UL, CSA	UL	UL	UL	UL

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS, REQUEST CATALOG C/1010.

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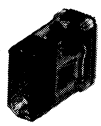
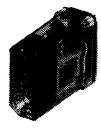
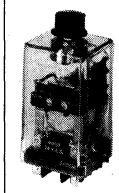
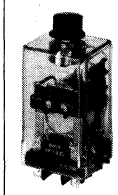
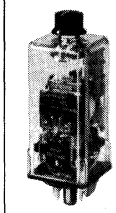
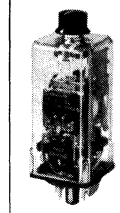
FAX (24 HRS.) 609-589-2619

TIME DELAY PLUG-IN RELAYS

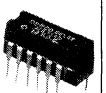
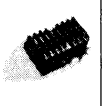
									
SERIES	**236**	**237**	**T219**	**282**	**286**	**287**	**306**	**326**	**327**
FEATURES	• High quality • Versatile • Delay-on-operate	• High quality • Versatile • Delay-on-release	• High quality • Versatile • Delay-on-operate • Delay-on-release • 0.2 sec. to 24 hr.	• Knob adjustable • 4 poles, 3A • Inverse polarity protection • Miniature • Delay-on-operate	• Low cost • 1, 2, or 3 poles • Transient protection • Inverse polarity protection • Delay-on-operate	• Economical • 1, 2, or 3 poles • Transient protection • Inverse polarity protection • Delay-on-release	• 4 poles, 10A • Square base • Transient protection • Inverse polarity protection • Delay-on-operate	• 1, 2, or 3 poles • Low cost • Octal plug • Transient protection • Inverse polarity protection • Delay-on-operate	• Low cost • 1, 2, or 3 poles • Transient protection • Inverse polarity protection • Delay-on-release
APPROXIMATE DIMENSIONS (inches)	1.469 × 2.625 × 4.06	1.469 × 2.625 × 4.06	1.469 × 2.625 × 4.06	1.109 × .859 × 2.250 (excl. knob)	1.531 × 1.41 × 1.91 (excl. knob)	1.531 × 1.41 × 1.91 (excl. knob)	1.5 × 1.94 × 1.88 (excl. knob)	1.38 × 1.38 × 3 (excl. knob)	1.38 × 1.38 × 3 (excl. knob)
CONTACT ARRANGEMENT	1 Form A & 2 Form C	2 Form C	1 Form A & 2 Form C or 2 Form C	2 Form C 4 Form C	1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C	4 Form C	1 Form C 2 Form C 3 Form C	1 Form C 2 Form C 3 Form C
CONTACT RATING	10A at 28VDC or 125VAC	10A at 28VDC or 125VAC	10A at 28VDC or 125VAC	3A, 5A, 10A at 28VDC or 120VAC	5A/10A at 28DC or 240AC	5A/10A at 28DC or 240AC	10A at 28DC or 240AC	10A at 28DC or 240AC	10A at 28DC or 240AC
MODE OF OPERATION	Delay on operate	Delay on release	Delay on operate, Delay on release	Delay on operate	Delay on operate	Delay on release	Delay on operate	Delay on operate	Delay on release
DELAY TIME	0.2 to 200 sec.	0.2 to 200 sec.	2.5 sec. to 36 hrs.	0.1 to 300 sec.	0.1 to 300 sec.	0.1 to 300 sec.	0.1 to 300 sec.	0.1 to 300 sec.	0.1 to 300 sec.
TYPE OF CONTROL	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed	• Potentiometer adjustable • External resistor adjustable • Fixed
REPEATABILITY	±5%	±5%	±2%	±3%	±3%	±3%	±3%	±3%	±3%
TEMPERATURE RANGE	0°C to +50°C	0°C to +50°C	0°C to +50°C	−10°C to +70°C	−10°C to +70°C	−10°C to +70°C	AC: −10°/+45°C DC: −10°/+70°C	−10°C to +70°C	−10°C to +70°C
INPUT VOLTAGE	24–120VAC 24–125VDC	24–120VAC 24–125VDC	24–120VAC/DC	12–120VAC 12–120VDC	12–240VAC 12–125VDC	12–240VAC 12–125VDC	24–120VAC 12–125VDC	12–240VAC 12–125VDC	12–240VAC 12–125VDC
MOUNTING	12 pin socket	12 pin socket	12 pin socket	Socket with solder, PC or wire wrap term.	Screw term. Solder term. PC term. Quick connect	Screw term. Solder term. PC term. Quick connect	Socket mount with screw term. or rear connect terminals	Socket mount	Socket mount
APPROVALS	——	——	——	UL	UL	UL	UL	UL	UL

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS, REQUEST CATALOG C/1010.

STRUTHERS-DUNN, INC.
a subsidiary of Nytronics, Inc.

RELAY DIVISION
Lambs Rd., Pitman, N.J. 08071-0901
Tel. 609-589-7500 TWX 510-686-7510
FAX (24 HRS.) 609-589-2619

GENERAL PURPOSE POWER RELAYS — PC BOARD RELAYS — REED RELAYS — REVERSING CONTACTORS

											
SERIES	**298**	**300**	**425**	**276**	**277**	**MRR-D**	**MRRQ**	**MR30Y/ MR35Y**	**275**	**375**	**575**
FEATURES	• Up to 3 poles • Polycarbonate cover • 8mm spacing • Coil-contacts	• 2 poles • Polycarbonate cover • 8mm spacing	• Up to 3 poles • Perm. magnet ARC blow-out (optional) • Optional quick connect terminals • Optional aux. contact (Form C)	• Sealed or unsealed types • Polarized coil 0.1 grid • 5KV surge resistance • 4mm VDE spacing	• AC or DC coils • 10 KV surge resistance • 8mm VDE spacing	• Dual in line epoxy molded • Up to 2 poles • Optional supressor diode	• Single in line epoxy molded • Optional supressor diode	• End to end terminals • Epoxy molded • Optional supressor diode	• Small size • Mechnical interlock • Optional electrical interlocks .250 quick conn. term.	• Molded block construction • Mechanical interlock • Up to 4 load contacts per coil .250 quick conn. term.	• Solenoid connector • Screw term. • Optional aux. contacts • Mechanical interlock
APPROXIMATE DIMENSIONS (inches)	1.375 × 1.5 × 1.875	1.375 × 1.5 × 1.875	2.5 × 3.25 × 2.5	.5 × .787 × .394	1.14 × 0.5 × 1.024	0.3 × 0.275 × .0.75	0.26 × 0.25 × .0.75	.40/.55 × .312 × .95	2.88 × 2.19 × 3.38	2.81 × 3.25 × 4.65	5.25 × 4.43 × 3
CONTACT ARRANGEMENT	1 Form C 2 Form C 3 Form C	2 Form C	1, 2, 3 Form A 1, 2, 3 Form B 1, 2, 3 Form C	1 Form A or 1 Form C	2 Form A or 2 Form C	1 Form A 1 Form B 2 Form A 1 Form C	1 Form A 1 Form B	1 Form A 1 Form B 2 Form A 1 Form C 2 Form C	3 N.O.D.M. contacts per coil	3 N.O.D.M. or 4 N.O.D.M contacts/coil	3 N.O.D.M. contacts/coil
CONTACT MATERIAL	AG-CD-0	AG-CD-0	AG-CD-0	AG	AG	—	—	—	—	—	—
CONTACT RATING	20A–28VDC to 277VAC 5A–600VAC	20A–28VDC to 277VAC 5A–600VAC	30A at 28VDC to 240VAC 10A at 600VAC	7–10A at 30VDC 240VAC, 1/10HP at 120VAC	5A–1/10HP at 30VDC, 240VAC	100V Max 500MA Max 10VA Max	100V Max 500MA Max 10VA Max	200V Max. 5HP 500MA Max. C to 10VA Max (Form A/B only)	1HP/15A–120AC 1HP/10A–240AC 2HP/10A–240AC 1HP/5A–600AC	1.5HP to 7.5HP from 120V 10 to 600V 30	1HP to 7.5HP from 120VAC to 600 VAC 30A–120/240AC 15A–600VAC
COIL VOLTAGE	6–240VAC 6–250VDC	6–240VAC 6–250VDC	6–480VAC 6–120VDC	3V DCT0 24VDC	AC: 6–120V DC: 3–110V	5–24VDC	5–24VDC	5–24VDC	6–240VAC 12–120VDC	12–600VAC	12–600VAC 12–230VDC
NOMINAL COIL POWER	3.4VA-AC 1.5W-DC	3.4VA-AC 1.5W-DC	9.8/11VA-AC 2/4W-DC	0.2W	AC: 0.9VA DC: 0.53W	—	—	—	17VA-AC 4.6W-DC	10VA-AC (52VA in rush)	22VA-AC 10W-DC
TEMP. RANGE	—	—	—	−40°C/ +70°C	−40°C/ +70°C	−20°C/ +105°C	−20°C/ +105°C	−55°C/ +85°C	—	—	—
TERMINAL SPACING	—	—	—	—	—	0.1 GRID	0.1 GRID	MR30Y .1 GRID MR35Y .15 GRID	—	—	—
MOUNTING	Panel Mount	Panel Mount	Panel Mount	PC Mount	PC Mount Plug-in	PC Mount	PC Mount	PC Mount	Panel Mount	Panel Mount	Panel Mount
APPROVALS	UL, CSA (pend)	UL, CSA (pend)	UL, CSA	UL, CSA	UL, CSA	—	—	—	UL, CSA	UL	UL

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
FOR DETAILS ON STRUTHERS-DUNN DISTRIBUTOR-STOCKED RELAYS, REQUEST CATALOG C/1010.
FOR DETAILS ON STRUTHERS-DUNN MINIATURE PC RELAYS, REQUEST CATALOG PC/200.

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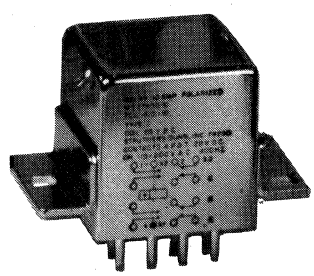
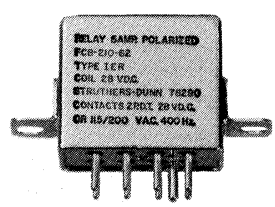
RELAY DIVISION
Lambs Rd., Pitman, N.J. 08071-0901
Tel. 609-589-7500 TWX 510-686-7510
FAX (24 HRS.) 609-589-2619

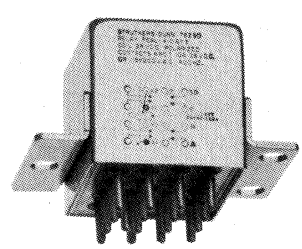
MIL-SPEC ELECTROMECHANICAL RELAYS

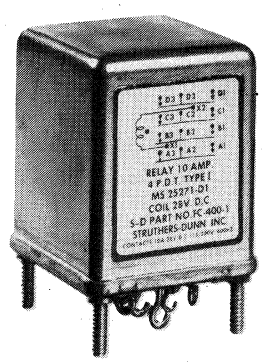
- **All built in accordance with Mil-R-6106**
- **Available with or without flanges, studs and track mounting**
- **Track and socket assemblies available**
- **Coil suppression available**

	to Mil Spec:	Contact Rating (Amps)	Coil Rating/ Frequency	Operate/ Release (ms. max)	Shock (min Gs) *track-mounted	Rated Vibration (min. Gs)
FCA Series 1 PDT FCA 125	6106/19	25	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 200 200 200 200 200	30 30 30 30 30 30
2 PDT FCA 210	MS27401 6106/1 (track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 50* 200 50 200 50 200 50 200 50 200 50	30 30 30 30 30 30 30
3 PDT FCA 325 FCAC 325	MS27743 6106/13 (2 amp aux cont.)	25	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 200 200 200 200 200	30 30 30 30 30 30
4 PDT FCA 410	MS27400 6106/2 (track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	200 50* 200 50 200 50 200 50 200 50 200 50	30 20 30 30 30 30
6 PDT FCA 610	6106/8	10	6V/DC 12V/DC 28V/DC 48V/DC 115V/400 115V/50 400	10/10 10/10 10/10 10/10 15/50 20/50	50 50 50 50 50 50	20 20 20 20 20 20
FCB Series 2 PDT FCB 210	6106/27 6106/21 (Track mount)	5	6V/DC 12V/DC 28V/DC 48V/DC	4/4	200 50*	30 20*
3 PDT FCB 310	6106/29 6106/24 (Track mount)	10	6V/DC 12V/DC 28V/DC 48V/DC	6/6	200 50*	30 20*
4 PDT FCB 410	6106/28 6106/22 (Track mount)	5	6V/DC 12V/DC 28V/DC 48V/DC	6/6	200 50*	30 20*
FCAL Series 1 PDT FCAL 125	6106/20	25	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
2 PDT FCAL 210	MS27744 (6106/ 50,36)	10	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200 50*	30
3 PDT FCAL 325 FCACL 325	MS27742 6106/13	25	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
4 PDT FCAL 410	MS27745 (6106/ 51)	10	6V/DC 12V/DC 28V/DC 115/400	15/15 15/15 15/15 20/20	200	30
FC Series 2 PDT FC-402	MS25273 MS25323 Mil-R- 5757	10	28/DC 115/400 115/50-60	20/20 25/50 25/50	50	10
4 PDT FC-4 FC-400 FC-404	Mil-R- 5757/7 5757/15 5757/18	2 5 10	26.5/DC 28/DC 115/400 115/50-60 28/DC 115/400 115/50-60	10/15 20/20 25/50 25/50 20/20 25/50 25/50	100 50 50	15 10 10
6 PDT FC-406 FC-6	5757/16 5757/1	5 2	28/DC 115/400 115/50-60 26.5DC	20/20 25/50 25/50 15/15	50 50 50 100	10 10 10 15









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RELAY DIVISION
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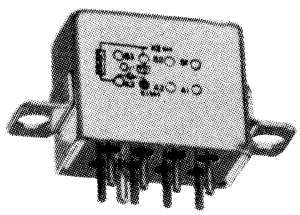
Tel. 609-589-7500 TWX 510-686-7510
FAX (24 HRS.) 609-589-2619

MIL-SPEC TIME DELAY RELAYS

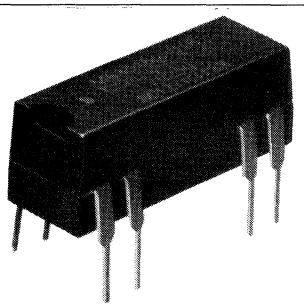
- **Delay on Operate or Delay on Release— Fixed (F) and/or Adjustable (A) and/or Programmable**
- **.05 to 600 sec. timing range (.10 to 300 sec. for TDA Series)**

	To spec. Mil-R-	Contact Rating (Amps)	Coil Rating/ Frequency	Recycle Times (ms.)	Shock (min. Gs)	Vibration (min. Gs)
TDA Series 2 PDT (F)	83726/ 1, 2, 3, 4, 18, 19, 27	10	28V/DC	50	100	20
TDB Series 1 PST (F) (A)	83726/ 24, 25	150 MA (ss output)	20V/DC	10	100	10
TDC Series 2 PDT (A)	83726/ 30, 31	10	28V/DC	10	200	30
TDD Series 2 PDT (F) (A)	83726/ 28, 29	10	28V/DC	10	200	30
TDE Series 4 PDT (F) (A)	83726	10	28V/DC	10	200	30
TDF Series 3 PDT (F) (A)	83726	25	28V/DC	10	200	30
TDG Series 6 PDT (F)	83726	10	28V/DC	10	50	20



MIL-SPEC REED RELAYS

DIP*	83516/ 1, 2	Form / VA 1A / 10 2A / 10 1B / 10 1C / 3	[5/6V/DC 12V/DC 24V/DC]	1/.5 1/.5 .5/.5 2/2.5	50 50 50 50	20 20 20 20
SIP	83516/3	1A 10 1B 10	[5/6V/DC 12V/DC 24V/DC]	1/.5 .5/.5	50 50	20 20
Mercury Wetted	83407/3	Form 1A, 2A, 3A (2A) Form 1C, 2C (1A)	[4.5V/DC 12V/DC]	3/3 3/3	20 20	4 4

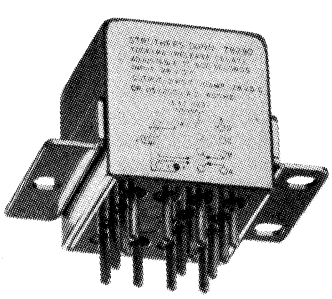


*Latched versions also available [ ]—applies to all contact ratings

MIL-SPEC SENSORS

- VS, CS, FS Series for Voltage/Current/Frequency

Struthers-Dunn custom designs and manufactures a range of Mil-Spec sensors that monitor AC and DC circuits and detect and signal when the parameters of voltage, current or frequency deviate from the required nominal range. These sensors use Struthers-Dunn Mil-approved relays or timers, and are available in models ranging from 1 PDT low level with reed contacts, to 4-pole 10A or 3-pole 25A. Magnetic latching relays are available for all contact arrangements. Enclosures are hermetically sealed, with terminals for socket plug-in, circuit board mounting or solder hooks. For detailed information, contact Struthers-Dunn.



MIL-SPEC QPL LISTING

MS25267	MS25325	MS27709	MIL-R-6106/5
MS25268	MS25327	MS27743	MIL-R-6106/25
MS25269	MS25329	MS27744	MIL-R-6106/35
MS25270	MS25917	MS27745	MIL-R-83407
MS25271	MS25918	MIL-R-5757	MIL-R-83516
MS25272	MS25919	MIL-R-6106	MIL-R-83726
MS25273	MS27400	MIL-R-6106/3	
MS25323	MS27401	MIL-R-6106/4	

ENGINEERING SPECIFICATION DATA SUBJECT TO CHANGE. CONTACT FACTORY FOR INFORMATION.
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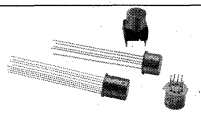
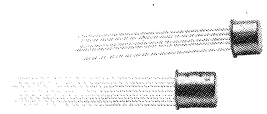


TELEDYNE RELAYS
Military TO-5 Relays

SERIES		CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	COIL DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	APPLICABLE MIL SPEC. SHEET MIL -R-
411		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/7
411D		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	39016/23
411DD		1 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 280, 500, 1130, 2000	300	39016/24
411T		1 FORM C	1	5, 6, 9, 12, 18, 26.5	63, 125, 280, 500, 1130, 2000	300	28776/5
412		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/9
412D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/15
412DD		2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/20
412T		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	28776/1
431	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/10
431D	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	39016/25
431DD	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	100, 200, 630, 1025, 2300, 4000, 6500, 11000	150	39016/26
431T	SENSITIVE	1 FORM C	1	5, 6, 9, 12, 18, 26.5, 32, 40	125, 255, 630, 1025, 2300, 4000, 6500, 11000	150	28776/4
432	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/11
432D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	39016/16
432DD	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 850, 1600, 3300, 6500, 11000	200	39016/21
432T	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 850, 1600, 3300, 6500, 11000	200	28776/3
421	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/8
421D	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/27
421DD	MAGNETIC LATCHING	1 FORM C	0.5	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/28
420/422	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/12
420D/422D	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290	39016/29
420DD/422DD	MAGNETIC LATCHING	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 97, 280, 500, 1130, 2000	290	39016/30

High Current (2 Amperes) Military TO-5 Relays

SERIES	CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	COIL DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	APPLICABLE MIL SPEC. SHEET MIL -R-
212	2 FORM C	2	5, 12, 26.5	28, 200, 800	820	—



Commercial/Industrial TO-5 Relays

SERIES		CONTACT DATA: ARRANGEMENT	CONTACT DATA: MAX. RATING (AMPS @ 28 VDC)	CONTACT DATA: NOMINAL VOLTAGE (VDC)	COIL DATA: NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
712		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712D		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
712TN		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
732	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732D	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
732TN	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
720/722	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
720D/722D	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

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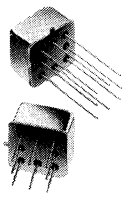
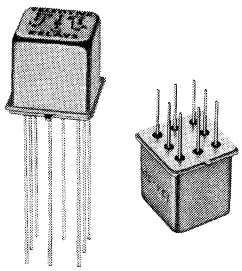


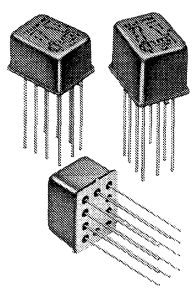


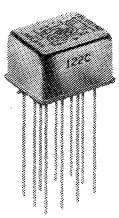
Centigrid® Military Relays

- **General purpose 114 Series**
- **Sensitive 134 Series**

The Centigrid® 114 Series relays are subminiature, hermetically sealed, armature relays featuring low profile, .275" (6.99mm) high by .370" (9.4mm) square, with .100" grid spaced terminals. The sensitive 134 Series is .375" (9.5mm) high and features ultra-low coil power dissipation. Both Centigrids® feature all-welded construction, hermetic sealing, and high force/mass ratios for excellent resistance to environmental extremes. Gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum. The 114 Series and 134 Series are qualified to L, M and P levels of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE	NOMINAL OPERATING POWER (mW) AT RATED VDC	
114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/17
114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450	39016/18
114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	39016/19
134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/41
134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200	39016/42
134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200	39016/43





CMOS Compatible Centigrid® Military Relays

- **CMOS compatible general purpose 116C Series**
- **CMOS compatible sensitive 136C Series**
- **CMOS compatible magnetic latching 122C Series**

CMOS compatible Centigrid® relays are subminiature, hermetically sealed, armature relays capable of being directly driven by most IC logic families. Their low profile height and .100" grid spaced terminals, which precludes the need for spreader pads, make them ideal for applications where extreme packaging density and/or close PC board spacing are required. The 116C and 136C Series are qualified to L and M levels of MIL-R-28776 and incorporate internal silicon planar epitaxial type diodes for coil suppression, zener diodes to protect the MOSFET gate inputs, and N-channel enhancement-mode MOSFET chips. The 122C, which incorporates the same interface circuitry as the 116C and 136C, is a magnetic latching relay which is actuated by a short duration voltage pulse. The magnetic "memory" of this device precludes the need for constant bias and or battery backup in the event of system power failure.

SERIES	CONTACT DATA		COIL DATA			APPLICABLE MIL SPEC. SHEET MIL -R-
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC	
116C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450	28776/6
136C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 800, 1600, 3200	200	28776/7
122C	2 FORM C	1	5, 6, 9, 12, 18, 26.5	48, 120, 280, 500, 1130, 2000	335	–

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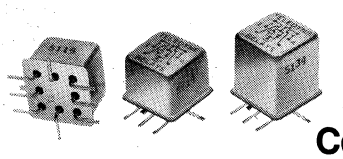
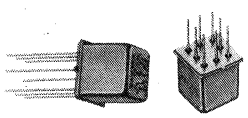


Surface Mount Centigrid® Military Style Relays

- **General purpose S114 Series**
- **Sensitive S134 Series**

Teledyne Relays' S114 and S134 Series are subminiature, hermetically sealed, surface mountable relays, which combine the proven reliability of the Centigrid® Series relays with pre-tinned leads specifically formed in compliance with MIL-STD-454 to make them ideal for all types of surface mount reflow processes. The basic design and internal construction are identical to the 114 & 134 Series Centigrid® relays (as described on Page 2) and meet the requirements of MIL-R-39016.

SERIES	CONTACT DATA		COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
S114	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114D	2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
S114DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5	39, 78, 220, 390, 880, 1560	450
S134	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134D	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	100, 200, 400, 800, 1600, 3200, 6500, 11000	200
S134DD	2 FORM C	1	5, 6, 9, 12, 18, 26.5, 36, 48	64, 125, 400, 800, 1600, 3200, 6500, 11000	200



Low Cost 172 Series Centigrid® Commercial/Industrial Relays

Low cost commercial versions of the DPDT MIL qualified Centigrid® relays. Hermetic sealing, all welded construction, and gold plated precious metal contacts assure reliable switching of loads from dry circuit to 1 ampere. Contact geometry and low intercontact capacitance provide RF switching capability well into the UHF spectrum.

	GENERIC PART NUMBERS	172-5 172D-5	172-12 172D-12	172-26 172D-26
Coil Voltage (VDC)	Nom.	5.0	12.0	26.5
	Max.	5.8	16.0	32.0
Coil Resistance (ohms ± 20%)		64	400	1600
Pick-up Voltage (VDC, max.) Pulse Operation		3.8	9.0	18.0
Coil Operating Power at Nominal Voltage (Milliwatts)		405	360	440
Diode P.I.V. (VDC, min.) 172D			100	
Negative coil transient (VDC, max.) 172D			2.0	

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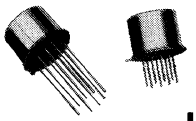

High Environmental Military Style TO-5 Relays

Designed to withstand severe environmental conditions of shock, vibration, or elevated temperature in excess of normal military specification levels. The following versions are available, all of which meet other requirements of MIL-R-39016:

412H Series—High Temperature (200°C)
412K Series—High Shock (4000 g's/0.5ms)
412V Series—High Vibration (380 g's @ 200 Hz)
432H Series—High Temperature (200°C)
432V Series—High Vibration (380 g's @ 200 Hz)
422H Series—High Temperature (200°C)
422K Series—High Shock (2000 g's/0.5ms)

SERIES		CONTACT DATA		COIL DATA		
		ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL OPERATING POWER (mW) AT RATED VDC
412H		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 98, 220, 390, 880, 1560	450
412K		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 80, 160, 300, 600, 1350	500
412V		2 FORM C	1	5, 6, 9, 12, 18, 26.5	50, 70, 155, 235, 610, 1130	525
432H	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	100, 200, 400, 850, 1600, 3300	200
432V	SENSITIVE	2 FORM C	1	5, 6, 9, 12, 18, 26.5	80, 120, 240, 480, 950, 1900	370
422H	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290
422K	MAG LATCH	2 FORM C	1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

RF Relays

- **RF120 Series Military Style Centigrid® Relays**
- **RF170 Series Commercial Centigrid® Relays**

The RF120 and RF170 Series relays are subminiature, hermetically sealed Centigrid® relays featuring extremely low intercontact capacitance that have been optimized to provide exceptional RF performance over the full UHF spectrum. These Series combine microwave switching capability with Teledyne Relays' superior all-welded construction, proven magnetic-latching design, and high force/mass ratios for ruggedness and performance stability in severe environments. Gold plated precious metal contacts ensure reliable DC switching from low-level to ½ amp, as well as low, stable insertion loss.

SERIES	CONTACT DATA			TYPICAL RF DATA AT 1GHZ			COIL DATA		
	ARRANGEMENT	MAX. RATING (AMPS @ 28 VDC)	INTERCONTACT CAPACITANCE (pF, TYP.)	ISOL. (dB)	INS. LOSS (dB)	VSWR	NOMINAL VOLTAGE (VDC)	NOMINAL RESISTANCE (Ω)	NOMINAL POWER (mW)
RF120 RF170	2 FORM C	0.5	0.02	45	.15	1.10:1	5, 6, 9, 12, 18, 26.5	61, 120, 280, 500, 1130, 2000	290

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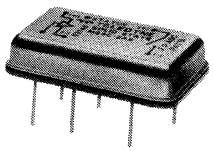
TELEDYNE SOLID STATE

Military Solid State Remote Power Controllers

Note: All military solid state remote power controllers are built in accordance with MIL-R-28750 utilizing the test methods and procedures of MIL-STD-883 and MIL-M-38510.

M85C-2AS/M33C-1NS — Remote Power Controllers (RPC)

Short Circuit Protected — True Output Status Feedback — Optically Isolated



- **Integrated Short-Circuit/Current Overload Protection Protects Unit and System Wiring**
- **True Output Status Feedback**
- **TTL/CMOS Logic Compatible Input**
- **Low ON Resistance Power FET Output**
- **Fast Switching Speed**
- **Meets 28 VDC MIL-STD-704 Surge and Spike Requirements**

OUTPUT STATE	STATUS PIN
OFF	LOW
ON	HIGH

STATUS PIN TRUTH TABLE

TELEDYNE PART NO.	MAXIMUM CONTINUOUS OUTPUT VOLTAGE	MAXIMUM LOAD CURRENT	MAXIMUM ON RESISTANCE
M85C-2AS	60 VDC	2.1 A	0.150
M33C-1NS	60 VDC	5.0 A	0.100

RPC OUTPUT RATINGS

Remote power controllers incorporate a solid state relay with output status feedback, and short circuit and current overload protection.

SHORT CIRCUIT PROTECTION

Teledyne Solid State has developed a revolutionary technique to provide the RPC with integrated short circuit protection. This short-circuit protection is provided whether switching into a dead short or shorting the relay while under load. In either case, the unit will sense the short-circuit conditon and shut down. The RPC will then block the short-circuit condition indefinitely until the short is removed and the unit is reset by cycling the input control or the output voltage.

TRUE OUTPUT STATUS FEEDBACK

In addition to short circuit protection, the RPC features an output status pin which provides feedback on the true power controller output state. Unlike electromechanical relays which employ an isolated set of auxiliary contacts, the output status indicates that the output section is ON and conducting current. This output status feedback feature provides the unit with a unique built-in-test capability. A high level on the status pin indicates the output is ON. A low level indicates the output is in the non-conducting state.

SHORT CIRCUIT TRIP STATUS

Additional models of the M85C and M33C families are available with short circuit trip status instead of true output status. Please contact the factory for additional information on these models.

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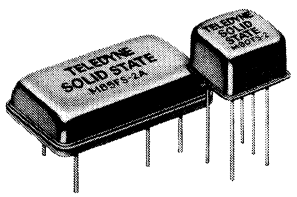
TELEDYNE SOLID STATE

Military Solid State Power Controllers

Note: All military solid state power controllers and relays are built in accordance with MIL-R-28750 utilizing the test methods and procedures of MIL-STD-883 and MIL-M-38510.

M90FS-2/M85FS/M33C DC Power Controllers

Short Circuit Protected — Optically Isolated — Power FET Output



TELEDYNE PART NUMBER	MAXIMUM OUTPUT BLOCKING VOLTAGE	MAXIMUM ON RESISTANCE (100 mA, 85°C)	MAXIMUM LOAD CURRENT (25°C)
M90FS-2	80 VDC	0.300	1.0 A
M85FS-2	80 VDC	0.300	1.35 A
M85FS-2A	80 VDC	0.150	2.1 A
M33C-1N	80 VDC	0.100	5.0 A
M33C-1	80 VDC	0.100	10.0 A

- **3.8 to 32 VDC Input Control Range**
- **Meets 28 VDC MIL-STD-704 Surge and Spike Requirements**

These DC Power Controllers incorporate the short circuit and current overload protection features of our Remote Power Controllers.

The M90FS-2 is housed in a low profile Centrigrid® package which conserves space in high density packaging applications.

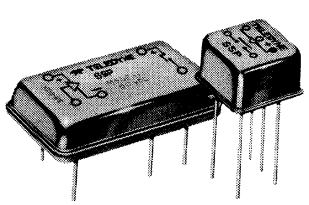
The M85FS series is housed in a metal DIP package which maximizes heat dissipation.

The M33C series is housed in a military style, low profile, 22 pin metal DIP package. Available without mounting flanges (M33C-1N).

MILITARY SOLID STATE RELAYS

M85F/M90F Series — Power FET AC/DC Hybrids — Optically Isolated Radiation Tested — High Speed

- **TTL/CMOS Logic Compatible Input**
- **3.8 to 32 VDC Input Control Range**



- **Meets MIL-STD-704 Surge and Spike Requirements**

Patent Pending

TELEDYNE PART NUMBER	MAXIMUM OUTPUT BLOCKING VOLTAGE	ON RESISTANCE TYP. (OHMS)	MAXIMUM LOAD CURRENT (25°C)
M90F-1	80 VDC	0.60	0.56 ADC
M90F-2	80 VDC	0.30	1.00 ADC
M91F-1	±80 Vpk	1.2	0.40 A (RMS)
M91F-2	±80 Vpk	0.60	0.70 A (RMS)
M85F-1	80 VDC	0.60	0.75 ADC
M85F-2	80 VDC	0.30	1.35 ADC
M86F-1	±80 Vpk	1.2	0.54 A (RMS)
M86F-2	±80 Vpk	0.60	0.95 A (RMS)
M93F-1	100 VDC	4.0	0.35 ADC
M93F-2	400 VDC	25.0	0.135 ADC
M92F-1	±400 Vpk	50.0	0.09 A (RMS)
M92F-2	±200 Vpk	20.0	0.18 A (RMS)
M92F-3	±100 Vpk	8.0	0.24 A (RMS)
M85VF-1	80 VDC	0.60	0.75 ADC
M85VF-2	80 VDC	0.30	1.35 ADC
M85F-2A	80 VDC	0.15	2.10 ADC

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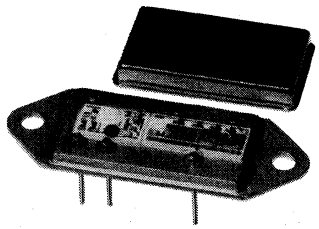
TELEDYNE SOLID STATE
Military Solid State Relays

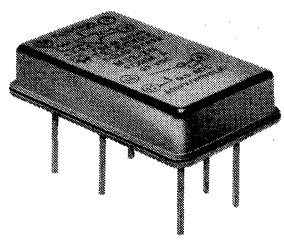
M33-1 — 10 Amps, 80 VDC Solid State Relay



- **Power FET Output**
- **Optically Isolated**
- **TTL/CMOS Logic Compatible Input**
- **Meets MIL-STD-704 Power Requirements**
- **Low Profile 22-pin Military DIP**

The M33 is a military style high power DC solid state relay, packaged in a low profile hermetically sealed case. The input and output are optically isolated to protect TTL compatible input logic circuits from output voltage transients.

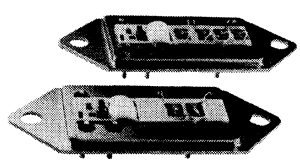
M33-2N High Current Pulse/Squib Fire Capability



- **Up to 100 Amp Pulse Load Capability**
- **Fast Switching Speed**
- **Low ON Resistance (0.07Ω)**
- **Power FET Output**
- **Transformer Isolated**

The M33-2N is a military style DC solid state relay designed specifically for high current pulse load applications such as squib firing. This device is constructed utilizing state-of-the-art microelectronic techniques and features the latest power FET output technology to eliminate bipolar offset and minimize ON resistance. This feature provides minimum output voltage drop and allows the M33-2N to switch high pulse currents up to 100 amps at higher temperatures than those allowable with bipolar devices. The input and output are magnetically isolated to protect delicate input logic circuits from output voltage transients.

M30/M31 Series — Single Pole Double Throw Bi-Directional/DC Power FET Output — Optically Isolated



- **TTL/CMOS Logic Compatible Input**
- **SPDT Break-Before-Make**
- **Low ON Resistance (0.15Ω)**

TELEDYNE PART NUMBER	MAXIMUM CONTINUOUS OUTPUT VOLTAGE	MAXIMUM OUTPUT BLOCKING VOLTAGE	MAXIMUM LOAD CURRENT (25°C)
M30-1	±80 Vpk	±80 Vpk	4.1 A RMS
M30-2	±160 Vpk	±180 Vpk	2.6 A RMS
M30-4	±320 Vpk	±380 Vpk	1.3 A RMS
M31-1	80 VDC	80 VDC	4.8 A DC
M31-2	160 VDC	180 VDC	3.0 A DC
M31-4	320 VDC	380 VDC	1.5 A DC
M31-1A	80 VDC	80 VDC	8.2 A DC
M31-2A	160 VDC	180 VDC	5.2 A DC
M31-4A	320 VDC	380 VDC	2.6 A DC

The M30 & M31 are military style SPDT high power bi-directional solid state relays, packaged in a 22-pin low profile hermetic case. The relays are optically isolated to protect delicate input logic circuits from output voltage transients. The logic input is a CMOS gate which is directly compatible with CMOS logic and TTL logic.

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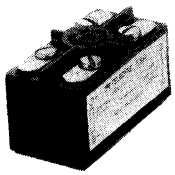
TELEDYNE SOLID STATE
Military Solid State Relays

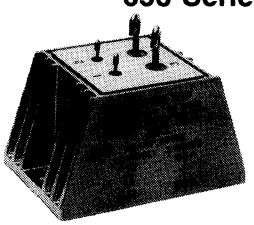
602/M02 10 Amp/250 VAC
Optically Isolated Radiation Tested



- TTL Logic Compatible Input
- Zero Voltage Turn-on

TELEDYNE PART NUMBER	INPUT (CONTROL) VOLTAGE	OUTPUT CURRENT RATING	OUTPUT VOLTAGE RATING 45-440 Hz	
			CONTINUOUS VAC (RMS)	TRANSIENT PEAK
602-1/M02-1	3.8-32 VDC	10 AMP	250	460
602-21	90-250 VAC	10 AMP	250	460

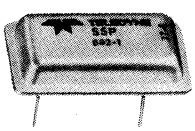
652 Series — 25 Amp/250 VAC — QPL'D to MIL-R-28750
653 Series — DC Power FET Output — Up to 30 Amps



TELEDYNE PART NO.	INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING	OUTPUT CURRENT RATING
653-1	3-16 VDC	50 VDC	25 A
653-4	24-32 VDC	100 VDC	20 A
653-5	16-32 VDC	50 VDC	30 A
652-2 (M28750/10-002)	4-32 VDC	250 VAC	25 A

652 Series — Patent #4,339,670

682/683 AC and DC Solid State DIP Relays
Optically Isolated — Radiation Tested
QPL Qualified to MIL-R-28750

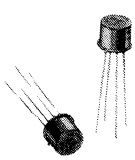


- TTL Logic Compatible Input
- Low Profile Metal DIP Package

PART NUMBER	INPUT VOLTAGE RANGE	OUTPUT RATING	APPLICABLE MIL SPEC
682-1 (M28750/9)	3.8-32 VDC	2A* 250 VAC (40-440 Hz)	MIL-R-28750/9-001
683-1 (M28750/8)	3-15 VDC	600mA/50 VDC	MIL-R-28750/8-001

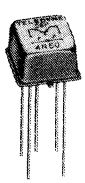
*with heatsink; 1 Amp w/o heatsink

M640 Series — QPL Qualified to MIL-R-28750
Radiation Tested — Fast Switching Speed



TELEDYNE PART NO.	MILITARY PART NO.	OUTPUT RATING (@ MAX. INPUT VOLTAGE)
M640-1W	M28750/5-001	±40V/50 mA Peak (Bi-directional)
M643-1W	M28750/6-001	40 VDC/250 mA
M643-2W	M28750/7-001	250 VDC/100 mA

4N50 ISOcube® Military Opto-Isolator
Hermetically Sealed — Radiation Tested



Packaged in a low profiled hermetically sealed case, .275″ (6.98mm) high by .370″ (9.4mm) square, with pin-out on .100″ grid centers for ease of pc board layout. Employing unique construction techniques developed for Teledyne hybrids. The miniature 4N50 provides the highest input/output isolation available in a military style optical isolator.

PERFORMANCE FEATURES	
Isolation	1500 VRMS
Transfer Ratio	140% min.
Output Voltage	40V min.

Meets DOD Radiation Requirements for Avionics and Ground Systems Applications

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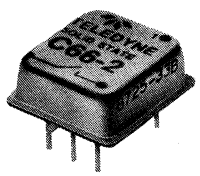
TELEDYNE SOLID STATE

Commercial/Industrial Solid State Relays

C66 Series — Power FET Bi-directional Hybrids
Low Leakage — Ideal For Automatic Test Equipment



TELEDYNE PART NUMBER	MAXIMUM OUTPUT BLOCKING	MAXIMUM LEAKAGE CURRENT	MAXIMUM LOAD CURRENT	TURN-ON TIME (TYPICAL)	TURN-OFF TIME (TYPICAL)
C66-1	±180 Vpk	200 nA	±800 mA	400 μs	300 μs
C66-2	±380 Vpk	50 nA	±300 mA	150 μs	300 μs

- **High Voltage Output**
- **Extremely Low Leakage Current**
- **Fast Switching Speeds**
- **Low Profile 6-pin Metal Mini-DIP**

Subminiature Solid State Relays in Standard DIP Packages

Features all solid state circuitry with hybrid microcircuit construction, and high input/output isolation (up to 2500 Volts/10^9 Ohms). Fourteen models available providing choice of output; bi-directional, AC (zero or non-zero switch) and DC. 640 Series, 643 Series and C46/47 Series are direct pin-for-pin replacements for standard TO-116 DIP reed relays.

TELEDYNE PART NUMBER	INPUT DATA		COUPLING	OUTPUT (LOAD) RATINGS*			
	VOLTAGE (VDC)	MAX. CURRENT (MADC @ 5V)	TRANS-FORMER OPTICAL	AC/DC	CURRENT @ MAX. INPUT VOLTAGE	CURRENT @ 5V INPUT	VOLTAGE
640-1	4-10	22	Trans	Bi-directional	±80 mA	±40 mA	±50 Vpk
641-1	4-10	16	Trans	AC	0.5 A	0.5 A	±200 Vpk
641-2	4-10	16	Trans	AC	0.5 A	0.5 A	±400 Vpk
645-1	3.8-32	12	Opto	AC	1 A	1 A	±200 Vpk
645-2	3.8-32	12	Opto	AC	1 A	1 A	±400 Vpk
645-2H/645V-2H	3.8-32	12/15	Opto	AC	1 A	1 A	±550 Vpk
643-1	3.8-10	15	Trans	DC	400 mA	200 mA	60 VDC
643-2	3.8-10	15	Trans	DC	100 mA	50 mA	250 VDC
643-3	3.8-10	15	Trans	DC	600 mA	250 mA	130 VDC

Serendip Power FET Relays

C46F-1	3.8-16	12	Opto	Bi-directional	225 mA	250 mA	±100 Vpk
C46F-2	3.8-16	12	Opto	Bi-directional	180 mA	200 mA	±200 Vpk
C46F-3	3.8-16	12	Opto	Bi-directional	90 mA	100 mA	±400 Vpk
C47F-1	3.8-16	12	Opto	DC	315 mA	350 mA	100 VDC
C47F-2	3.8-16	12	Opto	DC	125 mA	140 mA	400 VDC

NOTES:

1. **641 and 645 Series, UL recognized — File #E55197: CSA Certified #31043.**
2. **645V-2H is VDE approved to VDE 0883/6.80.**
3. **645 Series meets VDE and FCC Class A conducted emission limits.**
4. **645 Series, Patent #4,339,670.**
5. **C46/C47 Series, Patent #3,791,025.**
6. **Output current ratings w/o heatsink.**

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TELEDYNE SOLID STATE

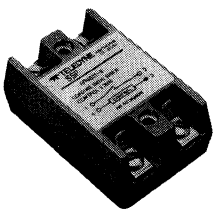
Commercial/Industrial Solid State AC Power Relays

601 Series — Optically Isolated, Zero Voltage Turn-On 5 and 10 Amps

UL Recognized — File #E59547

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT (LOAD) CURRENT RATING & PART NUMBERS	
	CONTINUOUS VAC (RMS)	TRANSIENT VAC (PEAK)	5 AMP	10 AMP
3-32 VDC	250	500	601-1	601-2
	250	600	601-1H	601-2H

611 Series — Optically Isolated, Zero Voltage Turn-On 10 to 40 Amps



UL Recognized — File #E55197
CSA Certified — File #LR31034, 31043

INPUT (CONTROL) VOLTAGE	OUTPUT VOLTAGE RATING		OUTPUT CURRENT RATING & PART NUMBERS			
	CONTINUOUS (RMS)	TRANSIENT (PEAK)	10 AMP	15 AMP	25 AMP	40 AMP
3-28 VDC	140	200	611-7*	611-3	611-1	611-5
	250	400	611-8*	611-4	611-2	611-6
	250	600	611-8H*	611-4H	611-2H	611-6H
90-250 VAC (47-70 Hz)	140	200	611-17	611-13	611-11	611-15
	250	400	611-18	611-14	611-12	611-16
	250	600	611-18H	611-14H	611-12H	611-16H

*Available in N/C (Form B) configuration, with "B" suffix (e.g., 611B-7).

C15, 615, 615 V Series — Optically Isolated, Zero Voltage Turn-On 10, 25, and 40 Amps

- TTL Logic Compatible Input
- High Dielectric Isolation
- VDE Versions Available

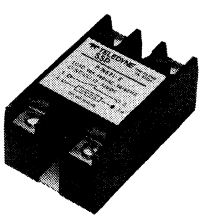
615 Series
CSA Certified
File #LR31043-11
#LR31043-8
UL Recognized
File #E55197

615V Series
VDE Approved
TO 0806/8.81

Control	OUTPUT (LOAD) CURRENT RATING & PART NUMBER			OUTPUT VOLTAGE RATING (VAC)	
	10 AMP	25 AMP	40 AMP	CONTINUOUS (RMS)	TRANSIENT (PEAK)
3-32 VDC (615) 3.8-32 VDC (615 V)	615-1	615-3	615-5	140	200
	615-2	615-4	615-6	250	400
	615-2H*	615-4H*	615-6H*	250	600
3.8-32 VDC	C15DS-V-AR44-25 (25 AMPS)			440	800
	C15DS-V-AR44-40 (40 AMPS)			440	800

*615V models meet VDE creepage and dielectric strength requirements.

621 Series — High Voltage, Optically Isolated, Zero Voltage Turn-On



- CSA Certified File #LR31043-10
- UL Recognized File #E55197
- 3750 VRMS Isolation
- High Voltage Output 480 VRMS, 800 V Peak

Designed to meet safety requirements of UL, CSA, VDE and IEC and dielectric requirements of VDE.

INPUT VOLTAGE RANGE	OUTPUT (LOAD) CURRENT RATING & PART NUMBERS		
	15 AMP	25 AMP	40 AMP
3-14 VDC	621-1*	621-3*	621-5*
12-32 VDC	621-2*	621-4*	621-6*
90-250 VAC (45-70 Hz)	621-11	621-13	621-15

*Available in N/C (Form B) configuration — Order e.g. 621B-1).

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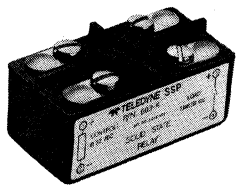
TELEDYNE SOLID STATE

Commercial/Industrial Solid State DC Power Relays

603 Series — Optically/Transformer Isolated



OUTPUT CURRENT RATING AND PART NUMBERS		INPUT VOLTAGE RANGE	OUTPUT (LOAD) VOLTAGE RATING	COUPLING TRANSFORMER/ OPTICAL
2 AMP	5 AMP			
603-1	603-2	3-32 VDC	50	Opto
603-21*	603-22*	3-32 VDC	50	Opto
—	603-3	4-10 VDC	250	Trans
—	603-4	10-32 VDC	250	Trans
603-11	603-12	90-250 VAC	50	Opto

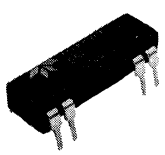
***Note: 603-21, -22 have controlled rise and fall time.**

613 Series — High Current, Transformer Isolated

PART NUMBERS	INPUT VOLTAGE RANGE	OUTPUT VOLTAGE	OUTPUT CURRENT RATING
613-1	4-10 VDC	50 VDC	20 Amps
613-2	10-32 VDC		

Solid State Computer Input/Output Interface Modules

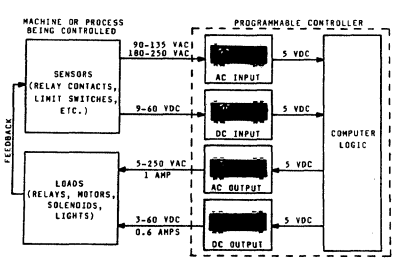
C76 Hybrid DIP I/O™ System
Optically Isolated — TTL/CMOS Logic Compatible Input



- **Enable Function on Inputs**
- **High Noise Immunity**
- **Meets VDE Voltage and Spacing Requirements**
- **TO-116 DIP Package (16 pin)**

PART NUMBER	TYPE	CHARACTERISTICS
C76AO-1	AC Output	3.8-16 VDC Input 5-250 VRMS, 1A Output
C76AI-1	AC Input	90-135 VRMS and 180-250 VRMS Inputs
C76DO-1	DC Output	3.8-16 VDC Input 3-60 VDC, 0.6A Output
C76DI-1	DC Input	9-60 VDC Input

C76 HYBRID I/O INTERFACE SYSTEM



Teledyne Solid State C76 DIP I/O™ Modules are designed for use in computerized control systems for noise-free isolated interfacing of computer logic elements to harsh industrial environments. Modules employ custom microcircuits in a TO-116 DIP. Eliminates mounting tracks for low "per-point" cost. Meets VDE requirements. Features CMOS and TTL compatibility, optical isolation, high noise immunity and an ENABLE function on input modules. For use in robotics, computerized process control, machine tool control, programmable controllers and ATE.

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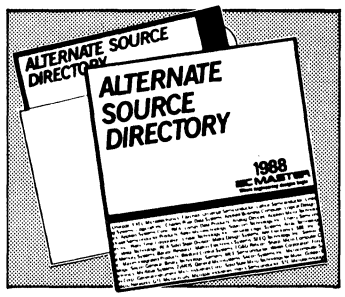

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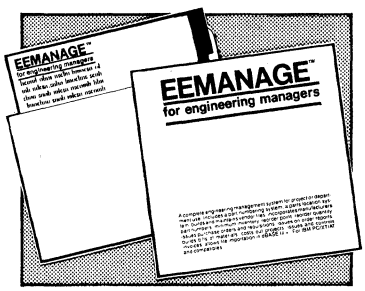

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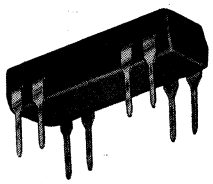
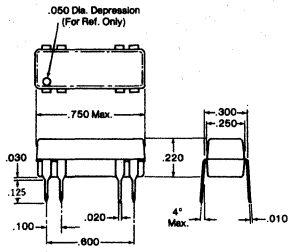
WABASH RELAY & ELECTRONICS DIVISION The Reed Relay Specialist

DIP PACKAGE DRY REED RELAYS
814 SERIES





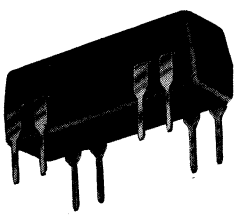
The 814 Series offers dry reed reliability and total isolation in a low profile IC type package, with DTL/TTL compatible coil drive available in most configurations.

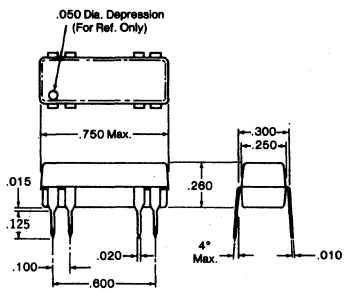
SPECIFICATIONS—Contact Ratings: 200 VDC or .500 Amps (switching); 10 watts; 200 milliohms max. initial contact resistance; 250 Volt pk. bkdn. **Temperature:** −40°C to +85°C. **Shock:** 100G max., 8 ±1 mSec. 1/2 wave. **Vibration:** 20G @ 10-5000 Hz. **Insulation Resistance:** 10^{10} Ohms min. **Capacitance:** 0.2 pf. **Operate Time (Typical):** to 0.5 mSec. **Release Time (Typical):** 0.5 mSec. **Life Expectancy:** 50 x 10^6 operations at signal level; 20 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	16	365	814-101-014
	5	19	500	814-102-014
	6	19	500	814-103-014
	12/15	24	800	814-104-014
	24	30	1250	814-105-014

▲ Measured at 25°C.

815 SERIES

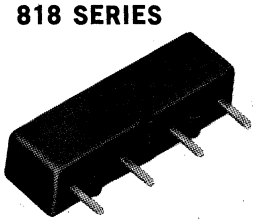


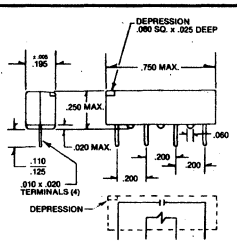


The 815 Series, with a profile slightly higher than the 814, offers increased versatility while maintaining the DIP package approach to hi-density printed circuit applications. Standard part numbers listed are subject to specifications shown for the 814 Series, however, the 815 has the capacity to offer dry reed switches to ½ Amp rating plus up to a 200 VDC max. switching voltage. Optional features include diode suppression, magnetic shielding and electrostatic shielding.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	14	200	815-101-014
	5/6	19	500	815-102-014
	12/15	19	500	815-103-014
	24	40	2150	815-104-014
2A	5/6	14	200	815-201-014
	12/15	19	500	815-202-014
	24	38	2000	815-203-014
1B	5/6	7	200	815-221-014
	12/15	16	500	815-222-014
	24	32	2000	815-223-014
1C	5/6	8	80	815-241-014
	12/15	19	500	815-242-014
	24	38	2000	815-243-014

818 SERIES

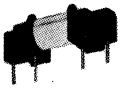


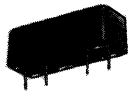


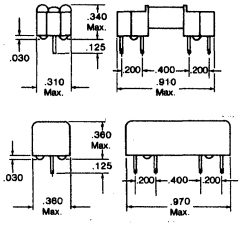
SPECIFICATIONS—Contact Ratings (Maximum Form A)—**Voltage:** 200 VDC. **Current (Switch):** 0.5 Amps. **Current (Carry):** 1 Amp. **Power (DC):** 10 Watts. **Power (AC Suppressed):** 15 Volt-Amperes. **Resistance (Initial):** 200 Milliohms. **Peak Breakdown Voltage:** 250 VDC. **Operate Time:** 0.5 mSec. **Max. Release Time:** 0.5 mSec Max. **Operating Parameters — Temperature** −40°C to +85°C. **Shock:** 100G Max. 8 ±1 mSec. 1/2 Wave. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.2 picofarad. **Nominal Coil Voltage:** 5/6, 12/15. **Must Operate Voltage:** 3.8, 9.6. **Must Release Voltage:** 0.5, 1.0. **Physical Characteristics—Contact Configuration:** 1A **Environmental Protection:** Enclosed for extended life and cleaning.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A SPST NO	5/6	19	500	818-101
	12/15	24	800	818-102

802/803 SERIES



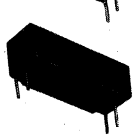


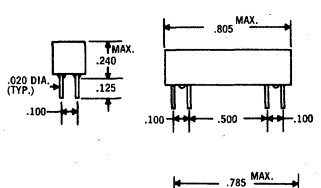


The 802 and 803 are sub-miniature reed relays in a Single-Inline package. They are both available in a 1 Form A configuration and are P.C. mountable. Contact ratings of 200 volts DC with total power handling of 10 watts is standard.

Contact Form	Nominal Voltage	Coil Resistance ±10%▲	Part Number
1A	5/6	500	802-101
	12/15	500	802-102
	24	2000	802-103
	5/6	125	802-104
Enclosed 1A	5/6	500	803-101
	12/15	500	803-102
	24	2000	803-103
	5/6	125	803-104

SUB-MINIATURE RR
804/806 SERIES



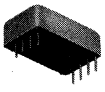


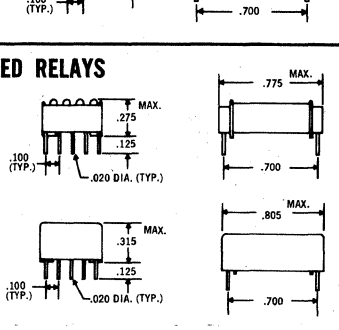
The 804 and 806 sub-miniature reed relays come in a 1 Form A configuration. Both relays are P.C. mountable and are completely enclosed for environmental protection, extended life and easy cleaning. Call Wabash Relay & Electronics for complete details.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 0.5 Amp (switching), 1.0 Amp (carry), 10 Watts DC, 15 V-A (AC suppressed), 250 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^{10} ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 operations at dry ckt.; 50 x 10^6 operations at signal levels; 20 x 10^6 operations at rated load.

Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	8	60	804-101
	12/15	18	370	804-102
	24	27	950	804-103
1A	5/6	12	500	806-101
	12/15	24	1200	806-102
	24	38	2000	806-103

SUB-MINIATURE DRY REED RELAYS
807/808 SERIES





Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1B†	5/6	8	200	807/808-211
	12/15	16	800	807/808-212
	24	32	2000	807/808-213
1C† *	5/6	8	125	807/808-316
	12/15	16	500	807/808-317
	24	32	2000	807/808-318
1A	5/6	13	350	807/808-101
	12/15	24	1200	807/808-102
	24	39	3200	807/808-103
2A	5/6	10	200	807/808-201
	12/15	20	800	807/808-202
	24	32	2000	807/808-203

* (1A1B guarantee break-before-make)

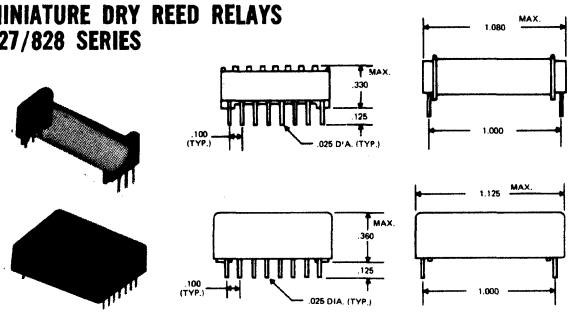
Contact Forms Available: 1, 2, 3 Pole. Forms A, B, & C.

Kearney wabash

Dept. EM, First and Webster Streets / Wabash, Indiana 46992 / (219) 563-2191 / TWX 810-290-2722 / FAX 219-563-1652

WABASH RELAY & ELECTRONICS DIVISION The Reed Relay Specialist

MINIATURE DRY REED RELAYS 827/828 SERIES



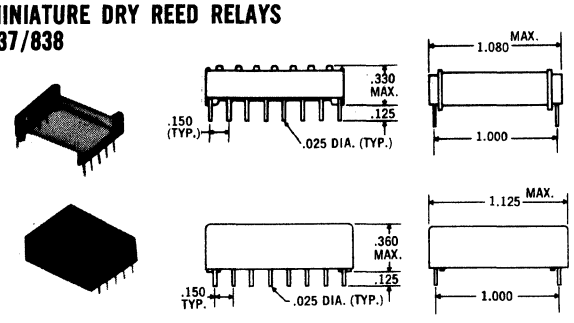
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	827/828-101	1B†	5/6	8	200	827/828-211
	12/15	28	800	827/828-102		12/15	16	800	827/828-212
	24	44	2000	827/828-103		24	32	2000	827/828-213
2A	5/6	14	200	827/828-201	1C†	5/6	8	60	827/828-316
	12/15	29	800	827/828-202		12/15	16	240	827/828-317
	24	46	2000	827/828-203	*	24	32	960	827/828-318

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Poles. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (Carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

MINIATURE DRY REED RELAYS 837/838



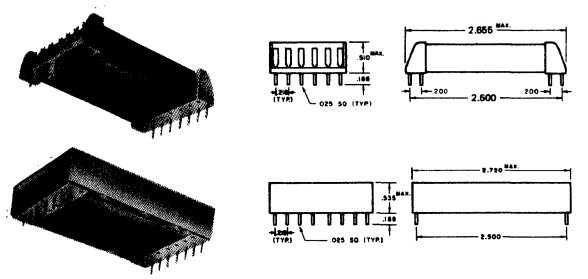
Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	500	837/838-101	1B†	5/6	8	200	837/838-211
	12/15	28	800	837/838-102		12/15	16	800	837/838-212
	24	44	2000	837/838-103		24	32	2000	837/838-213
2A	5/6	14	200	837/838-201	1C†	5/6	8	60	837/838-342
	12/15	29	800	837/838-202		12/15	16	240	837/838-343
	24	46	2000	837/838-203	*	24	32	960	837/838-344

* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, & 6 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: (max.) 200 VDC, 150 VAC, 0.5 Amp (switching), 3 Amp (carry), 10 Watts DC, 25 V-A (AC suppressed), 300 Volts peak breakdown, 200 milliohms max. initial contact resistance. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0 to 1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 0.5 pf. **Life Expectancy:** 100 x 10^6 ops @ dry ckt.; 50 x 10^6 ops @ signal levels; 20 x 10^6 ops @ rated load.

STANDARD REED RELAYS 842/843 SERIES



Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	842/843-101	1B†	5/6	9	100	842/843-209
	12/15	45	600	842/843-102		12/15	18	400	842/843-211
	24	90	2400	842/843-103		24	36	1600	842/843-213
	48	175	9000	842/843-104		48	72	6400	842/843-215
2A	5/6	20	100	842/843-201	1C†	6	9	100	842/843-311
	12/15	41	400	842/843-202		12	18	400	842/843-315
	24	82	1600	842/843-203	*	24	36	1600	842/843-319
	48	165	6400	842/843-204		48	72	6400	842/843-323

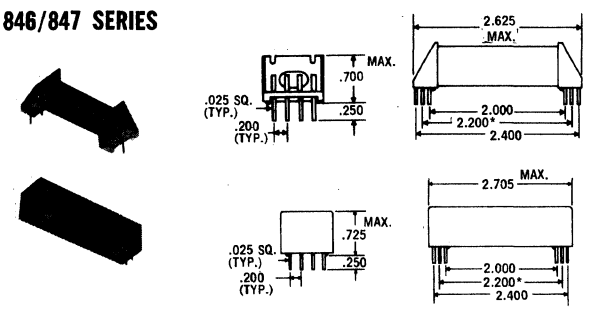
* (1A1B guarantee break-before-make)

Contact Forms Available: 1, 2, 3, 4, 5, 6, 8, & 12 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 50 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max.@ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.

Available to 12 form A. True form C also available.

846/847 SERIES



Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number	Contact Form	Nom. Voltage	Max. Voltage	Coil Resist. ±10%▲	Part Number
1A	5/6	22	150	846/847-101	1B†	5/6	9	100	846/847-209
	12/15	45	600	846/847-102		12/15	18	400	846/847-211
	24	90	2400	846/847-103		24	36	1600	846/847-213
2A	5/6	20	100	846/847-201					
	12/15	41	400	846/847-202					
	24	82	1600	846/847-203					

Contact Forms Available: 1 & 2 Pole. Forms A, B, & C including magnetic latchers.

SPECIFICATIONS — Contact Ratings: 400 VDC, 250 VAC, 1.5 Amp (switching) 6 Amp (carry), 25 Watts, 40 V-A (AC suppressed) 75 milliohm max. initial contact resistance 500 volts peak breakdown. **Temperature:** −55°C to +105°C. **Shock:** 30 G max., 11 ±1 mSec. **Vibration:** 10 G max. @ 0-1700 Hz. **Insulation Resistance:** 10^9 Ohms min. **Capacitance:** 1.5 pf. **Life Expectancy:** Dry ckt., 100 x 10^6 ops; signal level, 50 x 10^6 ops; rated power, 20 x 10^6 ops.

True form C also available.

* Spacing not available in 1 pole package.

The relays shown here are just a sampling of the many designs and configurations manufactured by Wabash Relay & Electronics as standard products. We also offer design assistance and custom designed relays through our fully staffed engineering department. Should you require a custom designed relay, here are some parameters to consider:

U.L. and C.S.A. Recognition

Several relay series are recognized under the Component Program of Underwriters' Laboratories. Most of these relays also have C.S.A. recognition. Regardless of which series you are interested in, Wabash Relay can help you obtain the U.L. or C.S.A. recognition your design requires.

Wabash Relay & Electronics Division
1st & Webster Streets, Wabash, Indiana 46992
(219) 563-2191 TWX: 810-290-2722 FAX: 219-563-1652

Prints and specifications, if available, are the best design tool. The minimum information required for Wabash Relay to design a relay is:

Mechanical Specifications

- Maximum length
- Maximum width
- Maximum height above P.C. board
- Pin configuration
- Open or covered
- Type of environment relay will be exposed to
- End Use

Electrical Specifications

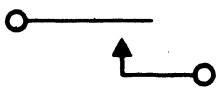
- Switch configuration
- Nominal voltage
- Must operate voltage or current
- Must release voltage or current
- Coil resistance
- Switching current
- Contact resistance
- Carry current
- U.L. recognition required
- Special considerations (ESS, low thermal, high insulation resistance, etc.)

SOLENOIDS

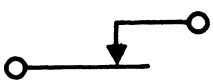
Manufacturer	EEM Page No.	Model/Series	Linear			Rotary	Proportional Servo	Stepping	
			Frame Type C	Frame Type D	Tubular			Unidirectional	Bidirectional
Deltrol Controls	B•1614	C1-7	¤				¤		
	B•1620	C-8,9	¤				¤		
		D-11-28		¤			¤		
	B•1616	D-2-4HD		¤			¤		
	B•1617	MED8-16			¤		¤		
Dormeyer Industries	B•1620	C-Frame	¤						
		D-Frame		¤					
	B•1621	Tubular			¤				
Electro-Mechanisms	B•1622	SP	¤						
		PO	¤						
	B•1623	SP-100	¤						
		PO-100	¤						
		TPO30-55			¤				
Electronic Specialty	B•1624-B•1625				¤				
Liberty Controls	B•1626	L-9	¤				¤		
		L-11		¤			¤		
		L-22		¤			¤		
		L-24	¤				¤		
		L-26	¤				¤		
		L-28		¤			¤		
		L-61	¤				¤		
		L-62	¤				¤		
		L-63	¤				¤		
		L-81		¤			¤		
		L-82		¤			¤		
		L-88		¤			¤		
		L-89		¤			¤		
		L-90		¤			¤		
Linear Motions	B•1627	All	¤		¤				
Lucas Ledex	B•1629-B•1632	Rotary	¤		¤	¤	¤	¤	¤
		20			¤	¤	¤		
		Stepping		¤				¤	¤
		D-Frame		¤			¤		
Regdon	B•1634	KEB				¤			
		GHUZ050			¤				
		GRFY+AW					¤		
	B•1635	C-Frame	¤						
		D-Frame		¤					
		Tubular			¤				

MINIGLOSSARY
RELAY CONTACT FORMS

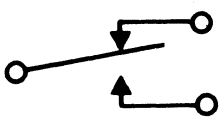
A
Make
SPST-NO



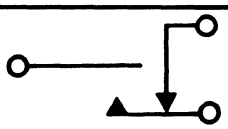
B
Break
SPST-NC



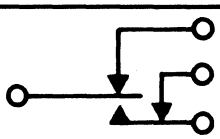
C
Break, Make
(Transfer)
SPDT



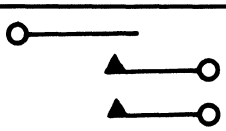
D
Make, Break
(Continuity
Transfer)



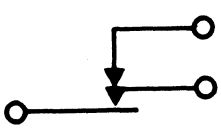
E
Break,
Make,
Break



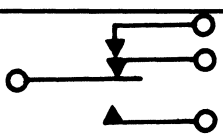
F
Make,
Make



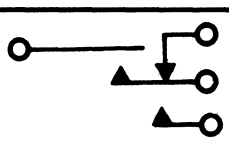
G
Break,
Make



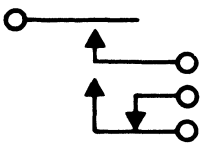
H
Break,
Break,
Make



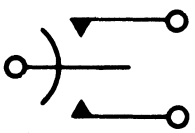
I
Make,
Break,
Make



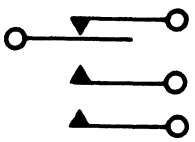
J
Make,
Make,
Break



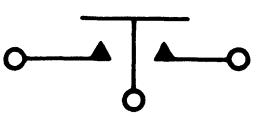
K
Center off
SPDT



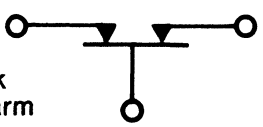
L
Break,
Make,
Make



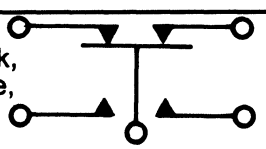
U
Double
make
Contact
on arm



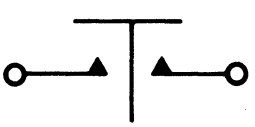
V
Double break
Contact on arm



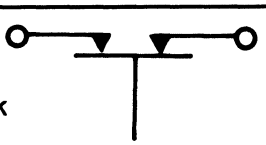
W
Double break,
Double make,
Contact
on arm



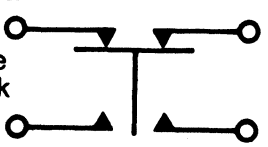
X
Double
make



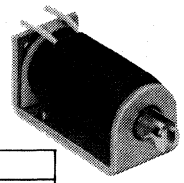
Y
Double break



Z
Double make
Double break
SPDT-DB



DELTROL SOLENOIDS MADE IN U.S.A. SEE SECTION 4500 FOR RELAYS



L = 13/16
H = 7/16
W = 23/64
WIRE LEADS

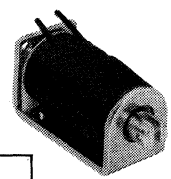
C-1 PULL TYPE

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53704-82	12VDC	Cont.	50	3W
53704-83	24VDC	Cont.	200	3W
53704-88	12VDC	Int.	12.2	12W
53704-89	24VDC	Int.	50	12W

NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 35 sq. in. heat sink is required.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	1-1/4	3/4	1/2	7/16	1/4
DC Int.	4	2-3/4	2	1-3/4	1



L = 63/64
H = 17/32
W = 31/64
WIRE LEADS

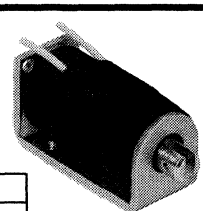
C-2 PULL TYPE

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53702-82	12VDC	Cont.	32	4.5W
53702-83	24VDC	Cont.	128	4.5W
53702-88	12VDC	Int.	8	18W
53702-89	24VDC	Int.	32	18W

NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 50 sq. in. heat sink is required.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	3-3/4	1-3/4	1-1/4	1	1/4
DC Int.	12	6-1/2	5	4	1-1/4



L = 7/32
H = 11/16
W = 19/32
WIRE LEADS

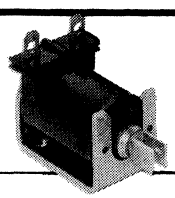
C-3 PULL TYPE

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53725-82	12VDC	Cont.	25	6W
53725-83	24VDC	Cont.	100	6W
53725-88	12VDC	Int.	6.2	24W
53725-89	24VDC	Int.	25	24W

NOTE: Standard intermittent duty at nominal voltage is 25%, maximum on time is 30 seconds. Approx. 65 sq. in. heat sink is required.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	8	3-1/4	2-1/4	1-3/4	1
DC Int.	30	13	9	8	4



C-6 PULL TYPE

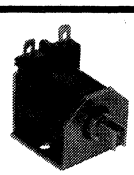
L = 1-1/8
W = 55/64
H = 1-17/64
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is one (1) minute on and three (3) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53685-83	24VDC	Cont.	124	4.7W
53686-83	24VDC	Int.	50.8	12W
53687-94	120VAC	Cont.	776	6.8VA
53688-94	120VAC	Int.	327	19.6VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	7	3	2	1-1/2
DC Int.	15	8	5	3-1/2
AC Cont.	10	7	5	4
AC Int.	21	13	11	8



C-7 PULL TYPE

L = 1-9/64
W = 1-1/16
H = 1-13/32
.187 QUICK CONNECT/ SOLDER TERMINALS

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53634-83	24VDC	Cont.	118	5W
53635-83	24VDC	Int.	.5	11.5W
53637-94	120VAC	Cont.	509	7.8VA
53638-94	120VAC	Int.	220	21VA

STROKE (INCHES) FORCE (OUNCES

	1/16	1/8	3/16	1/4
DC Cont.	19	8	5	3
DC Int.	28	12	8	5
AC Cont.	17	12	10	8
AC Int.	30	22	19	17

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

ALL DIMENSIONS ARE NOMINAL

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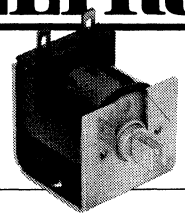


C-8 PULL TYPE

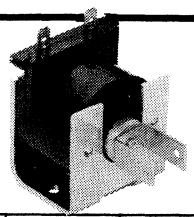
L = 1-3/16
W = 1-9/32
H = 1-11/16
.187 QUICK CONNECT/ SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

			Coil	
Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53713-82	24VDC	Cont.	93.3	6.5W
53713-88	24VDC	Int.	37.5	16W
53712-84	120VAC	Cont.	346	9.5VA
53712-90	120VAC	Int.	151	25VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	20	11	7	5
DC Int.	42	27	19	14
AC Cont.	16	11	10	9
AC Int.	32	24	21	20



C-9 PULL TYPE

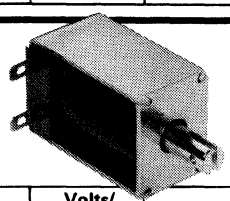
L = 1-1/16
W = 1-3/8
H = 1-13/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off. AC intermittent duty cycle is one (1) minute on and four (4) minutes off. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53676-83	24VDC	Cont.	66.5	8.6W
53677-83	24VDC	Int.	37.6	15.5W
53673-94	120VAC	Cont.	240	13.7VA
53674-94	120VAC	Int.	84.1	52VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	26	17	12	9	3
DC Int.	42	28	22	16	5
AC Cont.	21	16	15	14	10
AC Int.	54	43	39	37	27



D-11 PULL TYPE

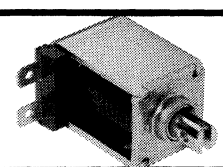
L = 1-27/32
W = 15/16
H = 1-3/16
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53736-81	12VDC	Cont.	18	8W
53736-82	24VDC	Cont.	72	8W
53736-87	12VDC	Int.	8	18W
53736-88	24VDC	Int.	32	18W
53738-84	120VAC	Cont.	200	12VA
53738-90	120VAC	Int.	85	42VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	38	28	16	11	4	3
DC Int.	55	40	24	22	10	6
AC Cont.	14	12	9	8	7	6
AC Int.	45	25	20	18	15	14



D-22 PULL TYPE

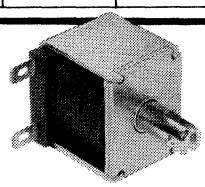
L = 1-1/4
W = 3/4
H = 3/4
.187 QUICK CONNECT/SOLDER TERMINALS

NOTE: Standard intermittent duty cycle at nominal voltage is 25% with three (3) minutes max. on and nine (9) minutes min. off in a repetitive cycle. Approx. 10 sq. in. heat sink required.

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53723-81	12VDC	Cont.	35	4.2W
53723-82	24VDC	Cont.	141	4.2W
53723-87	12VDC	Int.	14.8	9.6W
53723-88	24VDC	Int.	60	9.6W
53724-84	120VAC	Cont.	1,090	6.5VA
53724-90	120VAC	Int.	724	8.5VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	9	4	2-1/2	1-3/4	1
DC Int.	20	10	6	4	2
AC Cont.	6	3-1/2	2-3/4	2-1/2	1-3/4
AC Int.	8-1/2	5-1/2	4	3-1/2	2-1/2



D-28 PULL TYPE

L = 1-1/4
W = 1
H = 1-7/32
.187 QUICK CONNECT/ SOLDER TERMINALS

Stock No.	Volts/ Type	Duty	Resist. (Ohms)	Power
53708-81	12VDC	Cont.	27.1	5.5W
53708-82	24VDC	Cont.	108	5.5W
53708-87	12VDC	Int.	12.7	11.5W
53708-88	24VDC	Int.	51	11.5W
53706-84	120VAC	Cont.	420	8VA
53706-90	120VAC	Int.	220	21VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2
DC Cont.	20	10	6	4	2
DC Int.	35	19	12	8	3
AC Cont.	16	12	10	8	4
AC Int.	29	20	17	14	6

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

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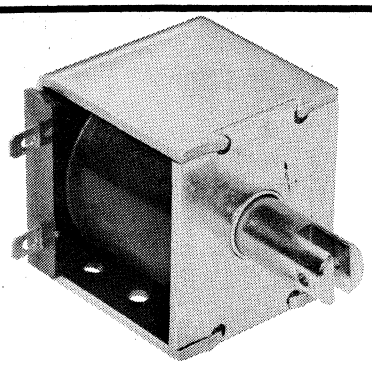
D-2 PULL TYPE



L = 1-9/16
W = 1-7/16
H = 1-5/8

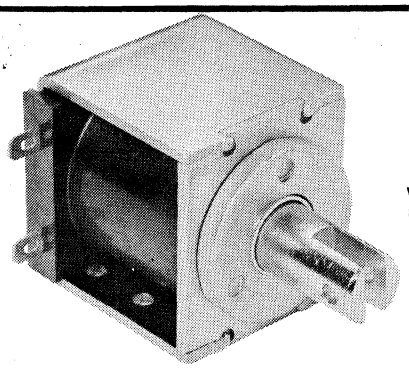
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53728-81	12VDC	Cont.	13.6	10.5W
53728-82	24VDC	Cont.	54.7	10.5W
53728-87	12VDC	Int.	4.92	29W
53728-88	24VDC	Int.	20.0	29W
53729-84	120VAC	Cont.	139	13VA
53729-90	120VAC	Int.	47.0	44VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	84	50	34	23	8	4
DC Int.	122	97	74	56	21	9
AC Cont.	27	20	17	16	14	5
AC Int.	69	56	50	45	36	15

D-3HD PULL TYPE



L = 1-3/4
W = 1-7/16
H = 1-5/8

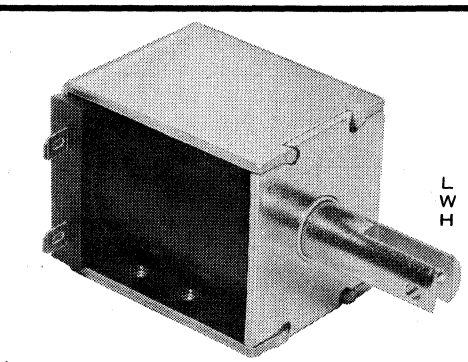
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53732-81	12VDC	Cont.	12.8	11.2W
53732-82	24VDC	Cont.	51.5	11.2W
53732-87	12VDC	Int.	5.3	27W
53732-88	24VDC	Int.	21.4	27W
53733-84	120VAC	Cont.	109	20VA
53733-90	120VAC	Int.	27	115VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	110	72	45	31	10	4
DC Int.	150	124	96	72	25	10
AC Cont.	35	26	23	22	21	13
AC Int.	112	88	80	78	68	40

D-4 PULL TYPE



L = 2
W = 1-7/16
H = 1-5/8

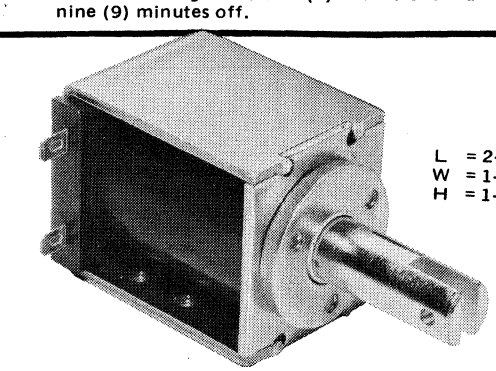
NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53717-81	12VDC	Cont.	12.3	11.5W
53717-82	24VDC	Cont.	50.4	11.5W
53717-87	12VDC	Int.	3.0	47.6W
53717-88	24VDC	Int.	12.3	47.6W
53718-84	120VAC	Cont.	133	11.5VA
53718-90	120VAC	Int.	37	60VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	94	66	46	34	14	7
DC Int.	142	122	106	92	52	30
AC Cont.	12	10	9	9	10	13
AC Int.	44	38	34	32	38	46

D-4HD PULL TYPE



L = 2-3/16
W = 1-7/16
H = 1-5/8

NOTE: Standard intermittent duty cycle at nominal voltage is three (3) minutes on and nine (9) minutes off.

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53719-81	12VDC	Cont.	12.1	11.7W
53719-82	24VDC	Cont.	49.2	11.7W
53719-87	12VDC	Int.	3.8	38W
53719-88	24VDC	Int.	15.2	38W
53720-84	120VAC	Cont.	72.4	32VA
53720-90	120VAC	Int.	19.1	170VA

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	1/2	3/4
DC Cont.	116	85	60	42	16	8
DC Int.	160	136	114	98	46	26
AC Cont.	24	20	19	18	21	24
AC Int.	84	72	64	60	66	76

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MED-8 x 1

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53762-81	12VDC	Cont.-Pull	36	4W
53762-87	12VDC	Int.-Pull	12	12W
53762-82	24VDC	Cont.-Pull	139	4W
53762-88	24VDC	Int.-Pull	48	12W
53766-82	24VDC	Cont.-Push	139	4W
53766-88	24VDC	Int.-Push	48	12W

PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1

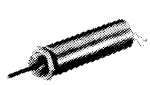
NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4
DC Cont.	4	2	1-1/4	1
DC Int.	7	4	3	2-1/2

MED-8 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53764-81	12VDC	Cont.-Pull	29	5W
53764-87	12VDC	Int.-Pull	9.6	15W
53764-82	24VDC	Cont.-Pull	115	5W
53764-88	24VDC	Int.-Pull	38.4	15W
53768-82	24VDC	Cont.-Push	115	5W
53768-88	24VDC	Int.-Push	38.4	15W



PUSH TYPE PULL TYPE

Dia. = 1/2
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/8 — 32 x 1/4" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	5/16
DC Cont.	4-1/2	2-1/2	2	1-3/4	1-1/2
DC Int.	9	6	4-1/2	4	3-1/2

MED-12 x 1-1/2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53751-81	12VDC	Cont.-Pull	25	6W
53751-87	12VDC	Int.-Pull	10	15W
53751-82	24VDC	Cont.-Pull	100	6W
53751-88	24VDC	Int.-Pull	40	15W
53761-81	12VDC	Cont.-Push	25	6W
53761-87	12VDC	Int.-Push	10	15W
53761-82	24VDC	Cont.-Push	100	6W
53761-88	24VDC	Int.-Push	40	15W

PUSH TYPE PULL TYPE

Dia. = 3/4
L = 1-1/2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 9/16 — 18 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2
DC Cont.	18	10	6-1/2	5	3	2
DC Int.	32	22	15	12	7-1/2	5-1/2

MED-16 x 1-1/8

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53754-81	12VDC	Cont.-Pull	19	8W
53754-87	12VDC	Int.-Pull	7.5	19W
53754-82	24VDC	Cont.-Pull	75	8W
53754-88	24VDC	Int.-Pull	30	19W
53759-82	24VDC	Cont.-Push	75	8W
53759-88	24VDC	Int.-Push	30	19W

PUSH TYPE PULL TYPE

Dia. = 1
L = 1-1/8

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8
DC Cont.	38	17	10	7	4
DC Int.	77	46	25	16	6

MED-16 x 2

Stock No.	Volts/ Type	Duty	Coil Resist. (Ohms)	Coil Power
53753-81	12VDC	Cont.-Pull	15	10W
53753-87	12VDC	Int.-Pull	6	24W
53753-82	24VDC	Cont.-Pull	60	10W
53753-88	24VDC	Int.-Pull	24	24W
53757-81	12VDC	Cont.-Push	15	10W
53757-87	12VDC	Int.-Push	6	24W
53757-82	24VDC	Cont.-Push	60	10W
53757-88	24VDC	Int.-Push	24	24W

PUSH TYPE PULL TYPE

Dia. = 1
L = 2

NOTE: Standard intermittent duty cycle is one (1) minute on and three (3) minutes off.
Mtg. Thread Size: 3/4 — 16 x 3/8" L.

STROKE (INCHES) FORCE (OUNCES)

	1/16	1/8	3/16	1/4	3/8	1/2	5/8
DC Cont.	57	35	24	17	11	8	6
DC Int.	80	58	46	37	27	20	15

ALL DIMENSIONS ARE NOMINAL.

DELTROL controls / DC DIVISION OF DELTROL CORP
2745 S. 19th St., Milwaukee, WI 53215, Phone (414) 671-6800, Telex 2-6871, Fax (414) 671-6809

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

Dormeyer Industries

Company Facts

Dormeyer manufactures a full line of solenoids, coils and transformers. We also specialize in custom solenoid and transformer designs required by special applications. Over 36 years of experience and know-how results in production of the finest products at the lowest possible cost.

We are among the world's leading manufacturers of solenoids. We service a wide range of industries, including most major appliance, vending, lighting, heating/air conditioning and circuit protection manufacturers.

- Over 36 years of transformer and solenoid design and production.
- Facilities geared to consistently satisfy production requirements for *any quantities.*
- Delivery according to *your* schedule.
- Designs to meet all *U/L* and *CSA* requirements.
- Quality — a **"certified supplier."**
- Very competitive prices.

Our specialized teams of transformer and solenoid design engineers are always ready to work with you on application problems. Call or write for a quick solution.

SUPER "T" LAMINATED SOLENOIDS
24VAC to 240VAC
Stroke length up to 1¼"
Push or pull up to ½" stroke

AC/AC PLUG-IN TRANSFORMERS
3VAC to 24VAC 4VA to 30VA

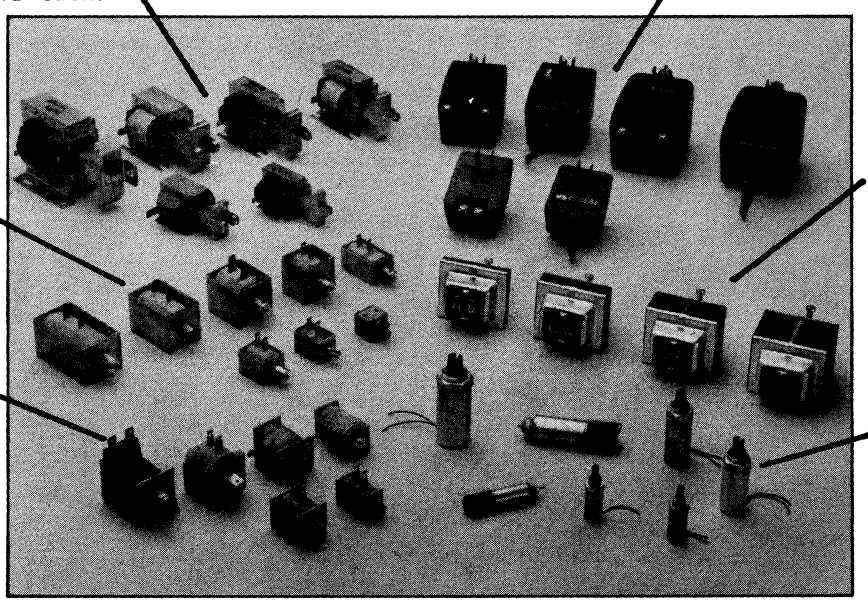
BOX FRAME SOLENOIDS
12VAC to 240VAC or 6VDC to 115VDC
Stroke length up to 1¾"

CONTROL TRANSFORMERS
Any VA rating between 5VA and 55VA

CUSTOM POWER TRANSFORMERS
5VA to 500VA

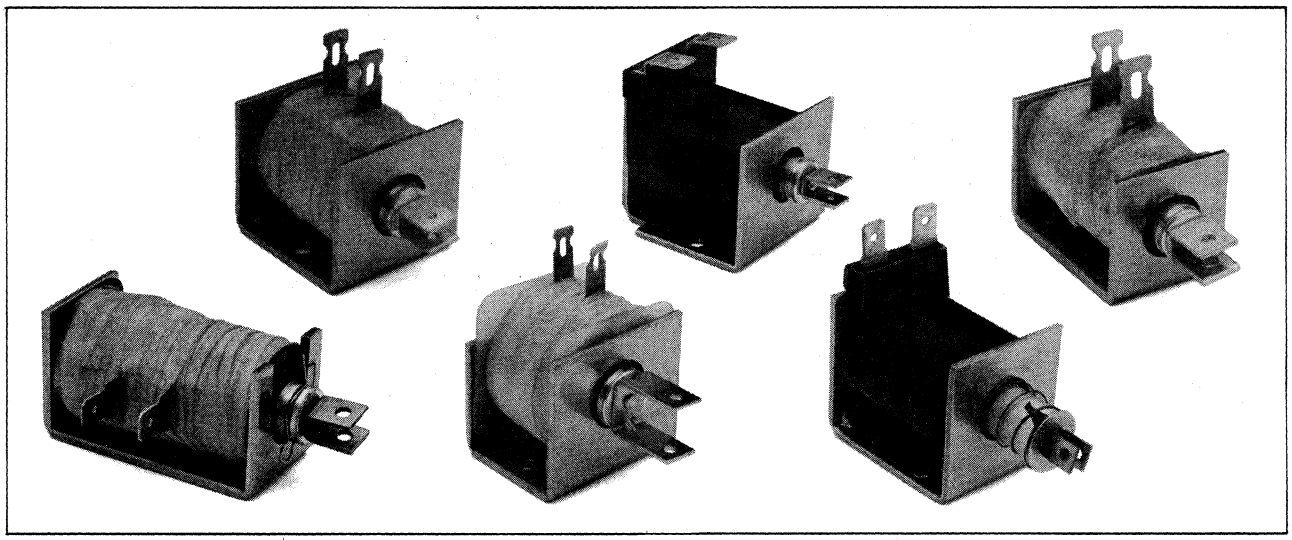
"C" FRAME SOLENOIDS
12VAC to 240VAC or 6VDC to 115VDC
Stroke length up to ¾"

DC TUBULAR SOLENOIDS
12VDC to 24VDC
Push or Pull types



Dormeyer Industries
3418 N. Milwaukee Ave., Chicago, IL 60641
Telephone: 312-283-4000 FAX: 312-283-4927

Dormeyer Industries



"C" Frame Series Solenoids

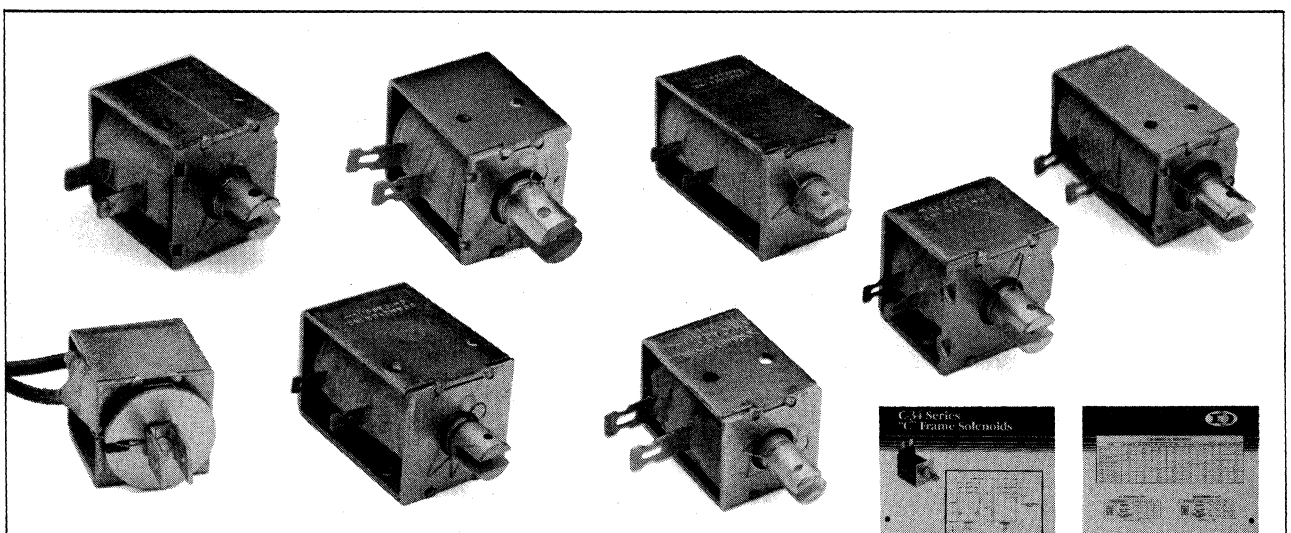
Standard Voltages	12 VAC to 240 VAC 6 VDC to 115 VDC
Stroke Length	0 to ¾"
Pull Force	up to 45 oz.

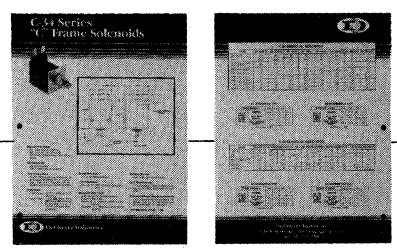
The "C" Frame Series is our lowest cost line of solendoids. Our A.C. models are designed to operate in the 12 to 240 VAC range. Our D.C. models are designed to operate in the 6 to 115 VDC range. We are tooled for high volume production. Mounting hole locations and dimensions, terminal styles, as well as plunger configurations, are easily modified with our existing tooling to meet customer requirements.

Box Frame Solenoids

Standard Voltages	12 VAC to 240 VAC 6 VDC to 115 VDC
Stroke Length	0 to 1¾"
Pull Force	up to 45 oz.

The Box Frame Series provides a longer stroke length than the "C" Frame Series along with a measureable increase in operational life. Both AC and DC models are available. As with all our products, tooling for high volume production is in place. Mounting hole locations and dimensions, terminal styles, as well as plunger configurations, are easily modified with our existing tooling to meet customer requirements.



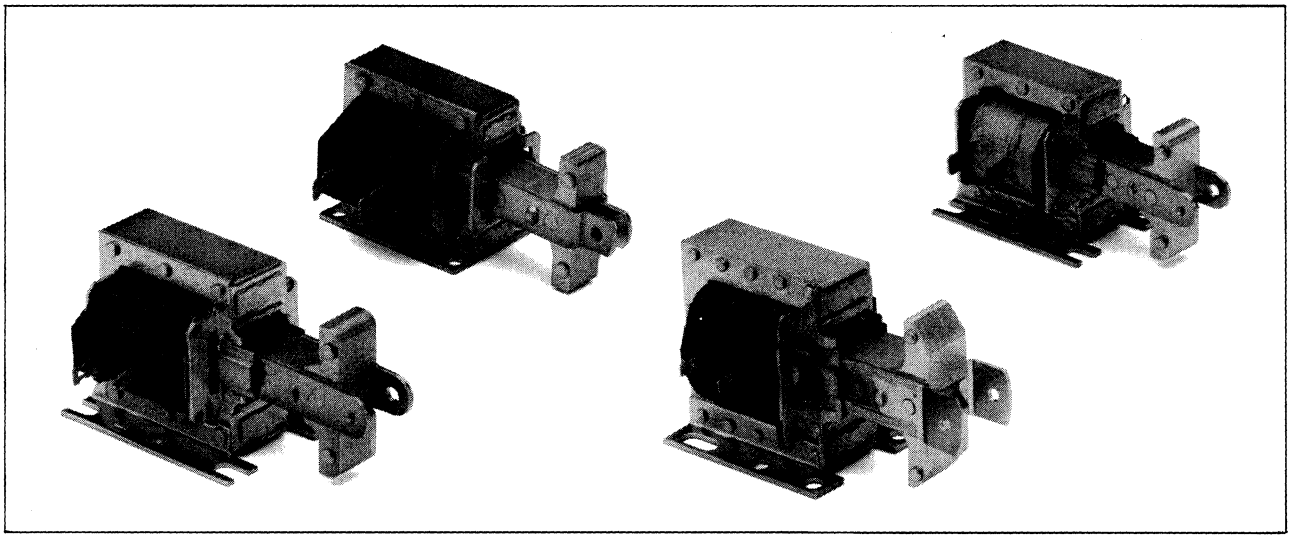


Dormeyer Industries

3418 N. Milwaukee Ave., Chicago, IL 60641 312/283-4000

Call or write for a detailed Engineering Data Sheet covering these Dormeyer products.

Dormeyer Industries



Super "T" Laminated Solenoids

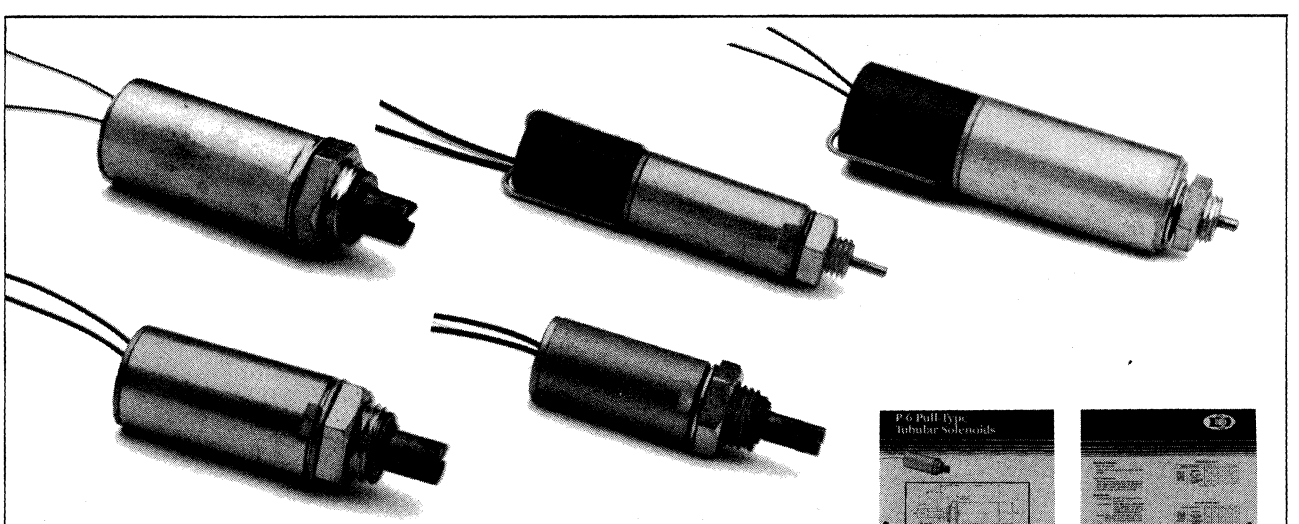
Standard Voltages	24 VAC to 240 VAC
Stroke Length	0 to 1¼"
Pull Force	up to 23 lbs.

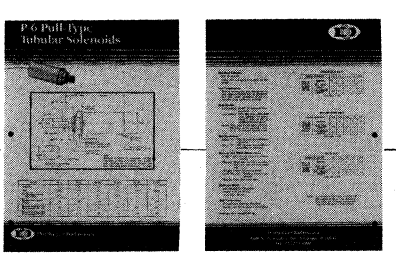
Super "T" Laminated Solenoids are designed to meet high pull force "AC" applications. We are tooled for high volume production. Terminal styles, as well as plunger configurations, are easily modified with our existing tooling to meet customer requirements.

DC Tubular Solenoids

Standard Voltages	12 VDC to 24 VDC
Stroke Length	0 to ½" pull 0 to 3/16" push
Force—pull	up to 70 oz.
Force—push	up to 50 oz.

Tubular solenoids are designed to offer very high reliability and a cycle life in excess of 25,000 operations. Both push and pull models are available for applications in the 12 VDC to 24 VDC range.





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Call or write for a detailed Engineering Data Sheet covering these Dormeyer products.

electro-mechanisms INCORPORATED
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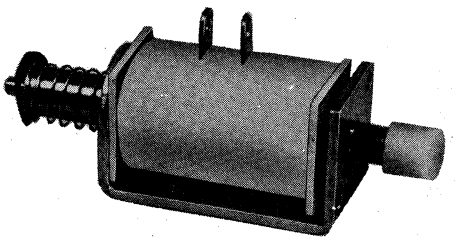
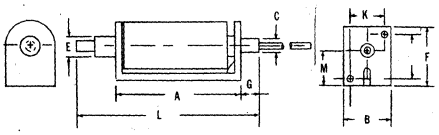
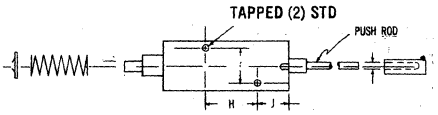
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535
FAX (818) 303-2189

MINI-SOLENOID ACTUATORS



SP SERIES PUSH TYPE





Frame: ..... C1006 Iron — Cad-II Plated
Core: ..... C1002 Electroless Nickel Plated
Plunger: ..... C1002 Electroless Nickel Plated
Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, 5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

3, 6, 12, 24, 48 VDC

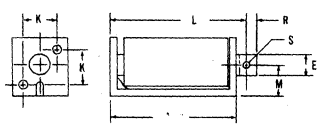
SPECIFICATIONS

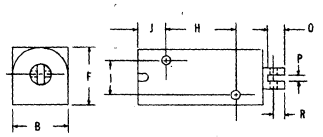
Note: Dimension L is shown with solenoid in energized position. Return Spring and Delrin Tip are Standard on all SP Series.

Part No.	A	B	C	D	E	F	G	H	I	J	K	L	M	S	Max. Stroke*	Weight Oz.	Tapped Holes	Wattage Nom.
SP-18	.403	.180	.062	.025	.068	.235	.085	3/16	3/32	1/8	*	.67	.145		3/16	.05	0-80	1.5
SP-25	.548	.236	.093	.036	.100	.298	.093	1/4	.136	1/8	*	.84	.180		1/4	.1	1-72	2
SP-37	.820	.360	.125	.051	.150	.430	.125	5/16	1/4	3/16	1/4	1.22	.250		3/8	.3	1-72	3
SP-50	.980	.488	.125	.051	.187	.530	.150	1/2	3/8	7/32	5/16	1.44	.285		1/2	.7	1-72	4.5
SP-62	1.215	.600	.187	.091	.250	.691	.178	5/8	7/16	1/4	7/16	1.732	.391		5/8	1.2	4-40	6
SP-75	1.621	.730	.240	.091	.306	.838	.172	5/8	7/16	1/4	1/2	2.15	.473		3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available. * Max Stroke, Standard Pushrod length.

PO SERIES PULL TYPE





Frame: ..... C1006 Iron — Cad-II Plated
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Wire: ..... 130°C Magnet Wire
Termination: ..... Heavy Leads — PVC, Type BU, .5″ Terminals — Solder Lugs
Tape: ..... Mylar
Bobbin: ..... 30% Glass Filled Nylon
Tip: ..... Delrin
Pushrod: ..... Phosphor Bronze
Tol: ..... .xxx ±.005

SPECIFICATIONS

Note: Dimension L is shown with solenoid in energized position.

Part No.	A	B	E	F	H	I	J	K	L	M	O	P	R	S	Max. Stroke	Weight Oz.	Tapped Holes	Wattage Nom.
PO-25	.548	.236	.100	.298	1/4	.136	1/8	*	.672	.180	.130	.025	.062	.031	1/4	.1	1-72	2
PO-37	.820	.360	.150	.430	5/16	1/4	3/16	1/4	.892	.250	.150	.051	.075	.031	3/8	.3	1-72	3
PO-50	.980	.488	.187	.530	1/2	3/8	7/32	5/16	1.180	.285	.200	.063	.106	.063	1/2	.7	1-72	4.5
PO-62	1.215	.600	.250	.691	5/8	7/16	1/4	7/16	1.434	.391	.200	.063	.094	.063	5/8	1.2	4-40	6
PO-75	1.621	.730	.306	.838	5/8	7/16	1/4	1/2	1.797	.473	.200	.063	.094	.063	3/4	2.7	4-40	9

Standard Coils 105°C, Hi Temp Available.

SPECIALS

ELECTRO-MECHANISMS, INC., is completely equipped, both engineering and production wise, to supply you with variations of our solenoids that you might need for your application. We are also capable of designing special types that you might need within the size range of our products. We would appreciate the opportunity to help you solve design and application problems you may have in the area of miniature solenoid actuators.

The force charts below represent three different duty cycles.

Nominal voltage represents continuous duty.

2X Nominal voltage represents a 25%, intermittent duty cycle 4X Nominal voltage represents a 6% intermittent duty cycle.

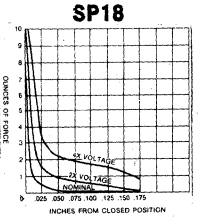
The duty cycle consists of two factors:

1. Percentage of time solenoid is energized in one complete operating cycle.

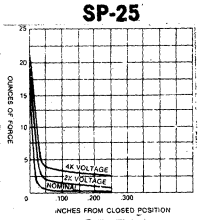
$$\text{(Ref: DUTY CYCLE} = \frac{\text{Time On}}{\text{Time On} + \text{Time Off}} \times 100\text{)}$$

2. Length of time of the longest single energization in one complete operating cycle.

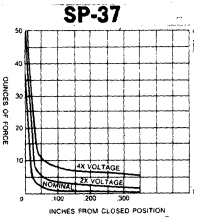
SP18



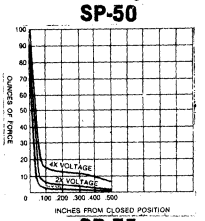
SP-25



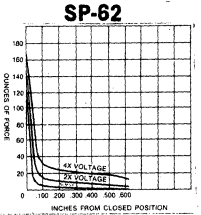
SP-37



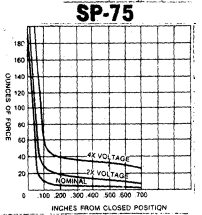
SP-50



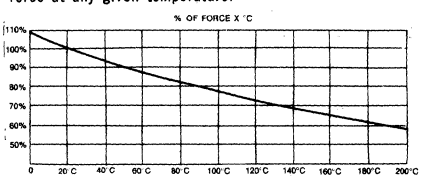
SP-62



SP-75



All forces shown are at 25° ambient. For use at higher ambient temperatures use the chart below to determine force at any given temperature.



FEATURES

ELECTRO-MECHANISMS micro-miniature solenoids offer you static and impact forces equal to standard solenoids 2 to 3 times the size of these units.

Because of their small size, they have extremely fast reaction time. As fast as 2 msec at 4x nominal voltage.

The unique design of PUSH or PULL action, offers many applications beyond the conventional pull type solenoid.

A complete line of 15 solenoids from 3/16″ O.D. to 1.250″ O.D. allows you to choose the correct solenoid with the force you require, from stock items.

The units are highly reliable with life of many millions of operations.

The solenoids are also available with coils in Class F and Class H for high temperature requirements.

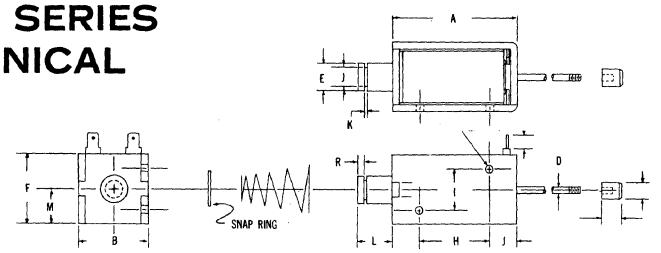
Simplicity of design helps keep the costs down and allows us to pass these savings on to you, our customer.

TYPICAL APPLICATIONS

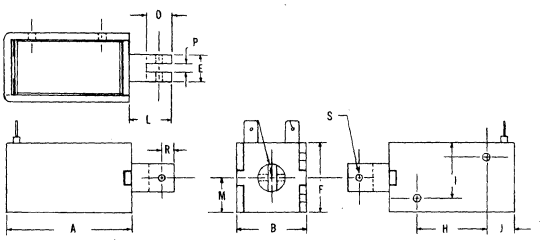
- Hammers for high speed printers
- Camera shutter actuators
- Locking mechanisms for switches, adding machines and typewriters
- Interpossers for card punching and tape perforation
- Cam actuation
- Pen lifters for plotters
- Event markers for chart recorders
- Key actuators for numerical readouts on typewriters and adding machines
- For life testing different devices
- For indicator flags
- Sensing devices
- Remote switching and actuation

electro-mechanisms INCORPORATED
P.O BOX A
AZUSA, CALIF. 91702
AREA CODE (818) 359-2535
FAX (818) 303-2189

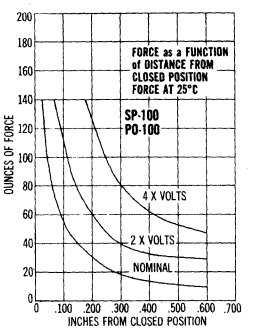
SP-100 SERIES
60° CONICAL



PO-100 SERIES
60° CONICAL



11.5 WATTS VDC
3, 6, 12, 24, 48, 110
60° CONICAL

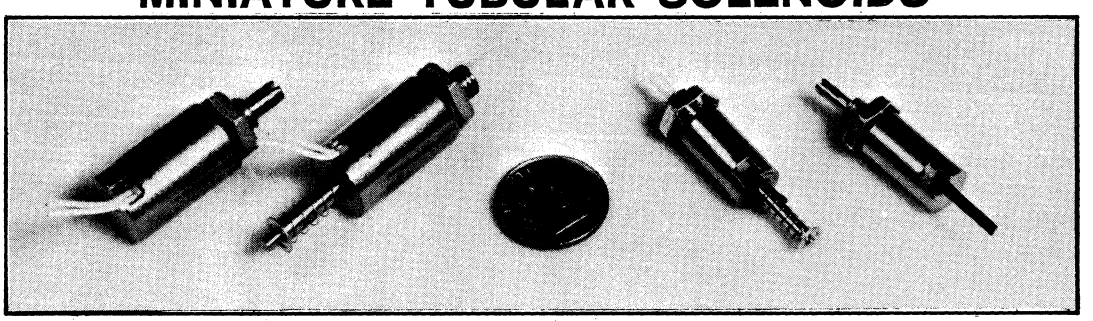


SPECIFICATIONS

Part No.	A	B	D	E	F	H	I	J	K	L	M	O	P	R	S	T	Height of Terms	Max. Stroke	Tapped Holes	Weight Oz.
SP-100	2.270	1.254	.092	.500	1.254	1.115	.750	.430	.040	.752	.627	*	*	.100	*	.343	.365	1	6-32	10
PO-100	2.270	1.254	*	.500	1.254	1.115	.750	.430	*	.700	.627	.375	.143	.168	.100	*	.365	1	6-32	10

Standard Coils 130°C, Hi Temp Coils Available. * Not Applicable.

MINIATURE TUBULAR SOLENOIDS



3 SIZES AVAILABLE PUSH or PULL

5/16" DIA. X .625
2 WATTS
MODELS TPO-TSP-30

1/2" DIA. X .875
3 WATTS
MODELS TPO-TSP-45

9/16" DIA. X 1.00
4.5 WATTS
MODELS TPO-TSP-55

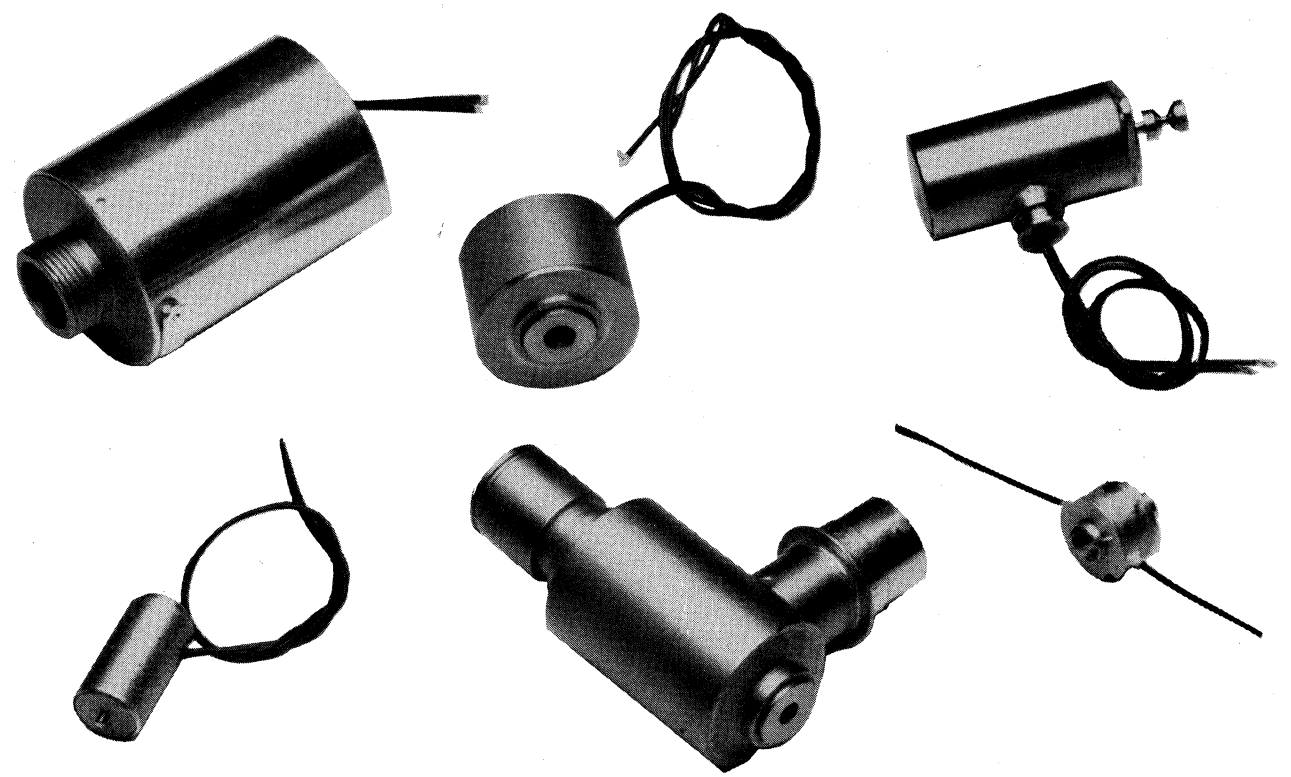
FORCE VS STROKE

Stroke (Inches) Force (Ounces)

MODEL TPO-30	1/32"	1/16"	1/8"	3/16"	1/4"	3/8"
DC CONTINUOUS	1.6	1.2	.90	.4		
DC 2X	3.2	2.1	1.7	1.2		
DC 4X	5.1	3.7	3.3	2.6		
MODEL TPO-45						
DC CONTINUOUS	4.9	2.8	1.8	1.6	1.1	
DC 2X	7.1	4.9	3.0	2.8	2.3	
DC 4X	15.0	10	7.0	6.8	6.1	
MODEL TPO-55						
DC CONTINUOUS	18	7.0	5.5	3.4	3.0	1.4
DC 2X	38	10.0	7.2	6.0	5.2	3.1
DC 4X	50	20.0	14.3	12.8	11.8	10.1

Now available from Electronic Specialty Corporation...

MILITARY GRADE
SOLENOIDS



Electronic Specialty Corporation

P.O. BOX 3501 / VANCOUVER, WASHINGTON 98668-3501
PHONE (206) 574-5000 / FAX 206 573 4635 / TWX 970-444-0005

SOLENOIDS

· ENGINEERING · QUALITY · DELIVERY ·

Hard to find all these in one company?

NOW YOU CAN!

Our engineers design only solenoids and relays. Their years of experience save you money and shorten your manufacturing lead time.

Complete designs from start to finish or slight modifications to existing products. We know our capabilities and if we can't design and build a cost-effective unit, we'll let you know immediately!

Quality: At Electronic Specialty quality is consistent. Our in-house environmental and dynamic testing lab gives us control of product quality and keeps our lead times to a minimum.

Delivery: Our sales engineers can help you with your particular application. Slight variations, or a totally new design, they give you answers on price and design quickly. Because we've supplied these kinds of components for years we are equipped to build and deliver your order when you need it.

Design capability, fast delivery of quality products with the assurance they are what you need. That's what Electronic Specialty Corporation offers you. Whether your orders are large or small we never forget the customer is what keeps us in business.

Call us, let us give you a competitive quote quickly and accurately.

PHYSICAL CHARACTERISTICS
Push or pull type

CASE SIZE
½″ diameter case O.D. to 3″ diameter case O.D.

STROKE RANGE
.01″ to .5″

WEIGHT
4 oz. to 48 oz.

ELECTRICAL CHARACTERISTICS
AC & DC Operation

Coil Voltages	AC	5 VRMs to 240 VRMs from 50 hz to 800 hz
	DC	5 VDC to 600 VDC

Coil resistance—Commensurate with required power and voltage requirements
Dielectric to 1500 VDC or VRMs
Insulation resistance 100 meg at 500 VDC

OPERATING CHARACTERISTICS
Force curves matched to customer requirements or use existing designs
Plunger strokes from .001 to .5 inches

ENVIRONMENTAL CHARACTERISTICS

Temperature ranges —65F to 300F	Vibration
Pressure range	Shock
Fluid compatibility	Salt Spray

CONNECTIONS

Stud screw terminal	Twist lock
Quick connect	Wire leads
Mil Spec multiple connectors	

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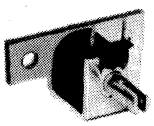
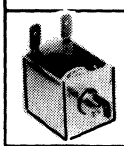
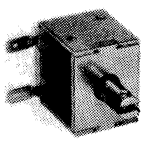
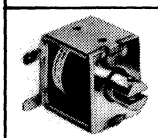
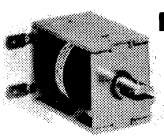
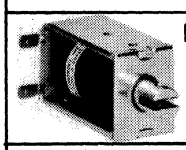
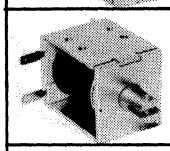
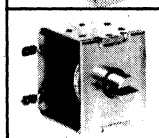
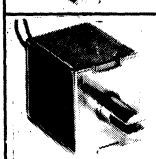
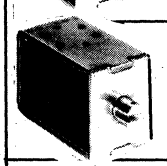
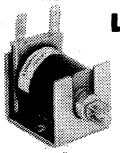
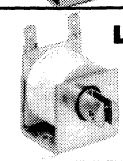
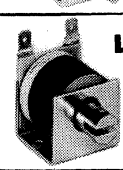
LIBERTY CONTROLS INC.

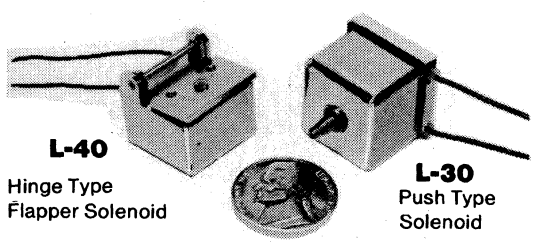
SOLENOIDS

BOX FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
 **L-5** H=.61 L=.63 W=.5	Cont.	2.5@1/16"	.3@5/16"	—	—
	Int.	7.5@1/16"	.6@5/16"	—	—
	Pulse	21@1/16"	.8@5/16"	—	—
L-22 H=.75 L=1.16 W=.75	Cont.	13@1/16	.5@1/2"	5.5@1/16"	.5@1/2"
	Int.	22@1/16"	1@1/2"	10@1/16"	1.5@1/2"
	Pulse	38@1/16"	3@1/2"	19@1/16"	3@1/2"
 **L-20** H=.94 L=1.14 W=.81	Cont.	21@1/16"	1@1/2"	10@1/16"	2@1/2"
	Int.	34@1/16"	2@1/2"	20@1/16"	4@1/2"
	Pulse	62@1/16"	8@1/2"	48@1/16"	11@1/2"
 **L-28** H=1.19 L=1.13 W=.94	Cont.	31@1/16"	1@1/2"	15@1/16"	2@1/2"
	Int.	47@1/16"	3@1/2"	29@1/16"	4@1/2"
	Pulse	83@1/16"	13@1/2"	62@1/16"	11@1/2"
 **L-81** H=1.24 L=1.25 W=1.00	Cont.	38@1/16"	4@3/8"	19@1/16"	5@3/8"
	Int.	53@1/16"	7@3/8"	34@1/16"	8@3/8"
	Pulse	107@1/16"	34@3/8"	90@1/16"	25@3/8"
 **L-11** H=1.19 L=1.84 W=.94	Cont.	48@1/16"	3@3/4"	18@1/16"	6@3/4"
	Int.	67@1/16"	7@3/4"	33@1/16"	13@3/4"
	Pulse	90@1/16"	26@3/4"	54@1/16"	23@3/4"
 **L-82** H=1.24 L=2.01 W=1.00	Cont.	55@1/16"	2@3/4"	17@1/16"	11@3/4"
	Int.	92@1/16"	7@3/4"	46@1/16"	28@3/4"
	Pulse	136@1/16"	16@3/4"	96@1/16"	51@3/4"
 **L-4** H=1.63 L=2.19 W=1.44	Cont.	98@1/16"	5@1"	15@1/16"	9@1"
	Int.	145@1/16"	18@1"	55@1/16"	34@1"
	Pulse	180@1/16"	36@1"	93@1/16"	56@1"
 **L-88** H=1.85 L=1.65 W=1.58	Cont.	120@1/16"	4@5/8"	24@1/16"	8@1/2"
	Int.	184@1/16"	11@5/8"	49@1/16"	4@3/4"
	Pulse	276@1/16"	40@5/8"	138@1/16"	13@3/4"
 **L-89** H=1.85 L=2.14 W=1.58	Cont.	144@1/16"	7@3/4"	17@1/16"	7@3/4"
	Int.	200@1/16"	16@3/4"	42@1/16"	18@3/4"
	Pulse	265@1/16"	58@3/4"	98@1/16"	43@3/4"
 **L-90** H=1.85 L=2.63 W=1.58	Cont.	148@1/16"	5@1-1/4"	12@1/16"	7@1-1/4"
	Int.	208@1/16"	16@1-1/4"	27@1/16"	17@1-1/4"
	Pulse	266@1/16"	40@1-1/4"	80@1/16"	43@1-1/4"

* Forces and Strokes (Ounces and Inches) @ 25°C

U-FRAME SOLENOIDS	DUTY CYCLE	DC MIN.*	DC MAX.*	AC MIN.*	AC MAX.*
L-61 H=.83 L=1.13 W=.75	Cont.	18@1/16"	1@1/2"	10@1/16"	2@1/2"
	Int.	22@1/16"	1@1/2"	22@1/16"	5@1/2"
	Pulse	38@1/16"	3@1/2"	44@1/16"	11@1/2"
 **L-9** H=1.00 L=1.14 W=1.06	Cont.	27@1/16"	1.5@1/2"	15@1/16"	2.5@1/2"
	Int.	38@1/16"	3@1/2"	35@1/16"	7@1/2"
	Pulse	84@1/16"	11@1/2"	72@1/16"	15@1/2"
L-24 H=1.00 L=1.23 W= .84	Cont.	28@1/16"	2@5/8"	14@1/16"	2@5/8"
	Int.	46@1/16"	3@5/8"	26@1/16"	5@5/8"
	Pulse	68@1/16"	8@5/8"	52@1/16"	18@1/2"
 **L-62** H=1.42 L=1.07 W=1.38	Cont.	48@1/16"	3@1/2"	24@1/16"	10@1/2"
	Int.	80@1/16"	5@1/2"	64@1/16"	26@1/2"
	Pulse	172@1/16"	27@1/2"	117@1/16"	48@1/2"
L-26 H= .94 L=1.75 W=.84	Cont.	33@1/16"	1@3/4"	16@1/16"	3@3/4"
	Int.	52@1/16"	3@3/4"	25@1/16"	6@3/4"
	Pulse	74@1/16"	11@3/4"	72@1/16"	20@3/4"
 **L-63** H=1.42 L=1.29 W=1.38	Cont.	56@1/16"	2@3/4"	20@1/16"	6@3/4"
	Int.	84@1/16"	4@3/4"	56@1/16"	18@3/4"
	Pulse	168@1/16"	16@3/4"	103@1/16"	34@3/4"

STANDARD VOLTAGES:
6, 12, 24, 48, 120, 240 AC/DC.
Other Voltages Available.



L-40
Hinge Type
Flapper Solenoid

L-30
Push Type
Solenoid

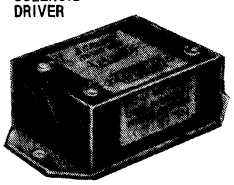
ENCLOSED TO SHIELD MAGNETIC LEAK!
Available only from Liberty Controls

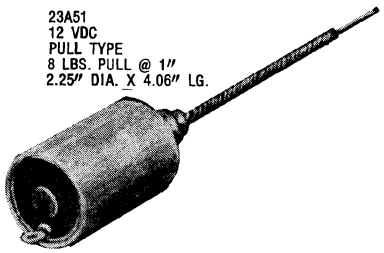
Call Now to find out more about our New line of Tubular Solenoids.

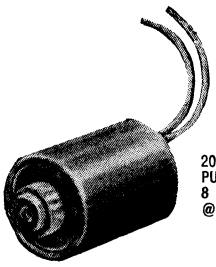
LIBERTY CONTROLS, INC.
500 BROOKFOREST AVENUE
SHOREWOOD, IL 60435
(815) 725-2241
FAX: (815) 725-6571

LMC
LINEAR MOTIONS COMPANY
17025 DUBESOR ST./VALINDA, CA 91744/**(818) 918-7806**

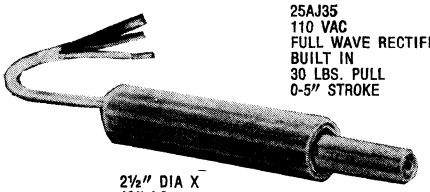
CUSTOM SOLENOIDS

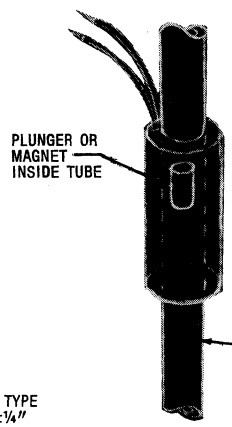

SOLENOID DRIVER

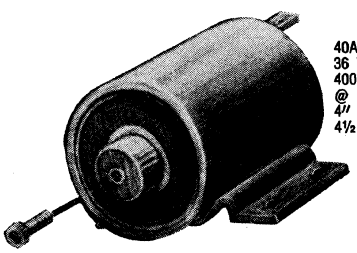

23A51
12 VDC
PULL TYPE
8 LBS. PULL @ 1″
2.25″ DIA. X 4.06″ LG.

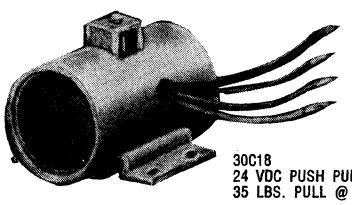

2″ DIA. X 3⅛″ LG.
20A17 12 VDC
PULL TYPE
8 LBS. PULL
@ .75″

09B32
12 VDC
PUSH TYPE
2 LBS. PULL
@ ¼″
(PCB OR PANEL MOUNTING)


25AJ35
110 VAC
FULL WAVE RECTIFIER
BUILT IN
30 LBS. PULL
0-5″ STROKE
2½″ DIA X 10″ LG.


PLUNGER OR MAGNET INSIDE TUBE
TUBE OF NON MAGNETIC MATERIAL


40A55
36 VDC
400 LBS. PULL
@ .375″
4″ DIA. X 4½″ LG.


30C18
24 VDC PUSH PULL TYPE
35 LBS. PULL @ ±¼″

CUSTOM SOLENOIDS

Linear Motions Company specializes in CUSTOM D.C. and Rectified A.C. Solenoids. The solenoids illustrated are a sampling of solenoids that have been designed for specific applications. It is not necessary to sift through numerous catalogs to find a solenoid that might fit your design; send us your specifications and we will design a solenoid to fit your application or send us your obsolete or unknown solenoid and we will reproduce it.

DESIGN FEATURES AVAILABLE

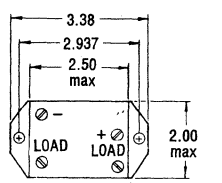
- Plunger return spring
- Pull, Push or Push-Pull actuation
- Long Stroke (5 inches & up)
- Choice of Leadwires, Quick disconnect, Screw type and Solder Terminals
- Built-in or external full wave rectifier
- Optional solid state Solenoid Driver—FULL Pull-in/REDUCED Holding Voltage
- Save assembly cost with unassembled solenoid components (i.e. built-into your enclosure)

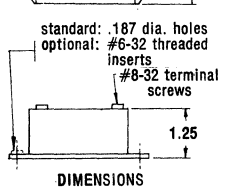
GENERAL DESCRIPTION

The SOLID STATE VOLTAGE CONTROLLED SOLENOID SYSTEM is a new innovation in high performance Continuous Duty Solenoids. The Solid State Voltage Control Unit is a variable duty cycle solid state device, there are no power robbing resistors to produce heat and no mechanical components to wear out. An Intermittant Duty solenoid is used in conjunction with the Voltage Control Unit.

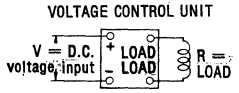
- Virtually burn-out-proof—switching is independent of plunger movement
- Higher reliability
- Longer life—solid state switching; no moving parts
- Smaller solenoid—no holding coil, switches, insulators, etc. are required
- Versatile—since there is no mechanic connection between the plunger and the switching device, any type of solenoid can be used (i.e. Pull, Push, Push-Pull).
- Control unit can be mounted anywhere

SOLID STATE VOLTAGE CONTROL UNIT

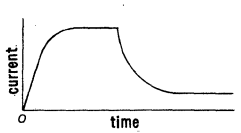




DIMENSIONS



VOLTAGE CONTROL UNIT
INSTALLATION WIRING



TYPICAL SOLENOID ACTUATION CYCLE

MODEL NO. VC102

SPECIFICATIONS:

Input Voltage:
Available From:
8VDC min to 40VDC max
(specify operating voltage)

Input Current:
10 amps max

Load Resistance:

$$R = \frac{V-2}{10} \text{ ohms min}$$

Output Current:
(to resistive or inductive load)
High mode = 10 amps max
Low mode = .2 HI mode current (specify other)

Output Duration:
High mode = 2 seconds (specify other from 10 m.s. to 5 seconds)
Low mode = on until voltage is removed

Temperature Range:
Operating = 0°C to 50°C
Non-operating = 0°C to 125°C

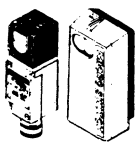
WHY do 40,000 Buyers and Electronic Engineers Keep Calling

MASTER DISTRIBUTORS

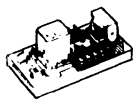
- BECAUSE orders placed by 3:00 p.m. are shipped the same day.
- BECAUSE we have over 8,000,000 relays & switches in stock.
- BECAUSE of our excellent Value-Added Service.
- BECAUSE of our Just-In-Time Program.

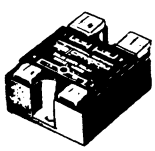
(213) 452-1229

TOGGLE SWITCHES

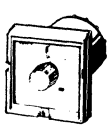

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

CABINETS
BUD

CIRCUIT BREAKERS
Airpax
Aromat
Carlingswitch
Heinemann
Potter & Brumfield

CONNECTORS & SOCKETS
Amphenol
Aromat
Curtis
Custom Connector
Idec
Lumberg
Master Electronics
Potter & Brumfield
Souriau
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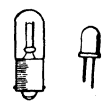
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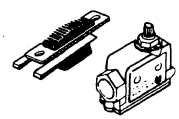
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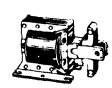
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SOCKETS

PUSHBUTTON SWITCHES

TIMERS

PADDLE SWITCHES

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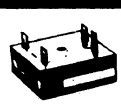
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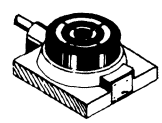
FANS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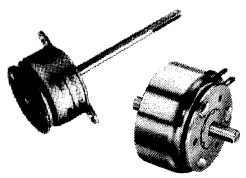
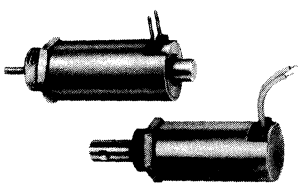
Lucas Ledex

Solenoids

Over 400 choices of standard solenoid designs are available off-the-shelf from us. But, if none of these meet your unique requirements, we'll provide you with custom engineered prototypes. Either way, Lucas Ledex Inc. offers you the widest variety of solenoids for your design.

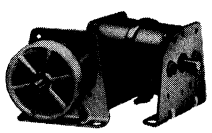


Rotary Solenoids
Step-turn-index-lock-punch-lift. For millisecond-fast torque and endurance, specify a Lucas Ledex rotary solenoid. Nine basic sizes, right or lefthand strokes from 10 to 110 degrees. Torque output to 117 pound-inches. Life of over 100 million cycles with endurance engineered models. Four standard size groups of Magton rotary solenoids produce high torque with no axial displacement. Standard angular strokes: 60°, 45°, and 30°, either CW or CCW. Can be modified. Long operating life: 500 million cycles. Request literature.

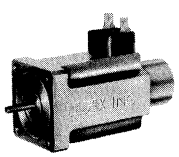


Linear Solenoids
Short-medium-long strokes are all available from one source—Lucas Ledex Inc. Choose our low profit flat face push/pull for high force/short stroke; our low profile conical face push/pull for medium force/stroke and our tubular solenoids for long strokes. New Series 20 tubular pull solenoids provide 100 million actuations (push, 50 million), quiet operation, push or pull, and economy—from stock. Rugged construction provides accurate repeatability after long usage. Our tubular solenoids have built-in impact cushions to absorb energy at the end of the stroke and electroless nickel plated plungers for longer life.

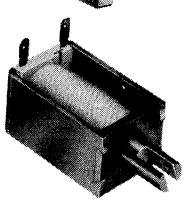
Magnetic Latching Solenoids
Magnetic latching solenoids use permanent magnets coupled with conventional rotary, tubular, low profile, or open frame solenoids, to hold the unit's plunger in an open or closed position without current drain. A momentary pulse releases the latch. Memory is retained during power loss. Request literature.



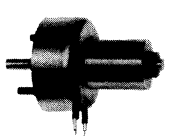
Stepping Solenoids
Step 10-15-20 or 30 degrees with the highest torque a stepping solenoid makes—the Series 50-L. Square wave pulse drives either the unidirectional or bidirectional model for 10,000,000 steps with a non-accumulative accuracy of ± 1°. Direct couple for mechanical ease and avoid linkages. Can be manually overridden in case of power failure.



Proportional Solenoids
Open loop/closed loop, variable position sensing is now possible by using our proportional solenoid with our controller for smooth, accurate response. Hydraulic systems can use our wet plunger type which requires no dynamic seals and provides up to 50 pounds force. Do away with pilot stages and expensive servo valves.



Open Frame Solenoids
TDS Series open frame solenoids for large volume OEM applications are available at competitive prices in 34 standard configurations, manufactured in Japan. Lucas Ledex D-Frame solenoids are dependable and reliable. Eight standard models are available from stock with strokes up to 1.25". Quick connect terminals and class "B" coils are standard. Request literature.



Soft Shift® and Custom Designed Solenoids
Soft Shift Solenoids give variable speed control, from snap action to quiet variability. Variable positioning with electronic control.

Typical custom designed solenoids include dot matrix and printhammer models.

Lucas Ledex Inc.
P.O. Box 427
Vandalia, Ohio 45377-0427 USA

FAX: 513-898-8624

Call 513-898-3621

Lucas Ledex Solenoids & Switches

Solenoids and switches—We have both the products and the people to help you with the quickest and best solutions to your design problems. Our wide selection of stock models lets you get a fast start on your prototype, and our expert engineering staff will work closely with you on custom designs. You'll find helpful solenoid and switch technology.

Rotary solenoids—choose from 250 stock models or custom designs for prototype work. Also Magton® rotary solenoids for high reliability applications. Stock units shipped within 24 hours.

Series 20 tubular push or pull solenoids have life expectancies in excess of 50 million actuations in push models, 100 million in pull models.

Low profile push/pull, flat face, or conical solenoids are built for high force to size, and fast response.

Soft Shift® solenoids—capable of proportional control as well as on-off.

Stepping solenoids—highest torque solenoid available. Extended life up to 10 million cycles minimum on unidirectional models or each direction on bidirectional models.

Open frame solenoids—34 models of TDS Series and 8 models of our D-frame Series solenoids offer economical long term service.

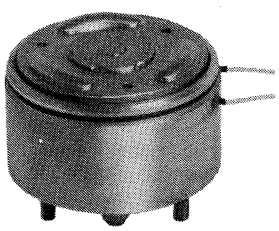
Magnetic latching solenoids—all solenoid configurations maintain energized position without current draw.

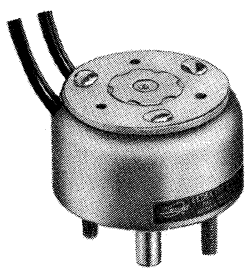
Pushbutton switches—All models stocked. Individual pushbuttons, flat panel pushbuttons, low profile rotary, binary selector, keyboard, and keylock switches. Ganged and panel mounted switches with the look and feel of quality.

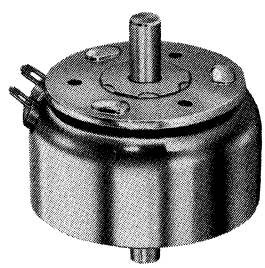
Rotary manual switches provide economy by simplifying circuitry, eliminating auxiliary circuit components and minimizing wiring. Reliable for military and commercial uses.

Stepping switches operate in −55°C to +80°C and switch 1A @ 120 VAC or 2A @ 28 VDC. More switching—less space.

Packaged switches handle high density transfer switching without relays in extreme environments. Meet relevant MIL specs.







Rotary Solenoids			25°		35°		45°		67½°		95°	
Model	O.D.(in.)	Ht.(in.)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)	Cont. (stroke)	1/20 (duty)
0E	3/4	9/16	—	.41			—	.20				
1E	1	5/8	—	1.10			—	.62				
2E	1 1/8	21/32	.20	1.70	.15	1.30	.10	.89				
3B	1 5/8	7/8	.35	3.2	.25	2.3	.15	1.7	.09	.8		
3E	1 5/16	51/64	.35	3.2	.25	2.3	.15	1.18	.09	.89		
4E	1 9/16	61/64	.9	5.2	.6	3.5	.4	3.1	.2	1.9	.15	1.2
5B	1 7/8	1 13/64	1.8	10.0	0.9	8.3	.7	6.0	.5	4.0	.19	1.9
5S	1 7/8	1 3/64	1.9	13.2	.9	9.2	.7	6.9	.5	4.9	.20	2.6
6S	2 1/4	1 27/64	4.6	30.6	3.4	20.5	1.7	12.1	1.6	9.7	0.9	5.7
7B	2 3/4	2 5/64	9	35.5	5	32.0						
7S	2 3/4	1 55/64	11	46.6	6	42.0	5	32.8	2.5	19.3	1.5	11.6
8S	3 3/8	2 5/16	16	117	12	77	10	65	4.2	35	3.5	20

For detailed performance curves, write for literature. Torque shown in lb. in. Many stock models to choose from.

Lucas Ledex

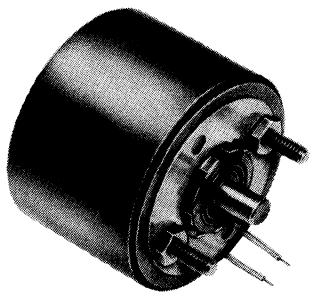
Lucas Ledex Inc.
P.O. Box 427
Vandalia, Ohio 45377-0427 U.S.A.

Phone: 513-898-3621
TWX/Telex: 6874241, 6874243
FAX: 513-898-8624

Magton® Rotary Solenoids

Magton solenoids give you hundreds of millions of cycles of life, severe environmental operating capabilities, low noise, and true rotary motion with no axial displacement. They may be what you need to handle shock or vibration in aerospace, or any demanding application where extremely long life is required.

Design uses a balanced armature mounted on ball bearings. Four sizes up to 2.42" dia. provide 30°, 45°, or 60°, (90° optional) at CW or CCW travel stop to stop; wide range of output torques (to 50 in.-oz.) and 5 to 400 VDC available. Request literature.

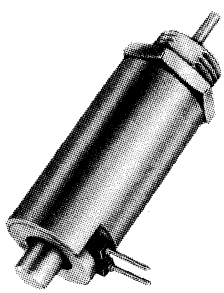


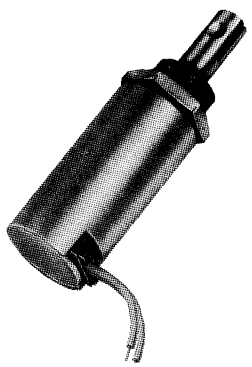
Series 20 Tubular Solenoids

Available push or pull
Typical output, 1/10 duty

Model	½"	¾"	1"
Size	½" dia. x 1"	¾" dia. x 1½"	1" dia. x 2"
Force .25 Stroke	1 oz. to 8½ oz.	¼ to 2½ lb.	¾ to 5½ lb.
Shaft diameter, push	.062"	.094"	.125"
Mounting	Thr'd Bushing	Thr'd Bushing	Thr'd Bushing
Weight	.84 oz.	2.6 oz.	6 oz.

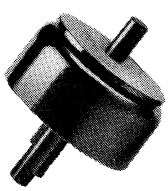
For detailed performance curves, write for our solenoid catalog now.
Stock models available both push and pull, ½", ¾", and 1".

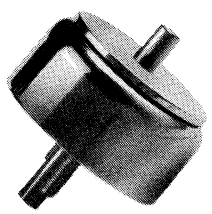




The Series 20 offers the economical solution to your long life actuating needs. A low friction bobbin assembly provides for a life expectancy of millions of actuations. The problem of powdered metal flaking is eliminated through the metal-to-plastic bearing surface construction. The terminal version mates with standard connectors. A special mounting nut is supplied, packed loose.

The Series 20 is ideal for applications where field servicing is prohibitive. Its quietness and high reliability provides definite advantages in applications involving peripheral equipment, business machine mechanisms, door inter-locks, interposers, and gate releases. Request literature.





Low Profile Solenoids

Typical output, 1/10 duty

Model	0EC	0BC	1EC	1EF	2EC	2EF	3EC	3EF	4EC	4EF	5SF	5EC	6EC
Size	.75"ϕx.5" Conical Face	.77"ϕx.680" Conical Face	1.0"ϕx.53" Conical Face	Flat Face	1.125"ϕx.58" Conical Face	Flat Face	1.312"ϕx.69" Conical Face	Flat Face	1.562"ϕx.835" Conical Face	Flat Face	1.875"ϕx.88" Flat Face	1.875"ϕx1.035" Conical Face	2.25"ϕx1.33" Conical Face
Stroke (in.)	.040	.040	.040	.010	.040	.010	.040	.010	.050	.020	.020	.100	.100
Force (lbs.)	2.9	2.9	5.8	17.5	7.7	25	12.5	40	20	50	92	31	58
Stroke (in.)	.120	.120	.120	.020	.120	.020	.120	.020	.200	.040	.040	.300	.300
Force (lbs.)	0.8	0.8	1.8	11.5	3.0	18	5.5	32	8	34	70	14	30
Weight (ozs.)	.875	1.0	1.5		2.25		3.75		6		9	10.5	21.5

For detailed performance curves, write for literature. Many stock models to choose from. New bobbin wound coil models provide extra economy.

Lucas Ledex

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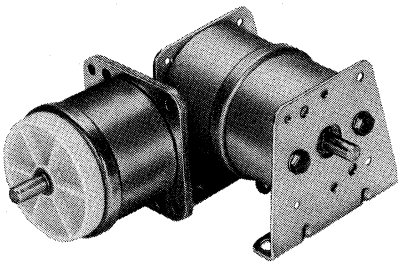
Phone: 513-898-3621
TWX/Telex: 6874241, 6874243
FAX: 513-898-8624

Stepping Solenoids

Summary Specifications	Unidirectional	Bidirectional
Voltage	6 to 220 VDC	6 to 220 VDC
High temperature	+85°C	+85°C
Low temperature	−40°C	−40°C
Length	1.9"	2.8"
Height	2¼" (sq. plate)	2¼"
Weight	14 oz.	24 oz.

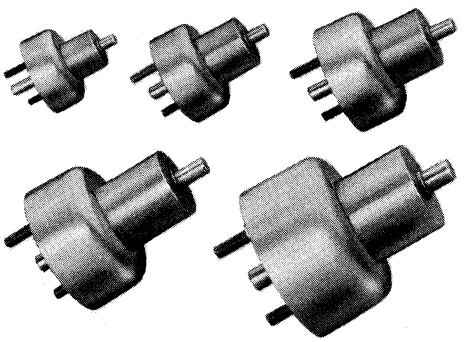
For more detailed specifications on 64 stock models, request literature.



Soft Shift® Solenoids

Soft Shift—in addition to snap-acting, these linear solenoids provide characteristics allowing variable positioning over a portion of the stroke for use in cost-reduced control systems. Request catalog.

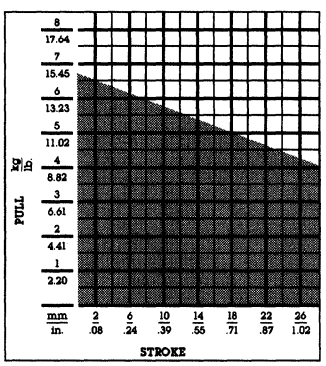
Model	2SF	3SF	4SF	5SF	6SF
Size	1.125"ϕx.986"	1.312"ϕx1.232"	1.562"ϕx1.471"	1.875"ϕx1.935"	2.250"ϕx2.214"
Stroke (in.)	.160	.250	.300	.400	.420
Force (lbs.)	.8	1.2	2.0	3.6	7.0
Weight (ozs.)	2.5	4.0	7.0	12.0	23.0

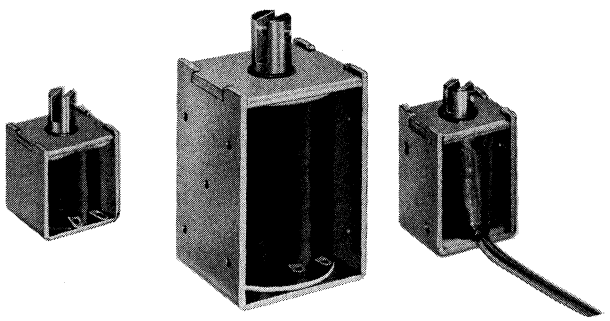


Open Frame Solenoids

TDS Series open frame solenoids feature 34 std. models, hundreds of variations for high-volume OEM applications. Pull-stroke curves fall in shaded range at right. Eight models of our D-frame solenoids also available.

Request Solenoid Catalog now.

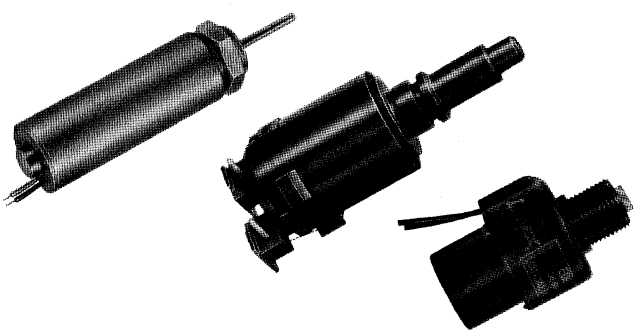




Other Solenoids

Magnetic latching—tubular, low profile, and open frame solenoids hold the plunger in the actuated position using no power. Excellent for fail-safe latching mechanisms. Request catalog.

Printer solenoids—dot matrix and printhammer solenoids are examples of custom designs that deliver exceptional reliability over a long life. Call us to discuss your needs.



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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

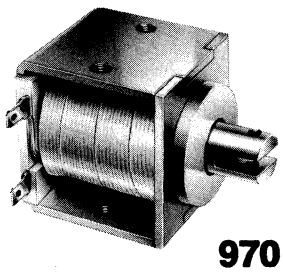
V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

regdon
SOLENOID, INC.



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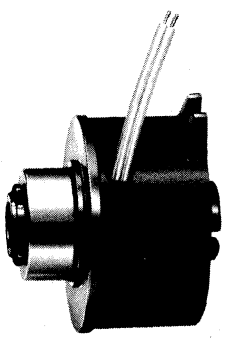
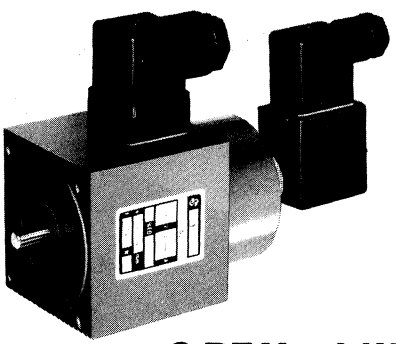


K EB
Wrap Spring Clutch
for Office Machines



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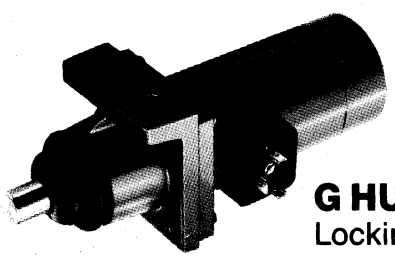

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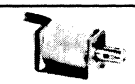
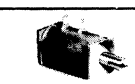
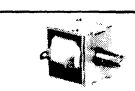
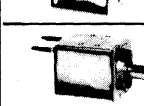
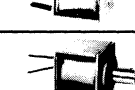
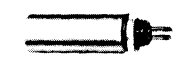
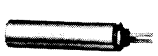
Box-Frame Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches H	L	W
	312-6005	24VDC	Cont.	144	22@ 1/32"	2@ 1/4"	3/4	1 5/32	3/4
	312-6006	24VDC	Int.	60	28@ 1/32"	4@ 1/4"	3/4	1 5/32	3/4
	312-6011	120VAC	Cont.	390	12@ 1/32"	2.5@ 1/4"	3/4	1 5/32	3/4
	312-6012	120VAC	Int.	100	20@ 1/32"	4@ 1/4"	3/4	1 5/32	3/4
	5U5-6053	24VDC	Cont.	114	14@ 1/16"	2.5@ 3/8"	15/16	1 1/4	27/32
	5U5-6054	24VDC	Int.	52	27@ 1/16"	5@ 3/8"	15/16	1 1/4	27/32
	5U5-6059	120VAC	Cont.	500	10@ 1/16"	4.5@ 3/8"	15/16	1 1/4	27/32
	5U5-6060	120VAC	Int.	310	17@ 1/16"	8.5@ 3/8"	15/16	1 1/4	27/32
	5U7-6065	24VDC	Cont.	85	15@ 1/8"	3@ 1/2"	15/16	1 3/4	27/32
	5U7-6066	24VDC	Int.	33	32@ 1/8"	7@ 1/2"	15/16	1 3/4	27/32
	5U7-6071	120VAC	Cont.	250	11@ 1/8"	7.5@ 1/2"	15/16	1 3/4	27/32
	5U7-6072	120VAC	Int.	140	18@ 1/8"	12@ 1/2"	15/16	1 3/4	27/32
	809-6101	24VDC	Cont.	104	12@ 1/8"	2@ 1/2"	1 3/16	1 1/8	15/16
	809-6102	24VDC	Int.	50	22@ 1/8"	3@ 1/2"	1 3/16	1 1/8	15/16
	809-6107	120VAC	Cont.	400	12@ 1/8"	5@ 1/2"	1 3/16	1 1/8	15/16
	809-6108	120VAC	Int.	220	24@ 1/8"	7@ 1/2"	1 3/16	1 1/8	15/16
	827-6113	24VDC	Cont.	72	24@ 1/8"	4@ 5/8"	1 3/16	1 7/8	15/16
	827-6114	24VDC	Int.	32	40@ 1/8"	8@ 5/8"	1 3/16	1 7/8	15/16
	827-6119	120VAC	Cont.	200	12@ 1/8"	6@ 5/8"	1 3/16	1 7/8	15/16
	827-6120	120VAC	Int.	85	20@ 1/8"	13@ 5/8"	1 3/16	1 7/8	15/16
	930-6125	24VDC	Cont.	54	63@ 1/8"	7@ 3/4"	1 5/8	2	1 7/16
	930-6126	24VDC	Int.	15	113@ 1/8"	25@ 3/4"	1 5/8	2	1 7/16
	930-6131	120VAC	Cont.	133	8@ 1/8"	7@ 3/4"	1 5/8	2	1 7/16
	930-6132	120VAC	Int.	37	36@ 1/8"	26@ 3/4"	1 5/8	2	1 7/16
	940-6137	24VDC	Cont.	50	78@ 1/8"	8@ 3/4"	1 5/8	2 3/16	1 7/16
	940-6138	24VDC	Int.	15	140@ 1/8"	18@ 3/4"	1 5/8	2 3/16	1 7/16
	940-6143	120VAC	Cont.	53	24@ 1/8"	15@ 3/4"	1 5/8	2 3/16	1 7/16
	940-6144	120VAC	Int.	15	100@ 1/8"	65@ 3/4"	1 5/8	2 3/16	1 7/16
	960-6149	24VDC	Cont.	58	50@ 1/8"	8@ 1/2"	1 5/8	1 9/16	1 7/16
	960-6150	24VDC	Int.	21	100@ 1/8"	18@ 1/2"	1 5/8	1 9/16	1 7/16
	960-6155	120VAC	Cont.	166	14@ 1/8"	10@ 1/2"	1 5/8	1 9/16	1 7/16
	960-6156	120VAC	Int.	60	45@ 1/8"	30@ 1/2"	1 5/8	1 9/16	1 7/16
	970-6161	24VDC	Cont.	58	65@ 1/8"	9@ 1/2"	1 5/8	1 25/32	1 7/16
	970-6162	24VDC	Int.	20	120@ 1/8"	24@ 1/2"	1 5/8	1 25/32	1 7/16
	970-6167	120VAC	Cont.	100	22@ 1/8"	16@ 1/2"	1 5/8	1 25/32	1 7/16
	970-6168	120VAC	Int.	125	85@ 1/8"	58@ 1/2"	1 5/8	1 25/32	1 7/16

Tubular Solenoids (Pull Version)

Push Version Also Available.

	Type	Volts	Duty	Oms	Forces and Strokes ounces @ inches (min.)	(max.)	Body inches Length	x Dia.
	R7X9-6171	12VDC	Cont.	80	5@ 1/32"	1.2@ 5/32"	1 1/8	7/16
	R7X9-6172	12VDC	Int.	14	9@ 1/32"	2.5@ 5/32"	1 1/8	7/16
	R7X9-6173	24VDC	Cont.	260	5@ 1/32"	1.2@ 5/32"	1 1/8	7/16
	R7X9-6174	24VDC	Int.	57	9@ 1/32"	2.5@ 5/32"	1 1/8	7/16
	R8X7-6362	12VDC	Cont.	55	2.5@ 1/16"	1@ 3/16"	7/8	1/2
	R8X7-6363	12VDC	Int.	20	6@ 1/16"	1.5@ 3/16"	7/8	1/2
	R8X7-6364	24VDC	Cont.	240	2.5@ 1/16"	1@ 3/16"	7/8	1/2
	R8X7-6365	24VDC	Int.	80	6@ 1/16"	1.5@ 3/16"	7/8	1/2
	R8X12-6372	12VDC	Cont.	40	7@ 1/32"	1.5@ 1/4"	1 1/2	1/2
	R8X12-6373	12VDC	Int.	10	14@ 1/32"	4@ 1/4"	1 1/2	1/2
	R8X12-6374	24VDC	Cont.	160	7@ 1/32"	1.5@ 1/4"	1 1/2	1/2
	R8X12-6375	24VDC	Int.	38	14@ 1/32"	4@ 1/4"	1 1/2	1/2
	R8X16-6384	24VDC	Cont.	145	2.8@ 1/8"	1.5@ 3/4"	2	1/2
	R8X16-6385	24VDC	Int.	24	7@ 1/8"	4@ 3/4"	2	1/2
	R12X12-6211	12VDC	Cont.	41	6.5@ 1/8"	1.2@ 5/8"	1 1/2	3/4
	R12X12-6212	12VDC	Int.	6	20@ 1/8"	6@ 5/8"	1 1/2	3/4
	R12X12-6213	24VDC	Cont.	165	6.5@ 1/8"	1.2@ 5/8"	1 1/2	3/4
	R12X12-6214	24VDC	Int.	25	20@ 1/8"	6@ 5/8"	1 1/2	3/4
	R16X9-6221	12VDC	Cont.	36	22@ 1/16"	2.5@ 1/2"	1 1/8	1
	R16X9-6222	12VDC	Int.	8	33@ 1/16"	4@ 1/2"	1 1/8	1
	R16X9-6223	24VDC	Cont.	145	22@ 1/16"	2.5@ 1/2"	1 1/8	1
	R16X9-6224	24VDC	Int.	30	33@ 1/16"	4@ 1/2"	1 1/8	1
	R16X16-6231	12VDC	Cont.	26	21@ 1/8"	6.5@ 5/8"	2	1
	R16X16-6232	12VDC	Int.	3.8	56@ 1/8"	20@ 5/8"	2	1
	R16X16-6233	24VDC	Cont.	105	21@ 1/8"	6.5@ 5/8"	2	1
	R16X16-6234	24VDC	Int.	15	56@ 1/8"	20@ 5/8"	2	1
	R24X13-6243	24VDC	Cont.	85	50@ 1/8"	5@ 5/8"	1 5/8	1 1/2
	R24X13-6244	24VDC	Int.	14	150@ 1/8"	20@ 5/8"	1 5/8	1 1/2
	R24X19-6253	24VDC	Cont.	59	80@ 1/8"	8@ 1"	2 3/8	1 1/2
	R24X19-6254	24VDC	Int.	10	140@ 1/8"	32@ 1"	2 3/8	1 1/2

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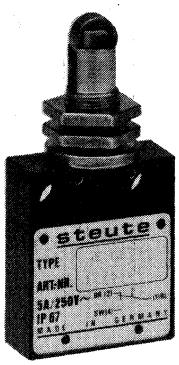
Manufacturer	Page No.	DIP	Lever	Pushbutton				Reed	Rocker/Paddle	Rotary		Slide	Snap action	Thumbwheel	Toggle	Mercury	Features										Hardware	Other Type
				Position																								
				Momentary Action	Positive action	Interlock	Push-on/Push-off			Single Section	Multisection						Decade	Explosion Proof	Illuminated	High Voltage	Key Lock	Power	RF	Sealed	Touch	Coded		
Altech	B•1640																	¤										Limit; Magnetic Position; Foot Operated; Tension
AME	B•1641																							¤			¤	
American Research & Engrg.	B•1642	¤										¤												¤				Surface Mount
American Switch	B•1643		¤	¤	¤		¤		¤				¤		¤				¤					¤				
Arco-electric	B•1644		¤	¤					¤			¤	¤		¤				¤								¤	
Arrow Hart	B•1661			¤			¤		¤			¤			¤				¤		¤							
Augat/ Alcoswitch	B•1656	¤	¤	¤	¤		¤		¤	¤		¤	¤	¤	¤		¤		¤	¤	¤	¤		¤		¤		Surface Mount
Burgess Switch	B•1658		¤	¤	¤	¤												¤						¤				Ultraminiature; Low Profile; Switches for difficult Environmen
C & K Comps.	B•1662	¤	¤	¤	¤				¤	¤		¤	¤	¤	¤				¤		¤	¤		¤				Solid State
C & K/Unimax	B•1665				¤		¤						¤						¤									Fiber Optic
Carling-switch	B•1666								¤						¤				¤									
Cherry	B•1672			¤		¤	¤						¤	¤					¤					¤		¤	¤	Low Torque
Cole Instr.	B•1676									¤	¤												¤			¤		MIL-S-3786
Compac	B•1677																						¤					
Crosspoint	B•1678																											Matrix
Crouzet Controls	B•1679			¤			¤		¤				¤	¤							¤							
CTS Corp	B•1681									¤																		
CTS Corp./ Switch Division	B•1682	¤								¤	¤	¤						¤						¤				MIL-S-83504/4 Programmable

Manufacturer	Page No.	DIP	Lever	Pushbutton				Reed	Rocker/Paddle	Rotary		Slide	Snap action	Thumbwheel	Toggle	Mercury	Features											Other Type
				Position																								
				Momentary Action	Positive action	Interlock	Push-on/Push-off			Single Section	Multisection						Decade	Explosion Proof	Illuminated	High Voltage	Key Lock	Power	RF	Sealed	Touch	Coded	Hardware	
CW Industries	B•1688			¤					¤			¤	¤						¤			¤	¤	¤				
Dai-Ichi Shoji	B•1691		¤	¤		¤			¤			¤	¤		¤				¤		¤	¤					¤	
Dialight	B•1692		¤	¤	¤				¤				¤		¤				¤					¤				Solid State
Digitran	B•1694		¤			¤			¤										¤					¤		¤		MIL Spec
Dreefs Switch	B•1695			¤	¤	¤	¤						¤					¤	¤	¤				¤			¤	PC Mount
Durakool	B•1696					¤										¤				¤		¤		¤				Tilt
EAO Switch	B•1697			¤	¤	¤	¤						¤				¤	¤			¤	¤		¤				
EECO	B•1698	¤							¤	¤				¤										¤	¤	¤		Membrane Surface Mount MIL Spec
Electro-Mech	B•1702			¤	¤	¤	¤												¤			¤					¤	Display Lenses, Filters
Electronic Comps. Groupe	B•1704			¤	¤	¤	¤		¤	¤		¤			¤				¤			¤		¤				
Electro-switch	B•1705									¤			¤				¤				¤	¤		¤				Solid State; MIL Spec
Electroswitch Southern Op.	B•1706									¤	¤													¤				
Elma	B•1707	¤								¤	¤		¤								¤			¤		¤		
Entech Corp.	B•1701		¤	¤		¤	¤		¤	¤			¤		¤				¤			¤		¤				Leaf
Fifth Dimension	B•1710					¤		¤					¤			¤				¤			¤	¤				MIL Spec
Gordos	B•1712															¤												
Grayhill	B•1713	¤		¤					¤	¤	¤	¤	¤		¤						¤			¤		¤		MIL Spec.
Grimes	B•1720			¤																								MIL Spec.
Hamlin	B•1721							¤										¤		¤				¤				
Hartman	B•1722		¤		¤												¤							¤		¤		
Hasco Comps.	B•1723	¤	¤					¤	¤						¤				¤	¤				¤				

Manufacturer	Page No.	DIP	Lever	Pushbutton: Momentary Action	Pushbutton: Positive action	Pushbutton: Interlock	Pushbutton: Push-on/Push-off	Reed	Rocker/Paddle	Rotary: Single Section	Rotary: Multisection	Slide	Snap action	Thumbwheel	Toggle	Mercury	Features: Decade	Features: Explosion Proof	Features: Illuminated	Features: High Voltage	Features: Key Lock	Features: Power	Features: RF	Features: Sealed	Features: Touch	Features: Coded	Hardware	Other Type
Hermetic Switch	B•1724							¤												¤		¤	¤	¤				
IDEC	B•1725			¤															¤									
Ilinois Lock	B•1726																				¤							Locks, Dial & Shaft
Inter-Market	B•1728														¤												¤	
International Resourc	B•1729			¤			¤					¤																
ITT Schadow	B•1730			¤	¤	¤	¤			¤	¤								¤			¤		¤		¤		
ITW Switches	B•1734		¤			¤			¤	¤	¤	¤	¤						¤		¤	¤		¤			¤	Surface Mount Solid State; MIL Spec.
IVO Industries	B•1747			¤		¤	¤							¤												¤		
JAE Electronics	B•1748	¤		¤										¤							¤			¤				
Janco	B•1750			¤						¤	¤									¤	¤		¤	¤		¤	¤	MIL Spec
Lucas Ledex	B•1752			¤		¤				¤	¤								¤		¤			¤		¤		
LZR Electroniocs	B•1756	¤							¤															¤				MIL Spec.
Marlee Switch	B•1758							¤															¤					Solid State; MIL Spec.; Matrix
Marquardt	B•1759			¤				¤	¤			¤	¤						¤			¤		¤				Keyboard, Line Voltage Selector
McGill Photoelectric	B•1764			¤					¤				¤											¤				Sensors
Mechanical Enterprises	B•1767			¤			¤												¤									
Mepco/Centralab	B•1768			¤						¤	¤								¤									
Mepcopal	B•1771	¤								¤	¤																	Surface Mount
Micro Switch	B•1772		¤	¤		¤	¤		¤	¤	¤		¤		¤	¤			¤		¤	¤		¤	¤			Hall Effect Sensors

Manufacturer	Page No.	DIP	Lever	Pushbutton				Reed	Rocker/Paddle	Rotary		Slide	Snap action	Thumbwheel	Toggle	Mercury	Features										Hardware	Other Type
				Position																								
				Momentary Action	Positive action	Interlock	Push-on/Push-off			Single Section	Multisection						Decade	Explosion Proof	Illuminated	High Voltage	Key Lock	Power	RF	Sealed	Touch	Coded		
Molex	B•1775			¤														¤						¤	¤			Membrane
NKK Switches	B•1776	¤	¤	¤	¤		¤		¤	¤	¤	¤			¤				¤			¤	¤		¤	¤		
Oak Switches	B•1778		¤	¤				¤	¤	¤	¤	¤	¤						¤		¤	¤	¤	¤	¤	¤	¤	MIL Spec Solid State
Omega Engineering	B•1779																											Temperature, Pressure, Strain
Omron	B•1780	¤		¤							¤	¤		¤	¤					¤	¤	¤	¤					Solid State
Oslo Controls	B•1782			¤					¤										¤		¤	¤						
Otto Controls	B•1784			¤	¤	¤	¤						¤		¤			¤						¤			¤	
Preh Electronic Switch	B•1786		¤									¤							¤			¤						Key Two position
Pres-Air-Trol	B•1787			¤													¤	¤			¤		¤					Pressure, Vaccuum, Potentio-meters
Shallco	B•1788	¤								¤	¤								¤		¤	¤		¤		¤		MIL Spec.
Shogyo	B•1794		¤	¤	¤	¤	¤		¤	¤	¤	¤¤			¤							¤						
Standard Grigsby	B•1796									¤	¤												¤			¤		MIL Spec.
Standex	B•1798					¤		¤								¤				¤		¤		¤				
Switchcraft	B•1801		¤	¤	¤	¤	¤		¤			¤			¤				¤	¤		¤	¤				¤	
T-Bar	B•1804			¤											¤								¤					Multipole
Tech Labs.	B•1805			¤	¤		¤			¤	¤		¤	¤														
Veetronix	B•1806			¤	¤	¤	¤	¤										¤	¤					¤			¤	

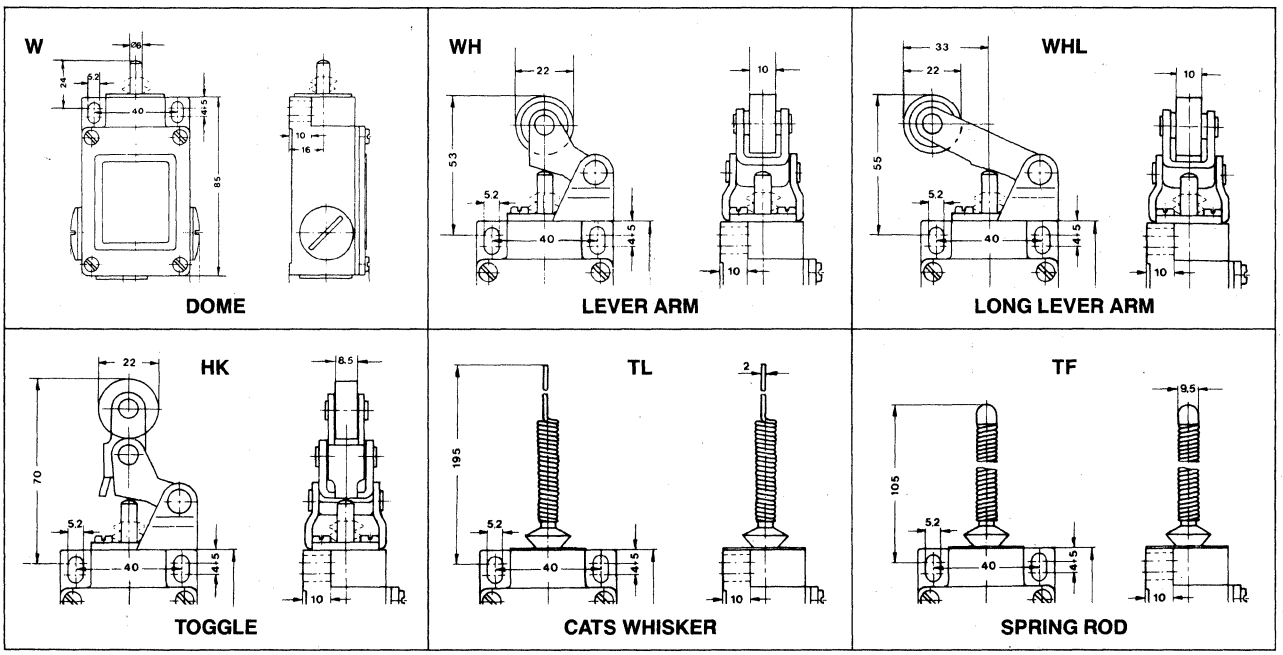
Altech ....Supplying Solutions



- Precise Limit
- Magnetic Position
- Tension Safety Switch
- Foot Operated Switches
- Multi-Position
- Power or Control Circuits
- Joystick Operators
- Control Console Chairs
- Custom Design Capabilities

Altech Limit Switch Operators

E61 SERIES

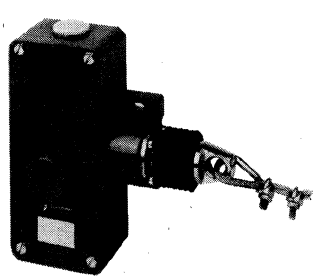


Dimensions Shown in mm.

Limit Switch Specifications:

	Max. Volts	Amp Rating	Max. Switch Cycle	Life	Mechanical Tolerance
E 12 (Encapsulated)	30 VDC, 250 VAC	5A	2/sec	50 mil	0.20″
E 95 (Thermoplastic)	380 VAC	6A	2/sec	10 mil	0.12″
E 41 (Standard)	380 VAC	10A	2/sec	10 mil	0.12″
C 50 (Clear Plastic)	380 VAC	4A	2/sec	10 mil	0.12″
E 51 (Mini, Metal)	380 VAC	4A	2/sec	10 mil	0.12″
E 61 (Heavy Duty)	500 VAC	16A	2/sec	10 mil	0.12″
E 63 (Special Head)	500 VAC	16A	2/sec	10 mil	0.12″

Call us for information on Magnetic Positioning, Trip Wire Safety, Foot Operated Switches. Altech offers a variety of switches for power & control.



For immediate assistance, call 201-359-4454 or FAX: 201-359-8178

Altech Corp. **"Puts it all-together" by**

Supplying Modern Solutions...to current problems.

349 Route 206 South, Somerville, NJ 08876.

AME SWITCH SEALS

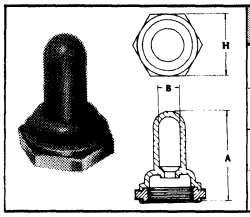
Backed by over 25 years of engineering solutions — for an ever-changing and demanding market.

The wide demand for custom-molded panel and switch seals, threaded inserts bonded to rubber, O-rings, boots and seals, etc., translated is really a demand for talent and know-how to handle the engineering and molding of particularly thorny or unusual custom requirements that frequently plague industry. AME meets the demand. . . with experience, service and unique production techniques.

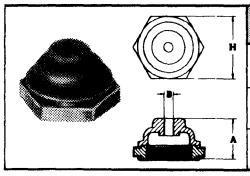
CUSTOM ENGINEERED PRECISION MOLDED ELASTOMERS

- Color filters for incandescent lamps
- Rubber to metal bonding
- Clear silicone products
- Self-sealing hex nuts
- Self-sealing washers
- Extrusions
- O-rings
- Boots
- Gaskets
- Seals
- Conductive rubber
- Die cutting

TOGGLE SWITCH SEALS

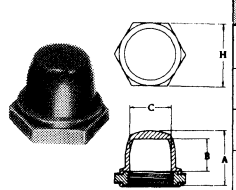


Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1100	M5423/01-01	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(21.84)	(5.59)	(15.88)	
1102	None	15/32-32 UNS-2B	in.	.86	.22	.625 Hex	
			mm	(21.84)	(5.59)	(15.88)	
1103	None	15/32-32 UNS-2B	in.	.90	.22	.625 Hex	Nut-Brass, Rubber-Neoprene, 50 Durometer Black
			mm	(22.86)	(5.59)	(15.88)	
1105	M5423/05-01	1/4-40 UNS-2B	in.	.50	.064	.375 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 30 Gray
			mm	(12.70)	(1.63)	(9.53)	



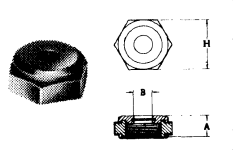
Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	H	Material Specifications
1101	M5423/02-01	15/32-32 UNS-2B	in.	.40	.09	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 50 Gray
			mm	(10.16)	(2.29)	(15.88)	
1104	None	5/8-24 UNEF-2B	in.	.75	.09	.812 Hex	
			mm	(19.05)	(2.29)	(20.62)	
1106	M5423/11-01	1/4-40 UNS-2B	in.	.25	.05	.375 Hex	
			mm	(6.35)	(1.27)	(9.53)	

PUSH BUTTON SWITCH SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	B	C	H	Material Specifications
2100	M5423/07-01	15/32-32 UNS-2B	in.	.55	.32	.42	.625 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(13.97)	(8.13)	(10.67)	(15.88)	
2101	None	1/2-32 UNS-2B	in.	.46	.29	.41	.750 Dia.	
			mm	(11.68)	(7.37)	(10.41)	(19.05)	
2102	M5423/07-02	15/32-32 UNS-2B	in.	.72	.48	.42	.625 Hex	
			mm	(18.29)	(12.19)	(10.67)	(15.88)	
2103	M5423/10-01	1/4-32 UNEF-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	
2104	M5423/10-02	1/4-40 UNS-2B	in.	.31	.20	.19	.375 Hex	
			mm	(7.87)	(5.08)	(4.83)	(9.53)	

ROTARY SWITCH & POTENTIOMETER SEALS



Part Number	Equiv. Military Part Number	Thread Size	Unit	A	Size of Shaft B	H	Material Specifications
3100	M5423/09-02	3/8-32 UNEF-2B	in.	.22	.250	.500 Hex	Nut-Brass, Nickel Plated, Rubber-Silicone per ZZ-R-765 Class III, Grade 60 Gray
			mm	(5.59)	(6.35)	(12.70)	
3101	M5423/09-01	3/8-32 UNEF-2B	in.	.22	.125	.500 Hex	
			mm	(5.59)	(3.18)	(12.70)	
3102	M5423/09-04	15/32-32 UNS-2B	in.	.22	.250	.625 Hex	
			mm	(5.59)	(6.35)	(15.88)	

MANY OTHER SIZES AND TYPES AVAILABLE

Pressure capabilities: Internal Pressure
1 Atmosphere, 15 psi (103.4 kPa)
External Pressure
2 Atmospheres, 30 psi (206.8 kPa)
For Part #1106 — Internal pressure
.7 Atmosphere, 10 psi (69 kPa)
External pressure
1.4 Atmospheres, 20 psi (138 kPa)

Endurance: Exceeds 100,000 actuations (depending on environment).

Useful life: 20 years to unlimited (depending on environment).

Switch Seals are designed and manufactured to meet or exceed applicable military specifications.

FAX (201) 263-8199

Switch Seals

An elastomeric boot which seals, thus protecting a switch and internal components against hazardous foreign elements. AME's one piece switch seal is constructed of a flexible rubber boot element bonded during molding to a threaded metal insert that fully encapsulates the switch and bushing to the panel.

This assembly replaces the panel mounting nut and seals the mounting hole making it watertight. It protects against moisture, oil, dirt, dust, most solvents, many acids (see elastomer selection guide).

Switch seals provide vibration resistant mounting and act as double insulation with no interference to switch movement.

CAST URETHANE & SILICONE

AME supplies cast urethane and silicone products precision engineered to meet your most demanding requirements.

If you need high tensile/tear strength, excellent resistance to abrasion and high impact capability, our cast urethane is ideally suited for the job. Superb temperature resistance to the damaging sub-zero cold or searing heat extremes is found in the cast silicone custom engineered by AME Corporation.

AME CORPORATION
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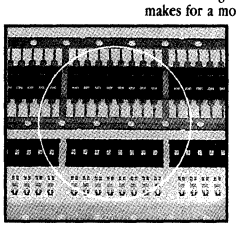
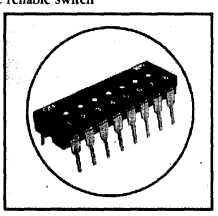
(201) 263-1700

SWITCH SEALS

THE WORLD'S SMALLEST SURFACE MOUNT DIP SWITCH!

American Research & Engineering's strip molding process makes for a more reliable switch





It's More Reliable

Three simple components: two composite metal/plastic strips and one plastic molded cover replaces a 25 piece assembly to make a switch that's more reliable because it's more consistent.

SAME SIZE AS AN IC!

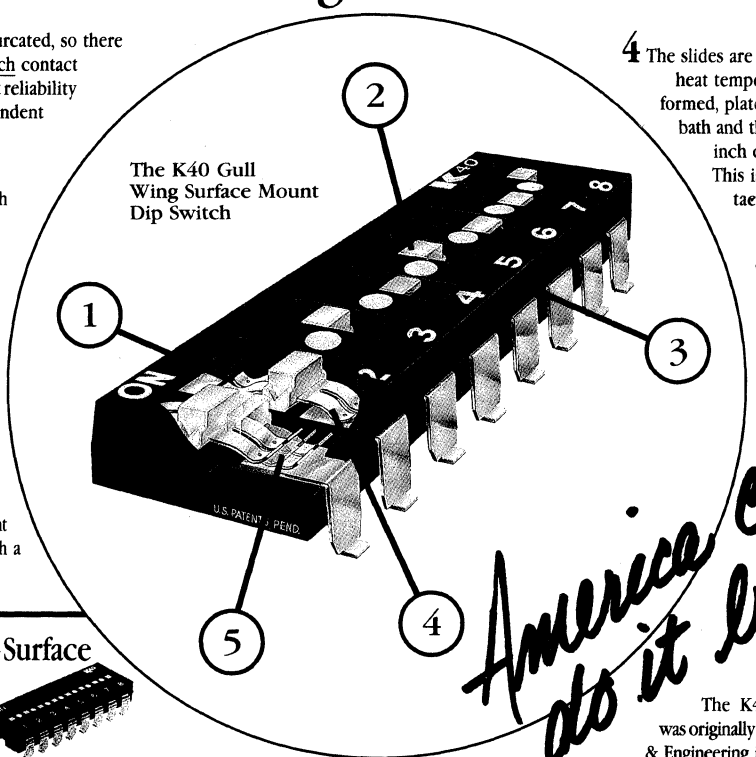
If you don't have automatic insertion equipment, we're banking that some day you will. In the meantime, your board will look neater, better and more professional. And if you have insertion equipment, you'll save the cost of hand insertion!

Three New Patent Designs That Use 40% Less Parts

1 The slides are split, or bifurcated, so there are two separate slides for each contact point. This doubles the contact reliability because you have two independent gold plated contacts at each switch point.

2 The switches are flush with the cover to eliminate accidental, on-off movement once the DIP is programmed. Simple.

3 The package is sealed. The lead frame is molded directly into the housing to provide a one piece, no-leak construction. The cover is ultrasonically molded to the frame after the switch is assembled. There is no better construction. The Surface Mount housing is made of Ryton with a Kapton tape seal.

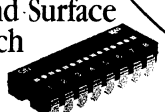


4 The slides are made from beryllium copper, heat tempered to a full hardness, spring formed, plated in a 100 micro inch nickel bath and then spot gold plated 30 micro inch deep at all the contact points. This is the best proven switch contaet surface that money can buy.

5 Every one of the switch contact surfaces on the main lead frame are plated with 30 micro inch of gold over 100 micro inch of nickel.

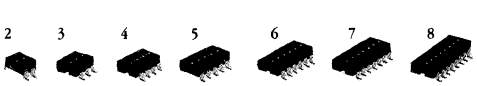
America can do it better!

The K40 "J" Bend Surface Mount Dip Switch



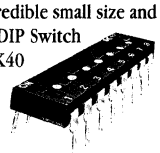
Also available for the design engineer trying to save every microinch of board real estate is the K40 "J" bend Surface Mount DIP Switch in positions two through eight.

All K40 Dip Switches Are Available In Positions Two Thru Eight!



The K40 Standard Pin Dip Switch

The K40 standard pin DIP Switch was originally designed by American Research & Engineering in 1982 as the world's smallest DIP Switch. It was with its incredible small size and durability that the K40 standard pin DIP Switch led to the development of the new K40 Surface Mount DIP Switch lineup. Lead time for the K40 standard pin DIP Switch is seven to fourteen days and fourteen to twenty-one days for the K40 Gullwing or "J" bend DIP Switch. All K40 switches are manufactured at our plant in Elgin, Illinois.



FREE SAMPLE! Send Us Your Business Card Stapled To Your Letterhead

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1500 EXECUTIVE DRIVE, ELGIN, IL. 60123 1-312-888-7245
FAX [312] 888-7094

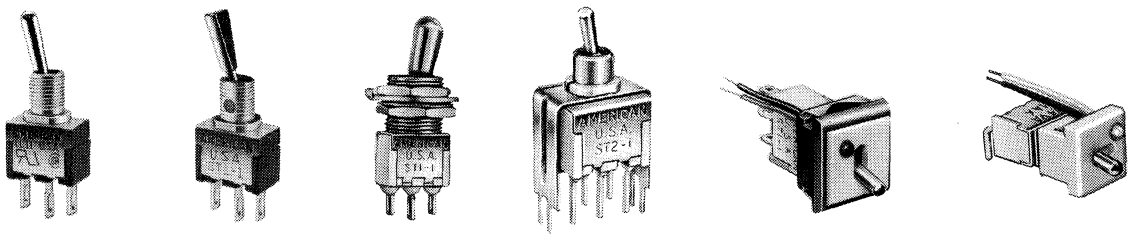
Your best source for quality engineered and innovative products.

ASC

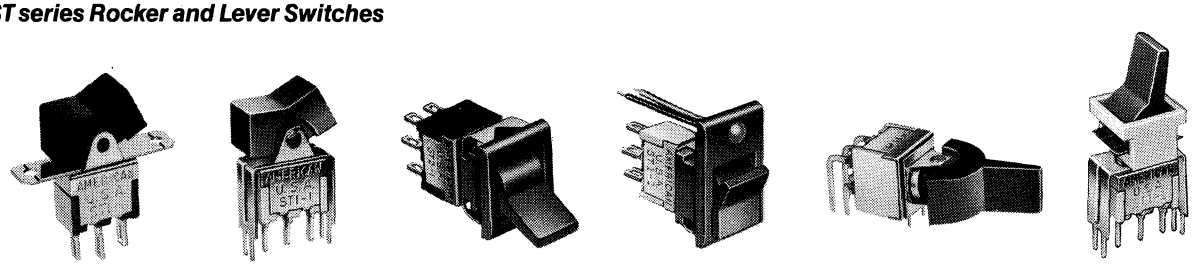
American Switch Corp.

- **Subminiature toggle, rocker, lever and pushbutton switches, lighted and unlighted.**
- **Ratings from dry circuit to 6 amps @ 125 VAC, 3 amp @ 250 VAC or 7 amps @ 30 VDC.**
- **Designed and manufactured in Wakefield, MA.**
- **Incomparable service and deliveries – Highest quality and value.**
- **Responsive application and engineering assistance.**
- **Ongoing new product development with emphasis on innovation.**

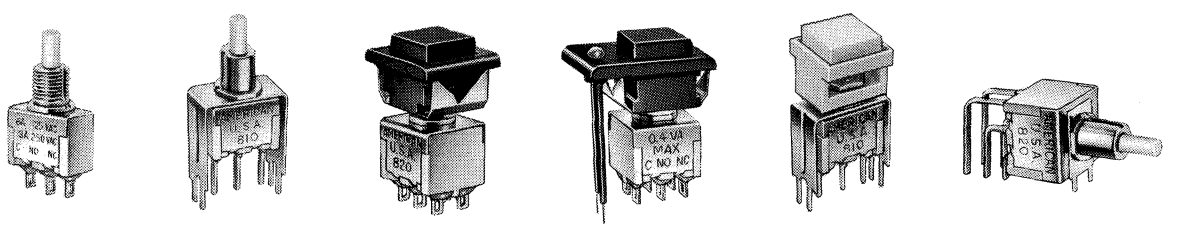
ST series Toggle Switches



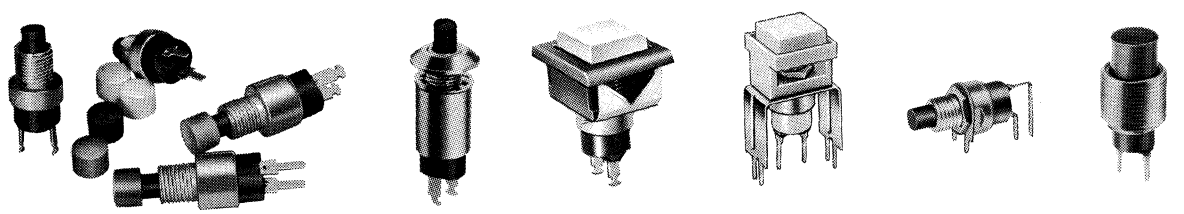
ST series Rocker and Lever Switches



800 series snap-action momentary Pushbutton Switches and PB series momentary Pushbutton Switches



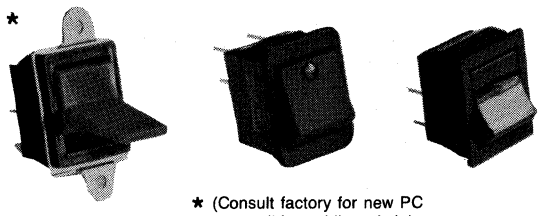
300 and 400 series Pushbutton Switches with momentary or alternate action



AMERICAN SWITCH CORP./134 WATER STREET, WAKEFIELD, MA 01880/TEL. (617) 246-1007/TWX 710-348-6756/FAX (617) 245-4531

DOUBLE POLE ROCKER SWITCHES — 1350 SERIES

LIGHTED AND NON LIGHTED



* (Consult factory for new PC compatible paddle switch.)

ELECTRICAL SWITCH RATINGS

4A 125/250VAC IND
16A 125/250 VAC
20A 6, 12, 28 VDC

HIGH IN RUSH 150A

INTERNATIONAL ELECTRICAL APPROVALS

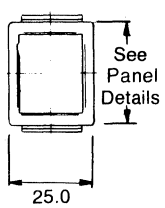
CURRENT APPROVAL DETAILS ON REQUEST

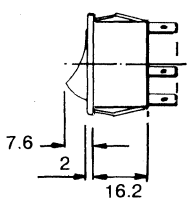
BASIC SWITCH TYPES

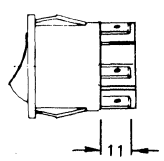
CATALOG NO.	CIRCUIT	FUNCTION			LIGHTED	PANEL CUTOUT	PANEL FLANGE	PANEL THICK	TERMINAL
1350		ON	—	OFF	No	A: 27.2 / 27.3 × 22.3/22.4	A: 30.2 × 25.0	.75 and 3.3mm (A)	C: 9.1, 6.3 Tab, Terminal 0.8mm thick
1353		ON	—	OFF	Yes				
1358		ON	—	OFF	Yes	B: 30.0 / 30.1 × 22.1/22.2	B: 33.4 × 25.0	.75 and 2.5mm (B)	G: 10.0, 6.3 positive lock Tab Terminal 0.8mm thick
1390		ON	—	OFF	Yes				T: 7.0, Solder Tag

Light in one Line

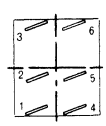
BODY DETAIL







With terminal barrier M441



P

illuminated spot

V

curved

All dimensions in millimeters.

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	ROCKER STYLE	PANEL CUTOUT	BODY COLOR[1]	ROCKER/LENS COLOR	VOLTAGE[2]	OPTION
C Solder Lug **G** 6.3 Tab **T** Solder Tag	**From table**	**V**-curved **P**-illuminated spot **W**-moisture[3] resistant	**A** **B**	**B** black **W** white	**Non-lighted** **B** black **R** red **W** white **Lighted** **A** amber **C** clear **G** green **R** red	**Incandescent** **6**-6V **7**-12V **8**-24V **Neon** **2**-100/130V **3**-200/250V	Rear terminal barrier M441

1 Body available in textured finish only
2 Lighted model only
3 Non-Lighted model only

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

SINGLE POLE ROCKER SWITCHES

5503 SERIES LIGHTED 1400/1500 SERIES NON-LIGHTED

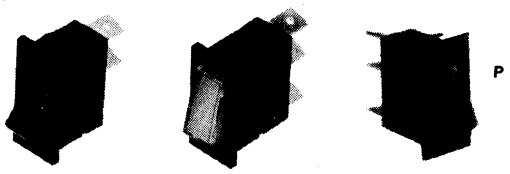
ELECTRICAL SWITCH RATINGS

1400: 10A, 125/250 VAC resistive
3A,125/250 VAC inductive
16A, 12 or 24 VDC resistive

1500: 16A, 125/250 VAC resistive
5503 4A, 125/250 VAC inductive
20A, 12 or 24 VDC resistive

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST



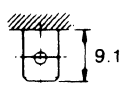
BASIC SWITCH TYPES

BASIC CATALOG NUMBER		CIRCUIT	FUNCTION		LIGHTED
10AMP	16AMP				
	5503	SPST	ON	OFF	YES
1400	1500	SPST	ON	OFF	NO
1401	1501	SPST	(ON)	OFF	NO
1402	1502	SPST	ON	(OFF)	NO
1410	1510	SPDT	ON	ON	NO
1411	1511	SPDT	(ON)	ON	NO
1420	1520	SPDT	ON OFF	ON	NO
1421	1521	SPDT	(ON) OFF	ON	NO
1422	1522	SPDT	(ON) OFF	(ON)	NO

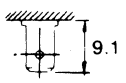
( ) = momentary

5503 only

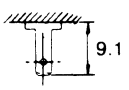
TERMINALS



C 6.3 Tab Terminal 0.8mm thick

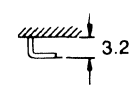


H 4.8 Tab Terminal 0.8mm thick



K 2.8 Solder Tag 0.8mm thick

T Solder Tag

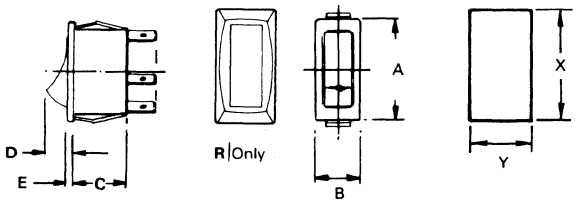


U Solder Tag

BODY DETAIL

All dimensions in millimeters.

SWITCH BODY **PANEL FLANGE** **PANEL CUTOUT**



Panel thickness 0.75 Min. 2.5 Max

1400/1500 NON—LIGHTED MODELS

	A	B	C	D	E	PANEL CUTOUT X	PANEL CUTOUT Y
A	30.2	14.0	16.2	7.6	2.0	27.2-27.3	12.3-12.2
M	30.9	14.0	16.2	7.6	2.0	30.0-30.1	11.1-11.0
Q	30.2	14.0	16.2	7.6	2.0	28.2-28.3	11.6-11.5
R	31.5	17.0	19.5	7.6	2.0	28.6-28.6	14.0-14.1

5503 LIGHTED MODELS/FLAT ROCKER ONLY

	A	B	C	D	E	PANEL CUTOUT X	PANEL CUTOUT Y
A	30.2	14.0	19.5	7.6	2.0	27.2-27.3	12.3-12.2
L	32.0	13.9	19.5	7.6	2.0	30.0-30.1	11.1-11.0
Q	30.2	14.0	19.5	7.6	2.0	28.2-28.3	11.6-11.5
R	31.5	17.0	19.5	7.6	2.0	28.6-28.6	14.0-14.1

HOT STAMP MARKINGS AVAILABLE. CONSULT FACTORY.
MATCHING INDICATOR LIGHTS AVAILABLE.

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	ROCKER STYLE	PANEL CUTOUT	BODY COLOR	ROCKER/LENS COLOR	VOLTAGE[1]
C H K T U } See dwgs.	From table	V curved[2] F flat W moisture[2] resistant **P-illuminated spot**	A L M Q R } See Chart	B black W white Gloss finish Textured finish available	**Non-Lighted** B black R red W white **Lighted** A amber B blue[3] C clear G green R red	**Incandescent** 6 6V 7 12V 8 24V **Neon** 2 110/130V 3 200/250V

1 Lighted model only
2 Unlighted model only
3 Available with incandescent lamp only

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

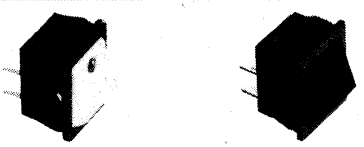
DOUBLE POLE ROCKER SWITCHES

1450/1550 SERIES LIGHTED AND NON-LIGHTED

ELECTRICAL SWITCH RATINGS

1450: 10A, 125/250 VAC resistive
3A,125/250 VAC inductive
16A, 12 or 24 VDC resistive

1550: 16A, 125/250 VAC resistive
4A, 125/250 VAC inductive
20A, 12 or 24 VDC resistive



BASIC SWITCH TYPES

BASIC CATALOG NO.		CIRCUIT	FUNCTION	LIGHTED
10A	16A			
1450 1450SP*	1550 1550SP*		ON OFF	No
1451 1451SP*	1551 1551SP*		(ON) OFF	No
1452 1452SP*	1552 1552SP*		ON (OFF)	No
1453	1553		ON OFF	Yes
1460 1460SP*	1560 1560SP*		ON ON	No
1461 1461SP*	1561 1561SP*		ON (ON)	No
1462	1562		Single Pole 2-position 2-circuit	No
1470 1470SP*	1570 1570SP*		ON OFF ON	No
1471 1471SP*	1571 1571SP*		ON OFF (ON)	No
1472 1472SP*	1572 1572SP*		(ON) OFF (ON)	No
1458	1558		ON OFF	Yes
1466	1566		ON ON Isol. Light	Yes
1490	1590		ON OFF Light in one Line	Yes

( ) = momentary

*SP = single pole switch in this body

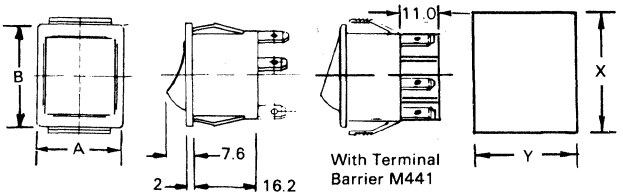
INTERNATIONAL ELECTRICAL APPROVALS

BEAB VDE KEMA KEUR OVE S M D UL CSA S D UL CSA N FI

CURRENT APPROVAL DETAILS ON REQUEST

BODY DETAIL

All dimensions in millimeters.



	BODY FLANGE		PANEL CUTOUT	
	A	B	X	Y
A*	30.2	25.0	27.2-27.3	22.3-22.4
B**	33.4	25.0	30.0-30.1	22.1-22.2
D*	32.0	25.0	29.4-29.5	22.0-22.1
E**	30.2	25.0	29.4-29.5	22.0-22.1
F**	33.4	25.0	29.4-29.5	22.0-22.1
Q*	30.2	25.0	28.2-28.3	22.3-22.4

* Square corner bezel ** Round corner bezel

SNAP-IN MOUNTING

Panel thickness between .75 and 3.3mm (A,Q.)

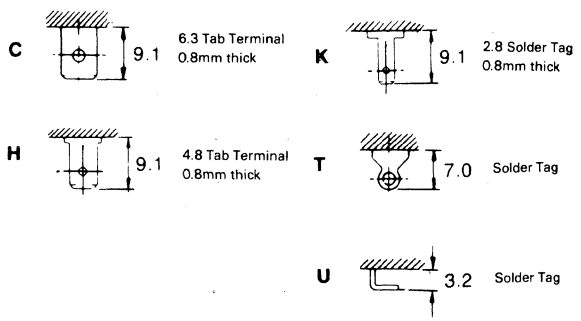
Panel thickness between .75 and 2.5mm (B.)

Panel thickness between .75 and 1.2mm (D,E,F.)

HOT STAMP MARKINGS AVAILABLE. CONSULT FACTORY.

MATCHING INDICATOR LIGHTS AVAILABLE.

TERMINALS



ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	ROCKER STYLE	PANEL CUTOUT	BODY COLOR[1]	ROCKER/LENS COLOR	VOLTAGE[2]	OPTION
C H K T U } See dwgs.	From table	**F** flat **V** curved **P** illuminated spot[2] **W** moisture[3] resistant	**A** **B** **D** **E** **F** **Q** } See table	**B** black **W** white	**Non-lighted** **B** black **R** red **W** white **Lighted** **A** amber **B** blue[4] **C** clear **G** green **R** red	**Incandescent** **6**-6V **7**-12V **8**-24V **Neon** **2**-100/130V **3**-200/250V	Rear terminal barrier M441 See Page 24

1 Body available in gloss and textured finish only
2 Lighted model only
3 Non-lighted curved only
4 Incandescent voltages only

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

DOUBLE POLE ROCKER SWITCHES

5500 SERIES LIGHTED AND NON-LIGHTED

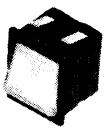
ELECTRICAL SWITCH RATINGS

16A, 125/250 VAC resistive 4A, 125/250 VAC inductive 20A, 12 or 24 VDC

BASIC SWITCH TYPES

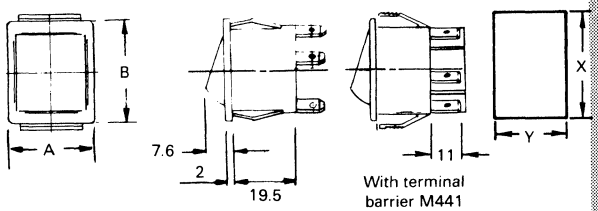
BASIC CATALOG NO.	CIRCUIT	FUNCTION	LIGHTED
5550		ON OFF	NO
5551		(ON) OFF	NO
5552		(ON) OFF Isol. Light	YES
5553		ON OFF	YES
5554		(ON) OFF	YES
5555		(ON) OFF-SP	YES
5556		ON OFF-SP Isol. Light	YES
5557		ON OFF Isol. Light	YES
5558		ON OFF-SP	YES
5559		(ON) OFF-SP Isol. Light	YES
5560		ON ON	NO
5562		ON OFF 2 Circuit	NO
5564		CIR 1 ON ON CIR 2 ON OFF	NO
5566		SP Isol. Light In One Pole	YES
5567		ON ON	YES
5568		CIR 1 ON OFF Light In One Pole	YES
5590		ON OFF Light In One Pole	YES
5591		(ON) OFF Light In One Pole	YES
5592		CIR 1 ON OFF CIR 2 ON ON	YES

Switching diagrams viewed from rear of switch.
( ) = momentary SP = single pole



BODY DETAIL

All dimensions in millimeters.



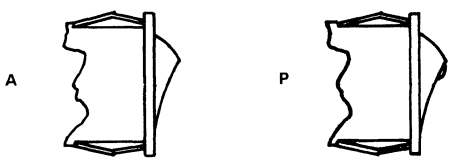
With terminal barrier M441

ORDER NO.	BODY FLANGE A	BODY FLANGE B	PANEL CUTOUT X	PANEL CUTOUT Y
L	24.9	32.0	30.1 30.0	22.1 22.2
T	25.0	30.2	28.2 28.3	22.3 22.4
B	24.9	33.4	30.1 30.0	22.1 22.2

Panel Thickness .75 Min - 2.5 Max

TERMINALS

ROCKER STYLES



INTERNATIONAL ELECTRICAL APPROVALS

BEAB KEMA KEUR OVE S M D DE S D UL CSA N FI

CURRENT APPROVAL DETAILS ON REQUEST

ORDERING INFORMATION

TERMINAL

C, T } See dwgs.

BASIC CATALOG NO.

From table

ROCKER STYLE

A contoured
P illuminated spot

PANEL CUTOUT

L, T, B } See table

BODY COLOR

B Black
W White

ROCKER/LENS COLOR

Lighted
A amber
B blue[2]
C clear
G green
R red

Non-lighted
B black
R red
W white

VOLTAGE [3]

Incandescent[4]
6-6V
7-12V
8-24V

Neon
2-100/130V
3-200/250V

OPTION

Rear terminal barrier M441

1 Body textured finish only
2 Incandescent voltages only
3 Lighted model only
4 Not available in momentary versions

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

SLIDE SWITCHES

2000 SERIES

ELECTRICAL RATING:

12A, 125 VAC, resistive

BASIC SWITCH TYPES

BASIC CAT. NO.	NO. OF SWITCHING POSITIONS	CODE NO.	FUNCTION
2	2	1	2-Pos SP
		3	On Off SP
		2	2-Pos DP
		4	On Off DP
2	3	1	3-Position SP
		3	3-Position SP Including Off
		2	3-Position DP
		4	3-Position DP Including Off
2	4	1	4-Position SP
		3	4-Position SP Including Off
		2	4-Position DP
		4	4-Position DP Including Off
2	5	1	5-Position SP
		3	5-Position SP Including Off
		2	5-Position DP
		4	5-Position DP Including Off

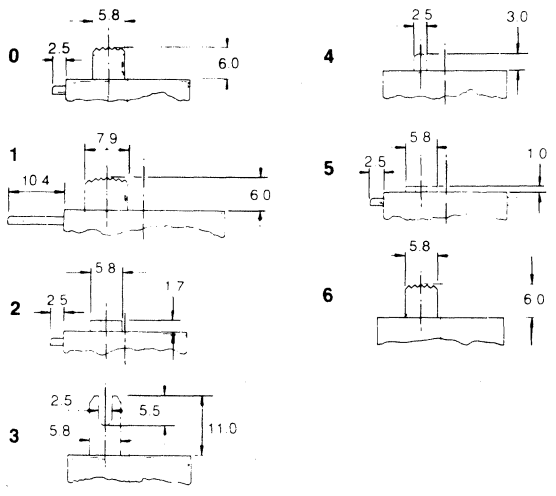
SP = Single Pole
DP = Double Pole

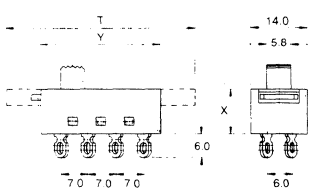
MARKING EXAMPLES

115/230
120/240
ON/OFF
etc.

SLIDER DETAIL

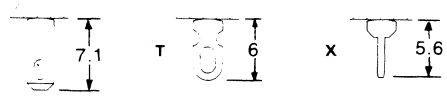
All dimensions in millimeters.





Pos	X	Y	T
2	12	23	41.5
3	11	30	47
4	11	37	—
5	11	44	—

TERMINALS

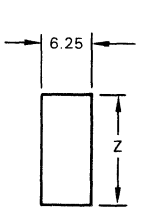


B: 2.8 x 0.5mm thick (3 Amp only)
T: 3.0 x 0.8mm thick
X: PCB Terminal 0.8 Sq.

MOUNTING DETAIL

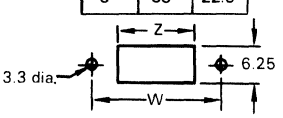
A- WITHOUT MOUNTING HOLES

Pos	Z
2	13.3
3	22.3
4	29.3
5	36.3



B- WITH MOUNTING HOLES

Pos	W	Z
2	34	13.3
3	38	22.3



Mounting Holes

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

ORDERING INFORMATION

TERMINAL — B, T, X } See dwgs.

BASIC CATALOG NO. — 2

NO. SWITCHING POSITIONS — From table

FUNCTION CODE — From table

SLIDER DETAIL — 0, 1, 2, 3, 4, 5, 6 } See dwgs.

MOUNTING DETAIL — A w/o holes; B w/ holes See dwg.

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

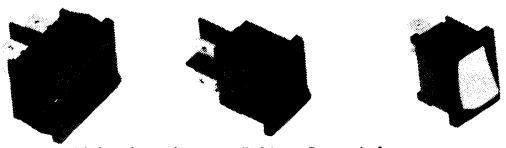
SINGLE AND DOUBLE POLE SUBMINIATURE ROCKER SWITCHES

8400/8550 SERIES

ELECTRICAL SWITCH RATINGS

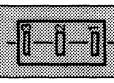
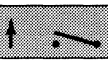
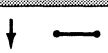
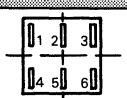
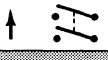
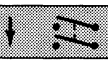
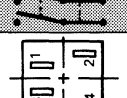
8400, 8450
6A 125/250 VAC resistive
1A 125/250 VAC inductive
Momentary Types
4A 125/250 VAC resistive

8550
6A 125/250 VAC resistive
U.L. Rating



Lighted versions available. Consult factory.

BASIC SWITCH TYPES

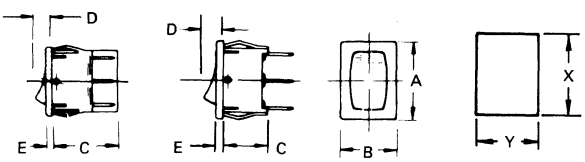
BASIC CATALOG NO.	CIRCUIT	FUNCTION
		
8400		ON OFF
8401		(ON) OFF
8402		ON (OFF)
8410		ON ON
8411		(ON) ON
*8430		Indicator Light
		
8450		ON OFF
8451		(ON) OFF
8452		ON (OFF)
8460		ON ON
8461		(ON) ON
		
8550		Double Pole ON OFF

*8430 indicator light available in various voltages and colors. Consult factory for details.
( ) momentary

BODY DETAIL

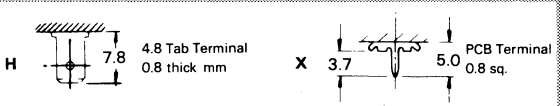
All dimensions in millimeters.

SWITCH BODY B W/Terminal Barrier SWITCH BODY C W/O Terminal Barrier PANEL FLANGE PANEL CUTOUT



SERIES	BODY TYPE	BODY DIMEN. A	B	C	D	E	PANEL CUTOUT PANEL THICKNESS	X	Y
8400	B No Terminal Barrier	21.0	15.0	11.8	5.1	2.0	0.75-1.25	19.2/19.1	13.0/12.9
							1.25-2.0	19.4/19.3	13.0/12.9
							2.0-3.0	19.8/19.7	13.0/12.9
8450	B With Terminal Barrier	21.0	24.0	18.9	5.1	2.0	0.75-1.25	19.2/19.1	21.9/22.0
							1.25-2.0	19.4/19.3	21.9/22.0
	C No Terminal Barrier	21.0	24.0	11.8	5.1	2.0	2.0-3.0	19.8/19.7	21.9/22.0
8550	B With Terminal Barrier	21.0	15.0	22.5	5.0	2.0	0.75-1.25	19.2/19.1	13.0/12.9
							1.25-2.0	19.4/19.3	13.0/12.9
							2.0-3.0	19.8/19.7	13.0/12.9

TERMINALS



X Not available in 8450B or 8550 body

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	ROCKER STYLE	BODY DETAIL	BODY COLOR	ROCKER COLOR
H, X } See dwgs.	From table	V curved	B with terminal barrier C without terminal barrier	B black W white	B black W white R red

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

LEVER SWITCHES

1700/1800/2700 SERIES

ELECTRICAL SWITCH RATINGS

1700:	16A, 125 250 VAC, resistive	20A 12, 24 VDC resistive
1800:	10A, 125/250 VAC, resistive	16A 12, 24 VDC resistive
2700 DP:	D P 13A 125 250 VAC	16A 12, 24 VDC resistive
2700:	Selective 3A 125 250 VAC	Selective 5A, 12, 24 VDC resistive

BASIC SWITCH TYPES

SINGLE POLE

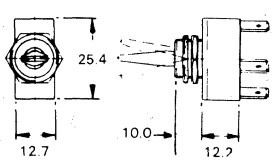
BASIC CAT. NO.		
1700 1800		ON OFF
1701 1801		(ON) OFF
1710 1810		ON ON
1720 1820		ON OFF ON

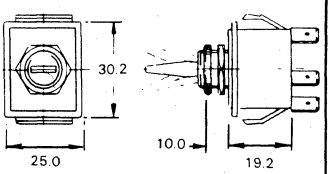
DOUBLE POLE

BASIC CAT. NO.		
1750 1850		ON OFF
1760 1860		ON ON
1770 1870		ON OFF ON

DOUBLE POLE

BASIC CAT. NO.	CIRCUIT	FUNCTION
2724		(ON) — OFF
2725		ON — (OFF)
2726		(ON) — ON
2734		(ON) OFF ON
2735		(ON) OFF (ON)



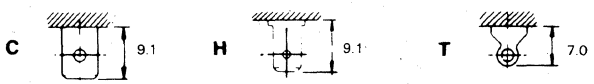


All dimensions in millimeters
( ) = momentary
Standard Hardware supplied M506 hex nut and T92 chrome knurled nut.
Max. Panel thickness: 3.5mm. This may be increased by omitting back nut.
12.7 Panel Hole

BASIC CAT. NO.	FUNCTION Pos. 1	Pos. 2	Pos. 3	TERMINAL CONNECTIONS Pos. 1	Pos. 2	Pos. 3	Line Term
Selective (3 Amp only)	3 2 1 / 6 5 4						
2744				OFF	A 4	A + B 4 1	2 or 5
2745				OFF	A 4	B 1	2
2746				A 3	A + B 3 4	B + C 4 1	2
2747				A 3	B 6	C 4	2
2748				A 3	B 1	B + C 1 4	2 or 5
2749				A 3	A + B 3 4	B 4	2 or 5

Switching diagrams viewed from rear of switch.
Numbers are terminal positions, as shown in drawing.

TERMINAL STYLES

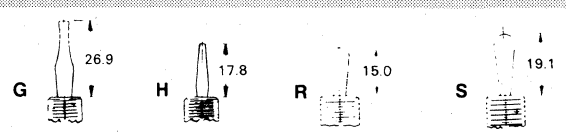


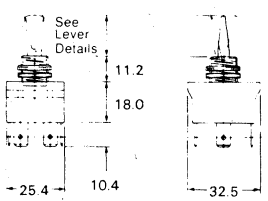
6.3 Tab Terminal 0.8mm thick

4.8 Tab Terminal 0.8mm thick

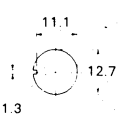
Solder Tab

LEVER STYLES





12.7 panel hole, or cut-out of following size:



INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

ORDERING INFORMATION

TERMINAL[1]	BASIC CATALOG NO.	LEVER STYLE[2]
C H T } See dwgs.	From table	G (ALL MODELS) H (ALL MODELS) R S } See dwgs.

1 2700 series only available with C terminal
2 R Lever for 1700/1800 single pole only
S Lever for 1700/1800 double pole only

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

HEAVY DUTY TOGGLE SWITCHES

LIGHTED AND NON LIGHTED

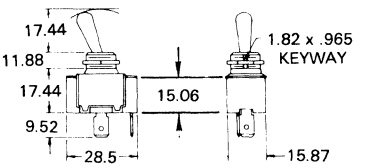
ELECTRICAL SWITCH RATINGS

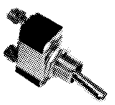
20 Amp 125 VAC Single Pole ¾ HP UL/CSA
10 Amp 250 VAC Double Pole 1.½ HP UL/CSA

All dimensions in millimeters.

BASIC CATALOG NO. — **SINGLE POLE**

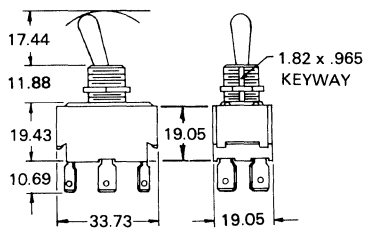
.250 Tab	6-32 Screw	Function
179652	179672	On Off
179652M	179672M	(On) Off
279652	279672	On On
379652	379672	On Off On
379652M	379672M	(On) Off On
379652MM	379672MM	(On) Off (On)



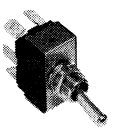


DOUBLE POLE

.250 Tab	6-32 Screw	Function
189652	189672	On Off
189652M	189672M	(On) Off
289652	289672	On On
289652M	289672M	(On) On
389652	389672	On Off On
389652M	389672M	(On) Off On
389652MM	389672MM	(On) Off (On)



12.7 Panel Hole



( ) = momentary

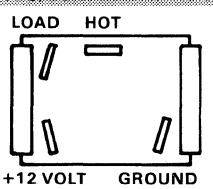
ORDERING INFORMATION

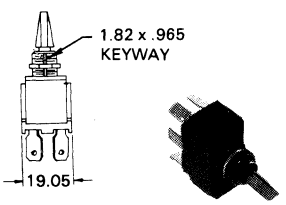
BASIC CAT. NO. [ ] FOR NEOPRENE SEAL ADD WS [ ]

SINGLE POLE SINGLE THROW LIGHTED ON-OFF SWITCH RATING 20 AMP 12VDC, BUILT IN LAMP 12 VOLT

BASIC CATALOG NO. — **FUNCTION**

.250 Tab	Color On	Color Off
170153RG	Red	Green
170153RW	Red	White
170153GW	Green	White
170253	Red	Red

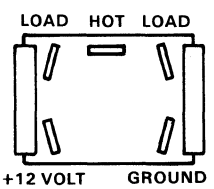


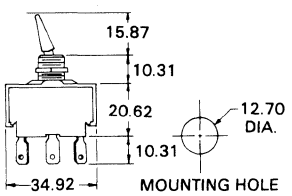


SINGLE POLE DOUBLE THROW LIGHTED ON-OFF-ON SWITCH RATING 20 AMP 12V 20 AMP DC, BUILT IN LAMP 12 VOLT

BASIC CATALOG NO. — **FUNCTION**

.250 Tab	Color On	Color Off	Color On
370153GR	Green	White	Red
370153RR	Red	White	Red
370153GG	Green	White	Green
370253	Red	Red	Red



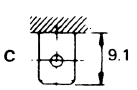


ORDERING INFORMATION

BASIC CAT. NO. [ ] NEOPRENE SEAL IS STANDARD

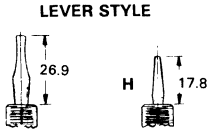
SINGLE POLE SINGLE THROW LIGHTED ON-OFF SWITCH RATING 16 AMP 12 VDC, BUILT IN LAMP 12 VOLT

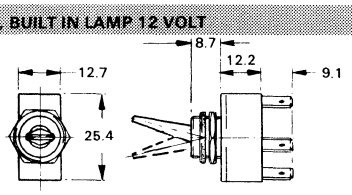
TERMINAL — **BASIC CAT NO.**



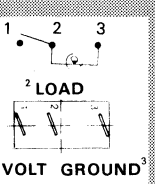
803

LEVER STYLE



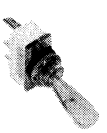


12.7 Panel Hole



ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	LEVER STYLE	LEVER COLOR
[ ]	[ ]	[ ]	[ ]
C	803	G H	A amber B blue C clear G green R red



Specifications subject to change without notice. Not all combinations always available.

ARCOELECTRIC CORPORATION. 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

7000

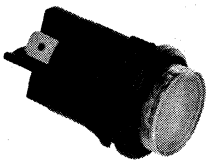
PUSH BUTTON LIGHTED, NON LIGHTED

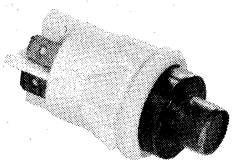
ELECTRICAL SWITCH RATING

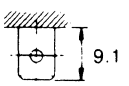
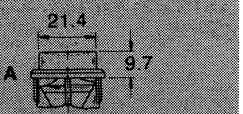
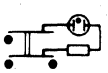
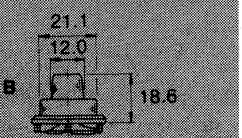
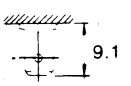
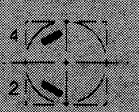
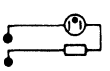
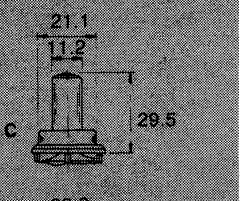
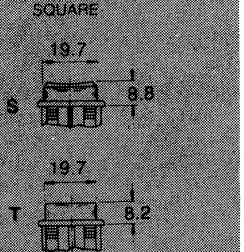
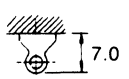
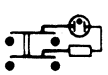
16A, 125/250VAC, resistive UL/CSA

A RANGE OF HIGH AMPERAGE SWITCHES WITH QUICK SNAP IN MOUNTING, OFFERING A VARIETY OF CIRCUITS, TERMINALS AND COLORS.

Flush button version available. Consult factory.





TERMINATIONS	BASIC CATALOG NO.	FUNCTION	STYLE	CIRCUIT	BUTTON STYLE
C  6.3 Tab Terminal 0.8mm thick	7000	Single Pole ON OFF Alternate			ROUND 
	7001	Single Pole ON OFF Momentary			
	7003	Single Pole ON OFF Alternate Illuminated			
	7004	Single Pole ON OFF Momentary Illuminated			
H  4.8 Tab Terminal 0.8mm thick	7030	Indicator light			
	7050	Double Pole ON OFF Alternate			SQUARE 
	7051	Double Pole ON OFF Momentary			
T  Solder Tag	7053	Double Pole ON OFF Alternate Illuminated			
	7054	Double Pole ON OFF Momentary Illuminated			

All dimensions in millimeters.

INTERNATIONAL ELECTRICAL APPROVALS

CURRENT APPROVAL DETAILS ON REQUEST

Specifications subject to change without notice. Not all combinations always available.

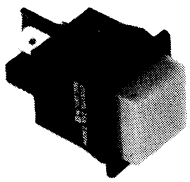
ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 Telex: 19-4645 FAX: (818) 700-9541

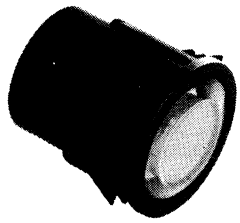
7000

AND MATCHING INDICATOR LIGHTS

Splashproof housing covers available for round and square products. These covers comply with spec IP54.

Details on request for square splashproof cover.

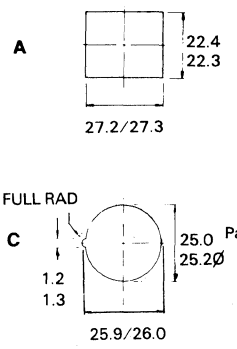


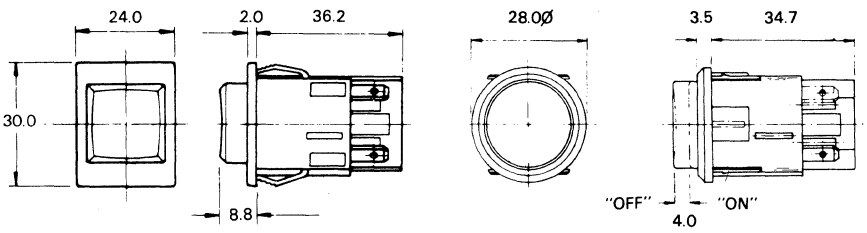


SWITCH PANEL CUTOUT

SWITCH DIMENSIONS

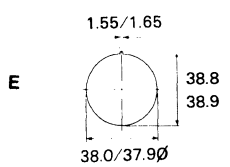
All dimensions in millimeters.

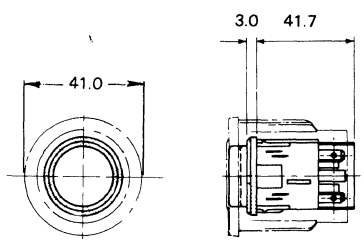




COVER PANEL CUTOUT

COVER DIMENSIONS INCLUDING SWITCH OR INDICATOR LIGHT





All dimensions in millimeters.

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	BUTTON STYLE	PANEL CUTOUT	BODY COLOR	BUTTON COLOR	VOLTAGE[1]
C **H** **T** } See dwgs.	From table	**A** **B** **C** **D** **S** **T** } See Table	**A** **C** **E** } See Dwgs.	Matte only **B** black **W** white	**Non-Lighted** **B** black **G** green **R** red **W** white **Lighted** **A** amber **C** clear **G** green **R** red	**Incandescent** **6** 6V **7** 12V **8** *24V* **Neon** **2** 110/130V **3** 200/250V

1 Lighted models only

Specifications subject to change without notice. Not all combinations always available.

ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

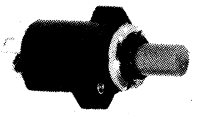
MOMENTARY PUSHBUTTON SWITCHES 900 SERIES

ELECTRICAL RATINGS
0.5A, 125/250 VAC
0.25, 250 VDC

BASIC CATALOG NO.	FUNCTION	CIRCUIT
NYLON BUSHING		
936 DI	Push for ON N/O	
938 DI	Push for OFF N/C	

N/O Normally Open N/C Normally Closed

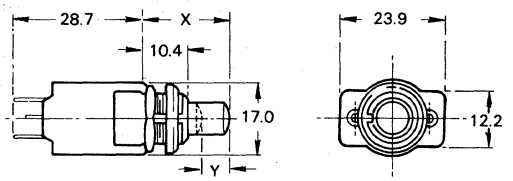
Standard nuts supplied M506 back hex nut and T92 front knurled nut



TERMINAL

C

6.3 Tab 0.8mm



Max. panel thickness 4.0
All dimensions in millimeters.
12.7 Panel Hole
All nylon body and bushing

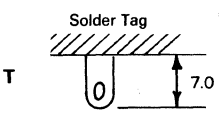
BASIC CATALOG NO.	X	Y
936 D1	19.8	6.3
938 D1	17.5	4.1

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	BUTTON STYLE
C	From table	B black R red

ELECTRICAL RATING
0.5A, 125/250 VAC

TERMINAL

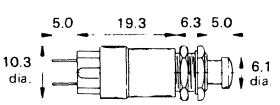


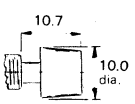
BASIC SWITCH TYPES

BASIC CAT. NO.*	FUNCTION	CIRCUIT	TERMINALS
916	Push for ON N/O		
917	SPDT ON ON 50 Volt only		
918	Push for OFF N/C		
919	2-Circuit		
920	Push for ON N/O DPST		

N/O Normally Open N/C Normally Closed

*Add "L" to part number for large button.





LARGE BUTTON

Max. panel thickness:
Both nuts: 2.5
Less back nut 4.0
Panel hole: 7.1 diameter
Max. plunger movement: 2.5
All nylon body and bushing

ORDERING INFORMATION

TERMINAL	BASIC CATALOG NO.	BUTTON STYLE	BUTTON COLOR
T See dwg	From table	L large button Omit for small button	B black R red W white G green

Specifications subject to change without notice. Not all combinations always available.

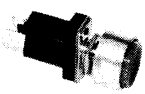
ARCOLECTRIC CORPORATION, 9001 Canoga Avenue, Canoga Park, CA 91304 Tel: (818) 700-1933 FAX: (818) 700-9541

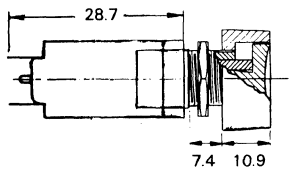
MOMENTARY PUSHBUTTON SWITCHES

BASIC CATALOG NUMBER

All dimensions in millimeters.

C936K
C938K





Single Pole
Single Throw
C936K
Push for on

C938K
Push for off

ELECTRICAL RATINGS
0.5 AMP 125/250 VAC

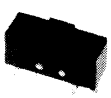
Panel hole: 12.7 dia

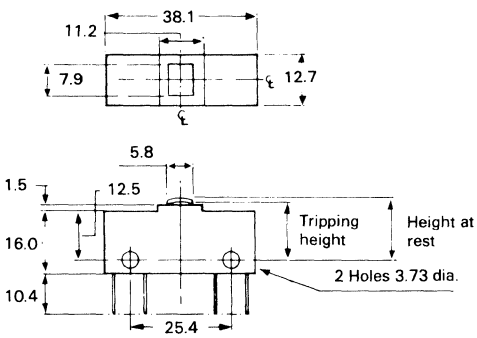
Max. Panel thickness: 4.0

6.3 Tab Terminals.

Option: alternate plastic shroud M562

C290





ELECTRICAL RATINGS
10.0 AMP 125/250 VAC

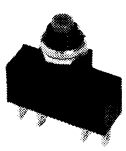
Normally 'CLOSED' or normally 'OPEN' depending on terminal connections.

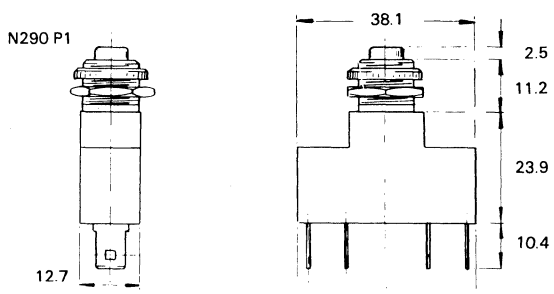
6.3mm Tab Terminals

Height at rest	15.6
Tripping point height	14.5
Movement differential	5.0
Available overtravel	Plunger flush with case

Operating force: C 290 680 gr. approx.

Single Pole
N290 P1
All nylon





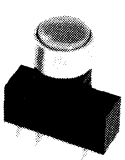
Panel hole: 12.7

Max. Panel thickness: 5.6

6.3 Tab Terminals

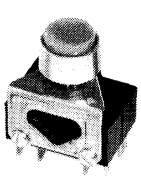
Shrouds on 'K' series anodized aluminum.

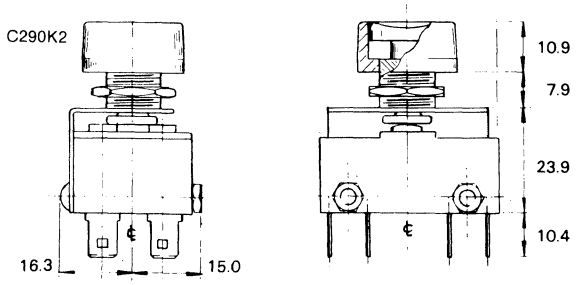
Single Pole
N290 K1
All nylon



Option: Alternative molded plastic shroud M562

Double Pole
C290 K2
Metal bushing and bracket





ORDERING INFORMATION

BASIC CATALOG NO.

From above

BUTTON COVER

B black
BL blue
G green
R red
W white

Specifications subject to change without notice. Not all combinations always available.

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AUGAT® ALCOSWITCH®

Quality and Innovation

Switch

SWITCH TYPE	# of Poles	# of Positions	Main-tained	Momen-tary	Alternate Action	Illumin-ated	CONTACTS Gold	CONTACTS Silver
DIP/SIP • Auto-Dip • Piano-Dip • Rotary-Dip • SS/SL Sip	1&2	2 thru 10 & 16	●				0.4VA 20 V	
KEYLOCKS • SKFC, SKT, SWK	1&2	1-10	●	●			0.4VA 20V	3-5A @ 125 VAC
PUSHBUTTON-MINIATURE • Green Series (MPA, etc.) • MPA-3 Series • MSPM • MPS • MPB • MSPF • MSP-5	1,2&4	2		●	●	•LED •Bicolor LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
PUSHBUTTON-SUBMINIATURE • TP Series • FSM Series • SMP Series • MLP • TP 200 Series	1&2	2		●	●	•LED •Reflector	0.4VA 20V	1A@ 125VAC
RELAYS •Blue-Line Series	1,2&4		●	●			●	1-2A @125 VAC
ROCKER/PADDLE - MINIATURE • Gemini (A,AE) • Green (MHV, MRV, MLD) • TRD Series	1,2&4	2&3	●	●		•LED •Bicolor LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
ROCKER/PADDLE-SUBMINIATURE • TR Series	1,2&4	2&3	●	●			0.4VA 20V	3A@ 125VAC
ROTARIES - MINIATURE • MRS	1,2&3	1-12	●				●	●
• MRC	1,2,3&4	1-10	●					●
SLIDE SWITCHES • MSS, MHS, MSSA-1350	1thru12	1-5	●	●			0.4VA 20V	.300A @ 125V
• SL, SLS, SLSA	1,2	1-10	●					.3-.5A
• MSSA, TSS	1,2&4	1-4	●					.3-1A
• Auto-slide	1,2,4&6	1,2&3	●					.3A@ 125 VAC
TOGGLE-MINIATURE • Gemini Series (A, AE) • Green Series (MTA, etc.)	1,2&4	2&3	●	●		•LED	0.4VA 20V	6A@ 125 VAC 3A@ 250VAC
TOGGLE-SUBMINIATURE • TT Series • SMT Series • AT Series	1,2&4	2&3	●	●		•LED	0.4VA 20V	3A@ 125VAC

Specialists in Miniature & Subminiature, PC, SMD, & Panel Mount Switches

AUGAT® ALCOSWITCH® 1551 Osgood St., No. Andover, MA 01845 Tel: (617)685-4371 Telex: 275423 Fax:(617)686-9545

Selector CHART

TERMINATIONS						MOUNTING						Process Compatible (withstands post solder wash)	Agency Approvals	Other
PC	WW	WL	SMD	RA	VRA	Panel Bushing	Panel Snap-in	Panel Other	PC Board	Sealed	Unsealed			
•			•	•					•	•	•	•		•Internal Resistors or Diodes
•		•				•					•		UL	•Medium & High Security
•	•	•		•		•	•		•		•			•Caps •Boot Seals •Guards
•	•	•	•	•	•	•			•	•	•	•		•Boot Seals •Guards •Tactile Feedback •0.100 Term Spacing
•									•	•	•	•		•High Sensitivity •Latching
•	•	•		•	•	•	•	•	•	•	•	•	UL CSA	•Custom Legends •Custom Colors
•	•	•		•	•	•			•		•			•Custom Legends •0.100 Term Spacing
•		•		•		•			•	•	•	•		•Adjustable Stops
•						•			•	•	•	•		
•				•					•		•	•		
•				•		•			•		•	•		
•				•					•		•	•		
•			•	•					•	•	•	•		•Machine Insertable
•	•	•		•	•	•	•	•	•	•	•	•	UL CSA	
•	•	•	•	•	•	•			•	•	•	•	UL	•0.100 Term Spacing

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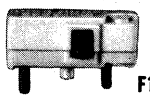
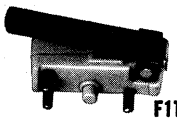
Burgess Switch Company

BURGESS Precision Switches
1010 North Main Street/Elkhart, IN 46515
Telephone (219) 262-8608/FAX (219) 262-8819

American Electronic Components


F1T8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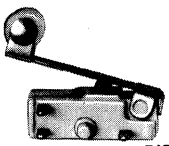
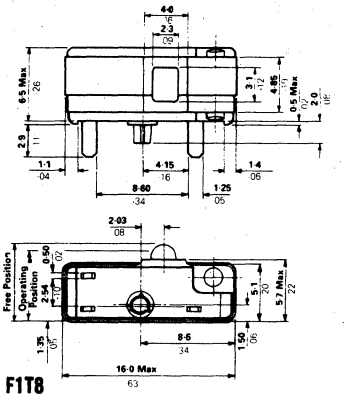

F1T8YR1

ULTRA MINIATURE MICRO SWITCHES
F1 SERIES

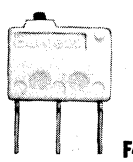
Low profile switches with side-protruding, gold-flashed terminals for printed circuit boards. Mounting by terminals assisted by moulded spigot. Low and standard force, changeover switching mechanisms. Contacts normally silver; add '-GP' to reference for gold. Plunger, plain lever or roller-lever may be depressed to case in overtravel.

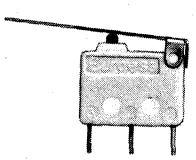
Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	Ozf	Rec. max. Rating 125/250 VAC
F1T8	Plunger	16	10	7	1.4	5	5
F12T8	Plunger	16	10	7	0.5	1.8	2
F1T8Y1	Lever	20	10	11	0.5	1.8	5
F12T8Y1	Lever	20	10	11	0.2	0.6	2
F1T8YR1	Roller-lever	19	10	16	0.5	1.8	5
F12T8YR1	Roller-lever	19	10	16	0.2	0.6	2

A variety of different lever lengths (to 2¼") and shapes are available.



F1T8


F4T6

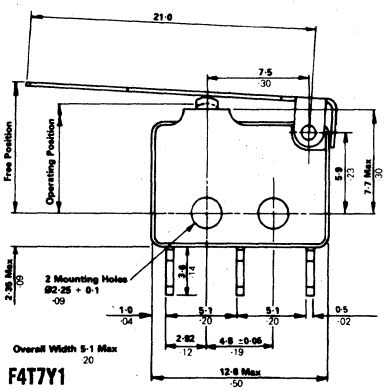

F4T7Y1

F4 SERIES

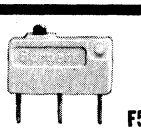
Similar to F5 Series but provided with side mounting holes. Changeover mechanism, recommended maximum rating 7 Amperes at 125/250 volts AC. Silver or gold contacts — add '-GP' to reference for the latter. Plunger, plain lever or cam-following lever actuators, all may be depressed to case in overtravel. 2 mm quick connect tab (QC in table) or solder tag terminals.

Ordering Reference	Actuator	Terminals	Dimensions L	B	H	Actuating Force N	Ozf
F4T6	Plunger	QC	13	5	18	1.2	4.3
F4T7	Plunger	Solder	13	5	15	1.2	4.3
F4T6Y1	Plain lever	QC	23	5	20	0.4	1.4
F4T7Y1	Plain lever	Solder	23	5	17	0.4	1.4
F4T6YC	Cam lever	QC	21	5	23	0.5	1.7
F4T7YC	Cam lever	Solder	21	5	21	0.5	1.7

MF4 Lug mounting frame for all F4 models. Switch secured without screws.



F4T7Y1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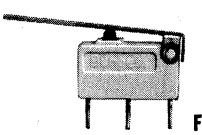
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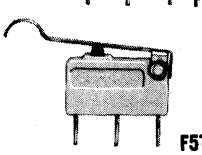
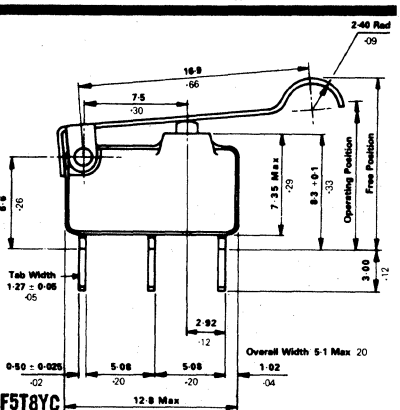

F5T8YC

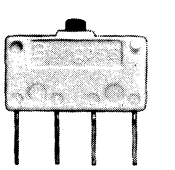
F5 SERIES

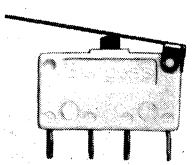
One of the world's smallest precision switches with power capabilities, the F5T8 has no mounting holes and may be mounted on a printed circuit board by means of its 5.08 mm pitched, gold-flashed, base-protruding terminal tags. Also available with plain or cam-following lever actuators. Changeover switching mechanism, recommended maximum rating 7 amperes at 125/250 volts AC resistive load. Silver contacts or add '-GP' to reference for gold. Actuators may be depressed to case in overtravel.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	Ozf
F5T8	Plunger	13	5	12	1.2	4.3
F5T8Y1	Plain lever	23	5	14	0.4	1.4
F5T8YC	Cam lever	21	5	15	0.5	1.7



F5T8YC

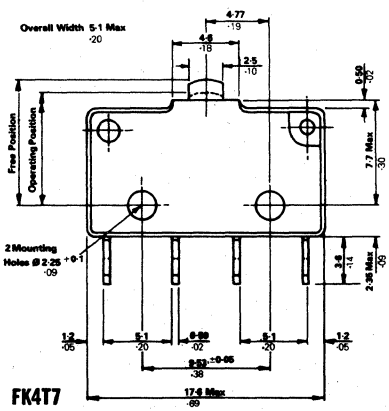

FK4T6


FK4T7Y1

FK4 SERIES

Double-break, two-circuit switches with four terminals. They are slightly smaller than V4 Series switches but have interchangeable mounting position. Lever actuators and terminals as for F4 Series. Recommended maximum rating 7 amperes, 125/250 VAC. Silver contacts, or add '-GP' to references for gold. All actuators may be depressed to case in overtravel.

Ordering Reference	Actuator	Terminals	Dimensions L	B	H	Actuating Force N	Ozf
FK4T6	Plunger	QC	18	5	18	1.5	5.4
FK4T7	Plunger	Solder	18	5	15	1.5	5.4
FK4T6Y1	Plain lever	QC	21	5	21	0.5	1.8
FK4T7Y1	Plain lever	Solder	21	5	18	0.5	1.8
FK4T6YC	Cam lever	QC	21	5	22	0.7	2.3
FK4T7YC	Cam lever	Solder	21	5	19	0.7	2.3



FK4T7

Burgess Switch Company

BURGESS Precision Switches
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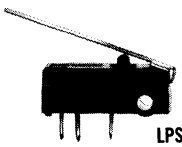
American Electronic Components

LPSP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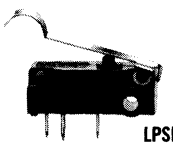
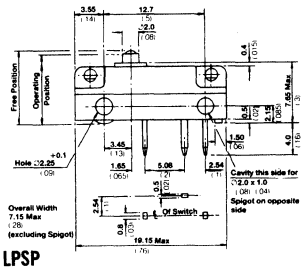

LPSPYC

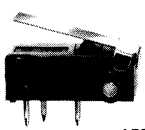
LOW PROFILE SINGLE POLE MICRO SWITCHES LP SERIES - Sub-Miniature

Low profile switches for printed circuit board mounting via the base, protruding gold flashed terminals changeover switching with silver or gold terminals (add-GP to reference for gold contacts). Four different actuating force variants and a wide selection of actuators available which can be fitted to all switches at either end of case.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF	Rec. max. Rating 125/250 VAC
LPHSP	Plunger	19		9	1.8	6.5	3
LPSP	Plunger	19		9	1.4	5.0	2
LP1SP	Plunger	19		9	0.75	2.7	1.5
LP2SP	Plunger	19		9	0.50	1.8	1.0
LPSPY1	Lever	19		14	0.50	1.8	2.0
LPSPYC	Cam lever	19		16	0.50	1.8	2.0



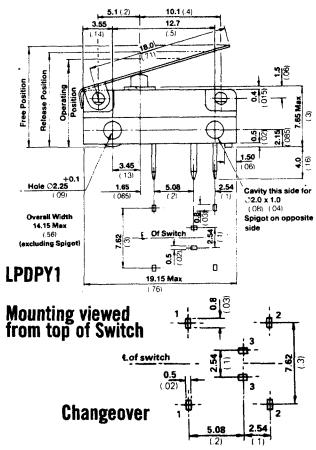
LPDP

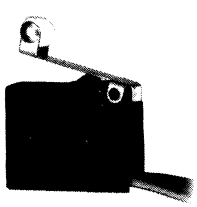

LPDPY1

LOW PROFILE DOUBLE POLE MICRO SWITCHES LPDP SERIES - Sub-Miniature

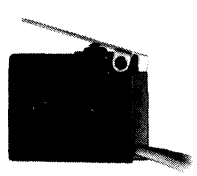
Similar to the above but double-pole consisting of two single-pole mechanisms mounted in one case and actuated by a common plunger. The two poles are electrically isolated and the switch terminals are pitched on the same 0.1 inch matrix. Add-GP to reference for gold contracts. Levers can be fitted at either end of case.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF	Rec. max. Rating 125/250 VAC
LPDP	Plunger	19		9	2.8	10.0	2
LP1DP	Plunger	19		9	1.5	5.4	1.5
LP2DP	Plunger	19		9	1.0	3.6	1
LPDPY1	Lever	19		14	1.0	3.6	2
LP1DPY1	Lever	19		14	0.5	1.8	1.5
LP2DPY1	Lever	19		14	0.4	1.5	1




V4SYR1

V4S


V4SY1

SEALED MINIATURE MICRO SWITCHES FOR DIFFICULT ENVIRONMENTS

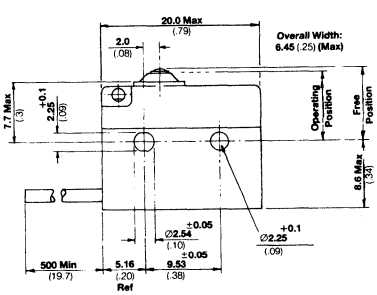
A range of single and multi-pole miniature and sub-miniature Micro Switches with mechanisms totally enclosed to the standard indicated by IEC Code EP67 and NEMA Type 6. Efficient sealing is proved by a pressure test. Explosion-proof models are included in the range. Single-pole switches have plunger actuators which may be used alone or with plain lever or roller-lever auxiliary actuators. Multi-pole models are available with either plunger or integral level actuators (plain or with roller). With one exception, all models are supplied with factory fitted, PVC insulated wires.

SINGLE POLE SUB-MINIATURE SWITCHES V4S MODELS

Glass-loaded nylon case and lid; acetal plunger; a neoprene cowl is fitted around the plunger and bonded to the lid. The well-proven Burgess V4 changeover mechanism is fitted within the enclosure. Three 16/0.2 mm p.v.c. insulated wires are potted in position. Silver contacts are standard. Temperature range – 10° to + 70°C and recommended maximum rating 3 amperes, 125/250 VAC. Silicone cowl/lead versions available for – 50°C operations.

Ordering Reference	Actuator	Dimensions L	B	H	Actuating Force N	OZF
V4S	Plunger	22*	7	18	2.5	9.0
V4SY1	Plain lever	22	7	23	0.9	3.2
V4SYR1	Roller lever	22	7	26	0.9	3.2

A variety of different lever lengths (to 2¼") and shapes are available; also auxiliary actuators in single and double pole configuration. (See page 2).
*excluding cables.



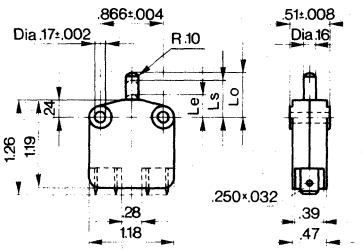
Burgess Switch Company
SAIA
BURGESS/SAIA Precision Switches
1010 North Main Street/Elkhart, IN 46515
Telephone (219) 262-8608/FAX (219) 262-8819
American Electronic Components

XP2

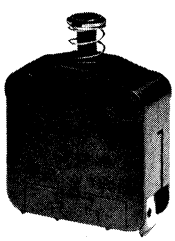
INTERLOCK SWITCHES BY SAIA
XP SERIES - SINGLE POLE

For use as a door interlock on office equipment, dispensing and industrial machinery. Normally open, normally closed changeover switching available, rated up to 16 amp 1250 VAC. Approvals include UL, CSA, VDE, SEV, SEMKO, NEMKO, DEMKO, and KEMA. Gold Contact (add-81) and elevated temperature (add-W) versions available. Mushroom plunger and additional security return spring (add-E1) 1/4" Q.C. terminals.

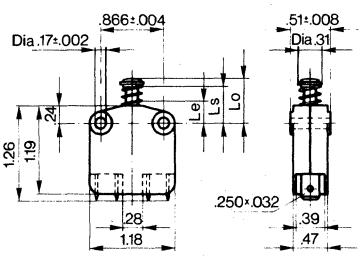
Ordering Reference	Actuator	Dimensions L	B	H	Circuit	Actuating Force	
XP2	Plunger	30	12	41	Changeover	300	10.5
XP42	Plunger	30	12	41	Normally Closed	175	6.2
XP52	Plunger	30	12	41	Normally Open	300	10.5
XP2-E1	Mushroom	30	12	41	Changeover	650	22.9
XP42-E1	Mushroom	30	12	41	Normally Closed	375	13.2
XP52-E1	Mushroom	30	12	41	Normally Open	650	22.9



XP2/XP42/XP52
XP2W/XP42W/XP52W

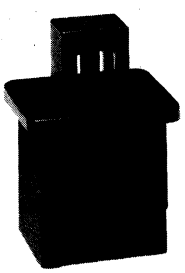


XP2-E1



Version with mushroom plunger

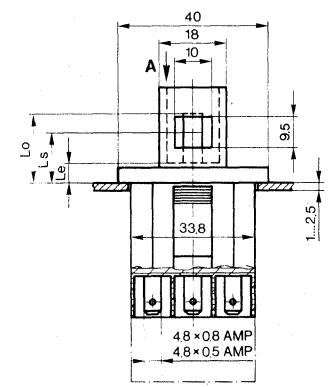
XP2-E1/XP42-E1/XP52-E1
XP2W-E1/XP42W-E1/XP52W-E1



XS

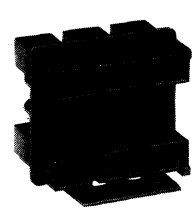
XS SERIES - DOUBLE/TRIPLE POLE

Available as either 2-pole or 3-pole for interlock use; 2-pole handles up to 15 amp, 125/250 VAC per pole with a low voltage 0.3 amp, 30 VAC/30 VDC pole to operate an indicator or electronics circuit. Optional 3-pole model handles up to 15 amp, 125/250 VAC on each pole. Normally open switching with reliable contact breaking by three reset springs acting independently. Convenient snap-in mount 8 mm contact gap and creepage which meets UL, CSA, VDE, SEMKO, DEMKO and BEAB; for use on office machines (UL114, IEC380/VDE 0806) cabinets, data processing and equipment requiring inter-locking. Multi plug mating connector (1/4" Q.C. terminals) and service key available.



XS Switch

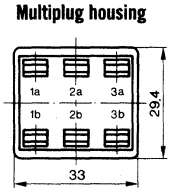
Ordering Reference	Circuit - Details/Description
XSK10RCAA	3-pole - circuit 1, low voltage gold contacts - circuit 2, 15 amp, 125/250 VAC silver contacts - circuit 3, 15 amp, 125/250 VAC silver contacts
XSK10RAAA	3-pole - circuit 1, 15 amp, 125/250 VAC silver contacts - circuit 2, 15 amp, 125/250 VAC silver contacts - circuit 3, 15 amp, 125/250 VAC silver contacts
XSK10RAOA	2-pole - circuit 1, 15 amp, 125/250 VAC silver contacts - circuit 2, not equipped - circuit 3, 15 amp, 125/250 VAC silver contacts
410451090	Multiplug housing
410948180	Service key



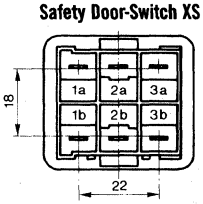
Multiplug Connectors

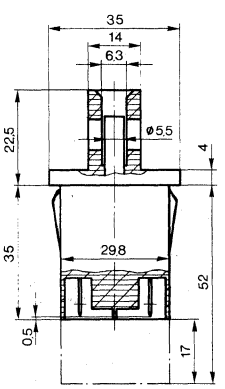
Service key

Multiplug housing

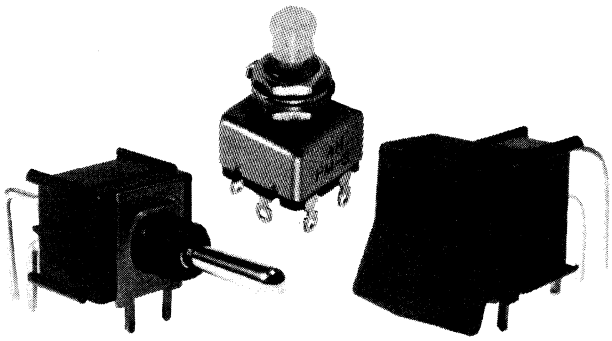


Safety Door-Switch XS





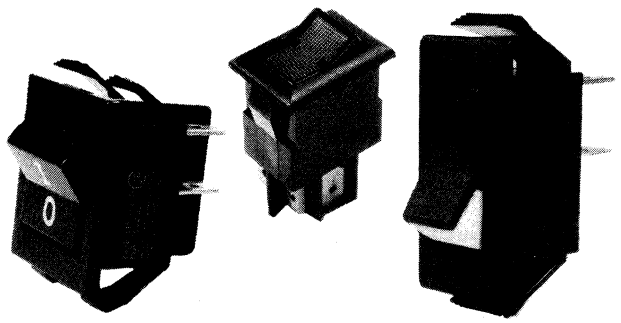
Arrow Hart
The Leader in Current Events.



Arrow Hart Control Switches

Arrow Hart offers a wide range of quality sealed switches for signal circuit applications. The "L" Series features a complete line of miniature washable switches compatible with PCB mounting, soldering, and cleaning processes, including those applicable to surface mount technology. All are 100% bubble tested to assure structural integrity. Also available are versions with anti-static capability up to 20,000V, and environmentally sealed threaded bushing mount switches.

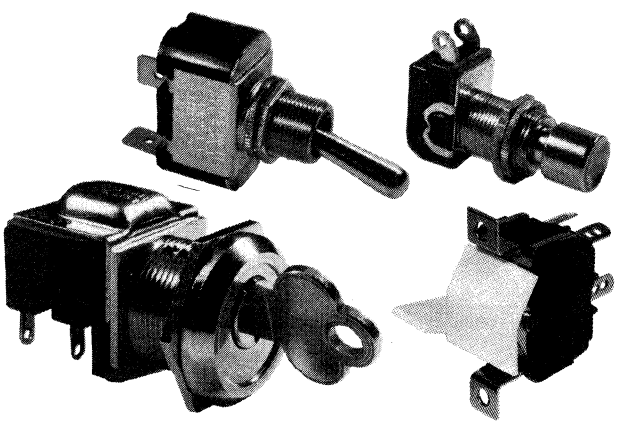
Arrow Hart control switches also include "TS" and "PM" miniature toggle and printed board switches as well as "TM" Series military toggle switches built to MIL-Spec 83731 and QPL'd under MS 75028 and MS 75029.



Arrow Hart Rocker Switches

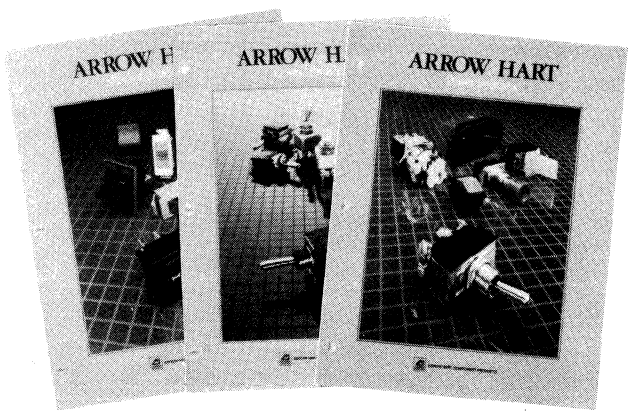
The complete line of rocker switches is designed to meet the industry's toughest needs with continually improved ratings, a wide range of circuit configurations, international approvals and innovative new product design.

From the 1600/2600 Series, the first rocker switch line to provide a full range of international approvals, to the 1500/2500 Series of contoured rockers featuring a contemporary look and feel. The mini rocker features high ratings in an aesthetically pleasing space saving package while the Hi-Lite 2-color rocker provides an "on" indication without being lighted. And the 92 Series, specially developed for applications where the positive response of a larger switch is required, all with traditional Arrow Hart quality.



Arrow Hart Power Switches

Arrow Hart offers a wide range of power switches rated from 1 ampere through 60 amperes at 125-600 V AC/DC. Designed for general purpose and heavy duty applications that require long service and dependability. Available in toggle, rotary, push button, slide and keylock variations. Built with Arrow Hart quality for superior performance.



Catalogs of Current Events

Each of our three catalogs includes selection tables, technical specs, factory and field modification charts, dimensional diagrams, key features and application information. For your free copy contact Arrow Hart Components, P.O. Box 9050, Charlottesville, VA 22906-9050 (804) 973-4411; FAX (804) 973-2236

COOPER INDUSTRIES

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Miniature Switches

7000 SERIES
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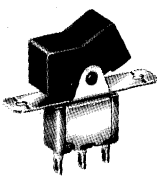
TOGGLE, ROCKER & LEVER HANDLE SWITCHES UL/CSA Available

Toggle Switches



Rocker & Lever Handle Switches

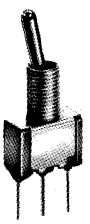
E/E010/E020 SERIES
SEALED TOGGLE, ANTI-STATIC ROCKER, LEVER HANDLE & PUSHBUTTON SWITCHES
UL/CSA Available

E Series Sealed Toggle Switches

E Series Sealed Anti-Static Rocker & Lever Handle Switches

E010 Series Sealed Momentary Pushbutton Switches

E020 Series Sealed Snap-Acting Momentary Pushbutton Switches



W SERIES
.025 WIRE-WRAP TOGGLE SWITCHES

8020 SERIES
(also U SERIES)
SNAP-ACTING MOMENTARY PUSHBUTTON SWITCHES
UL Available

8060 SERIES
ALTERNATE ACTION & MOMENTARY PUSHBUTTON SWITCHES
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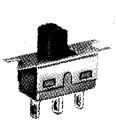

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Miniature Switches

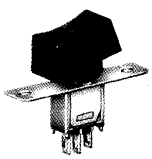
ET/EP/T/TP/TS SERIES
TINY SWITCHES
UL Available

ET Series Sealed Tiny Toggle Switches

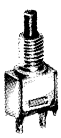
ET Series Sealed Tiny Rocker Switches

EP Series Sealed Tiny Pushbutton Switches

T Series Tiny Toggle Switches

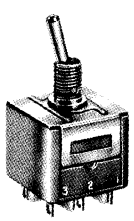


T Series Tiny Rocker Switches



TP Series Tiny Pushbutton Switches

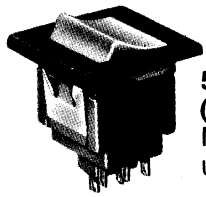
TS Series Tiny Slide Switches



9000 SERIES
POWER TOGGLE, ROCKER & LEVER HANDLE SWITCHES
UL, CSA, VDE, SEV & SEMKO Listed

Power Toggle Switches

Power Rocker & Lever Handle Switches



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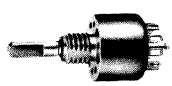
(also L SERIES)
ILLUMINATED ROCKER SWITCHES
UL/CSA Available

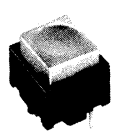
8500 SERIES
SUBMINIATURE PUSHBUTTON SWITCHES
UL Available

8600 SERIES
MICROMINIATURE PUSHBUTTON SWITCHES
UL Available

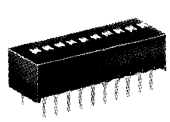


M SERIES
HALF-INCH ROTARY SWITCHES

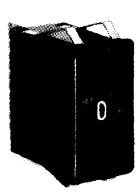
SS SERIES
SOLID STATE PUSHBUTTON SWITCHES



KS SERIES
PUSHBUTTON KEY SWITCHES

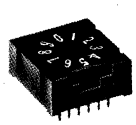


BD SERIES
DIP SWITCHES



3/3M SERIES
THUMBWHEEL SWITCHES

Thumbwheel Switches



Minithumbwheel Switches

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Miniature Switches

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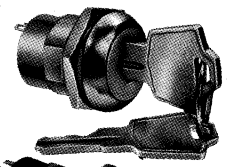
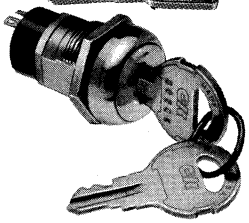
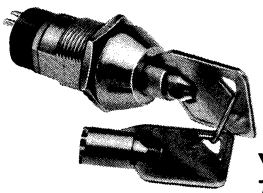


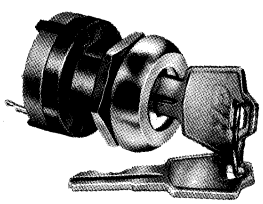
Y SERIES
4 and 5 Tumbler
Switchlocks



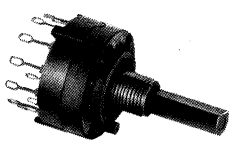
Y SERIES
6 Tumbler Double - Bitted
Switchlocks



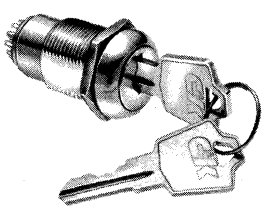
Y SERIES
7 Tumbler Tubular
Switchlocks



A SERIES
Switchlocks

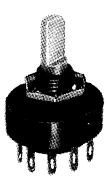


A SERIES
Rotary Switches



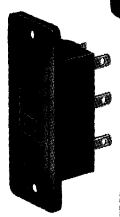
M SERIES
Switchlocks

H SERIES
Power ROTA-SLIDE®
Rotary Switches

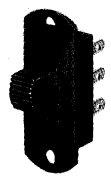


R SERIES
ROTA-SLIDE® Rotary
Switches

F SERIES
Miniature ROTA-SLIDE®
Rotary Switches

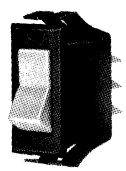


V SERIES
Power & Line Voltage Select
Slide Switches



S SERIES
Slide Switches

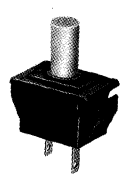
L SERIES
Miniature
Slide Switches



C SERIES
Power Rocker
Switches

D SERIES
Miniature Power
Rocker Switches

J SERIES
Rocker Switches



K SERIES
Pushbutton
Switches

MP SERIES
Mechanical Pushbutton
Switches

KM SERIES
Pushbutton
Switches

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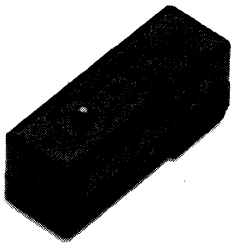
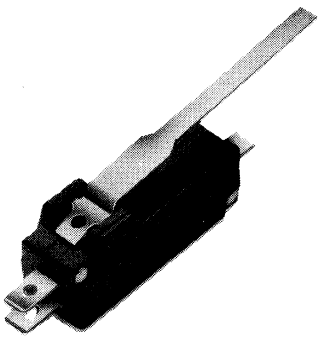
Switches

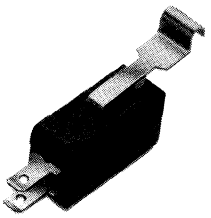
Snap-Acting Switches



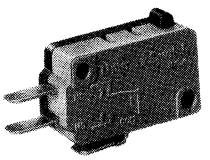
HB Series



A Series



TM Series

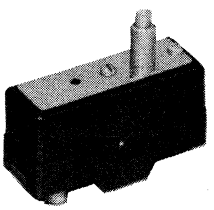


TF Series

Manually Operated Switches

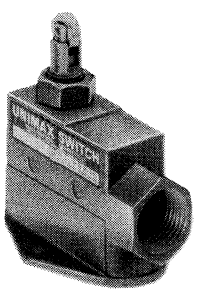
MM Series

LM Series

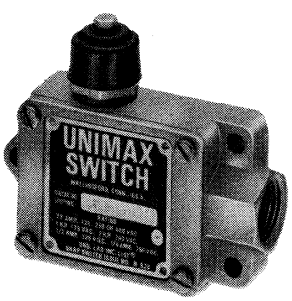


Fiber Optic Switches

Metal-Cased Switches



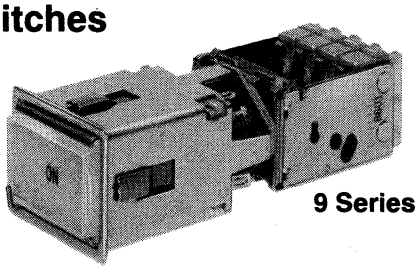
KS Series



KL Series

Illuminated Switches

TH Series



9 Series

C&K / Unimax, Inc. P.O. Box 152, Ives Rd., Wallingford, CT 06492 TEL: (203) 269-8701
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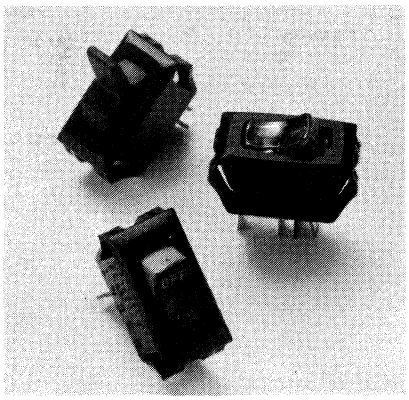
CARLINGSWITCH ROCKER SWITCHES

"R" Series Curvette® Rocker Switches



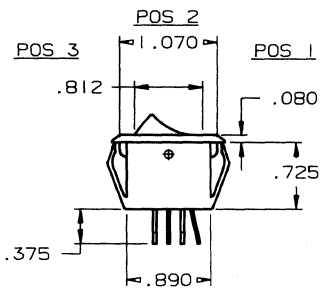
The "R" Series Curvette miniature snap-in rocker switch features an aesthetically pleasing, rounded appearance. It also features rocker, paddle and Visi-Rocker® actuators as well as illuminated versions. The Curvette has electrical ratings up to 16 amps and is compatible with a range of standard panel cutouts due to its patented mounting ear design.

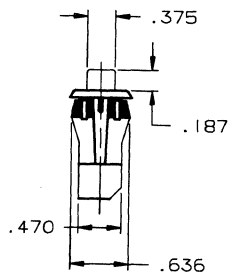
Specifications

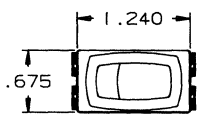
- UL, CSA and VDE*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Base Material: Nylon
- Actuator Material: Polyester/Nylon
- Lighted Versions Available

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications







R A 91 — 1 — V B — B — O — V

Series Type
R

Circuit Pattern
A On-Off
B On-On
Available w/ ratings 20,21
C On-Off-On
Available w/ rating 21
D Off-(On)
Available w/ ratings 22,23

Rating
20 16A 125VAC
10A 250 VAC
3/4HP 125-250VAC
21 16A 125VAC
10A 250VAC
80 16A 125VAC
10A 250VAC
3/4-HP 125-250VAC
6(4)A 250VAC u + + +
81 16A 125VAC
10A 250VAC
6(4)A 250VAC u + + +
90 16A 125VAC
10A 250VAC
3/4HP 125-250VAC
10(4)A 250VAC u
91 16A 125VAC
10A 250VAC
10(4)A 250VAC u
22 8A 250VAC
12A 125VAC
1/2HP 125-250VAC
23 8A 250VAC
12A 125VAC
Additional ratings are available, consult factory.

Termination
0 Solder Lug
1 .250 Tab (Q.C.)
5 Wire Leads

Actuator Type
R Rocker
V 2 Color Visi-Rocker
M Momentary Rocker
P Paddle

Actuator Color
B Black
R Red
W White
Custom colors available. Consult factory.

Base Color
B Black
R Red
W White
Custom colors available. Consult factory.

Color of Molded-In Legend and/or Visi-Rocker End
N Not Applicable
V Visired (std.)
B Black
O Orange
R Red
W White
Custom colors available. Consult factory.

Rocker Face Legend

Molded-In	Ink Transfer Stamp
0	No Imprint 0
1	On-Off Imprint (Vertical) A
2	On-Off Imprint (Horizontal) B
8	I-O Imprint (Horizontal) D
9	I-O Imprint (Vertical) E

Molded-In Legend Available With Visi-Rocker Option.

White is standard with dark actuators;
black is standard with light actuators.

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
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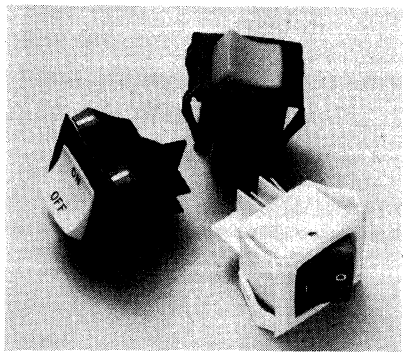
CARLINGSWITCH ROCKER SWITCHES

"RG" Series Double-Pole Curvette® Switches



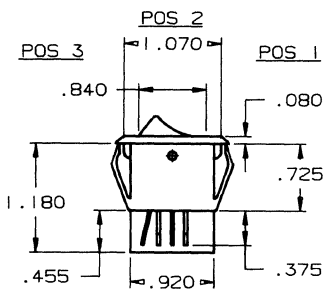
The "RG" Series Super Curvette double-pole snap-in rocker switch offers electrical ratings up to 20 amps. This switch can also handle current inrush in excess of 100 amps. The Super Curvette can accommodate a wide range of panel cutouts due to its patented mounting ear construction. The switch can be specified in either single or double throw circuits with illuminated or imprinted actuators if desired.

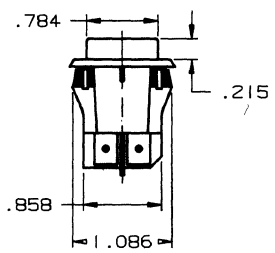
Specifications

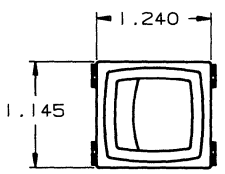
- UL, CSA, VDE*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Base Material: Nylon
- Actuator Material: Polyester
- Lighted Versions Available

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications







RGSC C 71 1 — R — B — B — O

Series Type
RGSC

Circuit Pattern
A On-Off Single Pole
B On-On Single Pole
C On-Off Double Pole
D On-On Double Pole
VDE Certified with Circuit Pattern C and D Only.

Rating
20 15A 250VAC
20A 125 VAC
3/4HP 125-250VAC
21 15A 250VAC
20A 125 VAC
70 15A 250VAC
20A 125 VAC
3/4HP 125-250VAC
16(6)A 250VAC
71 15A 250VAC
20A 125 VAC
16(6)A 250VAC
Additional ratings are available, consult factory.

Termination
1 .250 Tabs (Q.C.)

Actuator Type
R Rocker

Actuator Color
B Black
R Red
W White
Custom Colors Available, Consult Factory

Base Color
B Black
R Red
W White
Custom Colors Available. Consult Factory.

Rocker Face Hot Stamped Legend
O No Imprint
A Off-On (Vertical)
B Off-On (Horizontal)
D O-I (Horizontal)
E O-I (Vertical)

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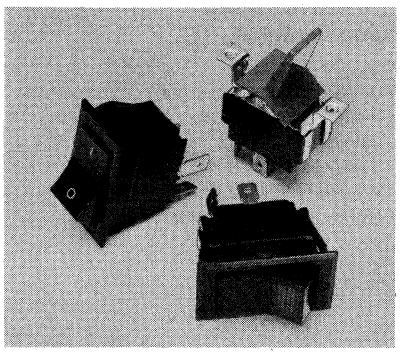
CARLINGSWITCH ROCKER SWITCHES

"TIG" Tippette® Rocker Switches



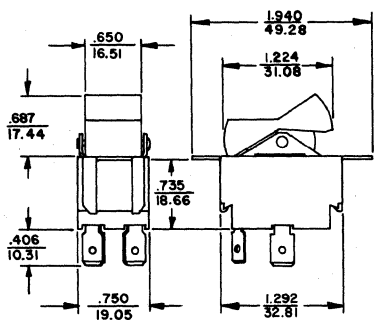
The "TIG" Series Tippette full size rocker switches are available in a wide range of circuits, colors and actuator styles. Screw and snap-in mounted brackets are available, as well as a number of illuminated variants. The Tippette can be ordered in 1–4 poles with quick connect, solder lug and screw terminations in ratings up to 20 amps.

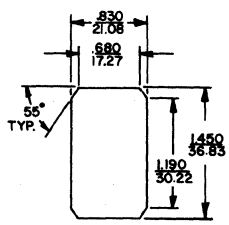
Specifications

- UL, CSA, VDE*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Base Material: Nylon/Phenolic
- Actuator Material: Nylon
- Bracket/Bezel Material: Nylon or Steel
- Lighted Versions Available

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications (in/mm)





TIG K 6 0 — IL — RD — A

Series Type
TIG

Circuit
K D.P.S.T.
L D.P.D.T.
M D.P.D.T.—Center Off

Rating
6 6A 125VAC
3A 250VAC
1/4HP 125–250VAC
5 15A 125VAC
10A 250VAC
3/4HP 125–250VAC
9 10A 250VAC
15A 125VAC
12(6)A 250VAC

Actuator Color
BL Black
WH White
RD Red

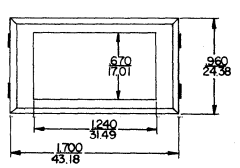
Bracket Style (See Diagrams)
A G
B FN
C FW
D N
E

Actuator Type
1L long lined (std.)
1C cross serrated
1S smooth
1F smooth w/flatted center
2L long narrow smooth
2C long narrow cross serrated high radius
2S short narrow w/ears smooth
3L Offset long lined
3S Offset smooth
4C cross serrated—high radius
5C long narrow cross serrated high radius, double pole
6S curved style
7S toggle style
7N Witches hat
7P Witches hat
For double actuator—add D to end of above number. For double actuator with interlock—add DI to end of above number. Special circuits available, consult factory.

Termination / Function

Function	Solder Lug	.250 Tab	.205 Tab	.187 Tab	Screw Term	Wire Leads	PC Term
On-None-Off	0	1	2	3	4	5	6
Off-None-(On)	A	B	C	D	E	F	G
On-None-(Off)	L	M	Q	R	S	T	U
On-None-On	0	1	2	3	4	5	6
On-None-(On)	A	B	C	D	E	F	G
On-Off-On	0	1	2	3	4	5	6
On-Off-(On)	A	B	C	D	E	F	G
(On)-Off-(On)	L	M	Q	R	S	T	U

FN



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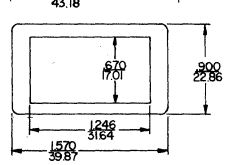
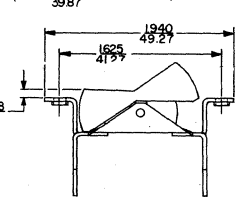


A



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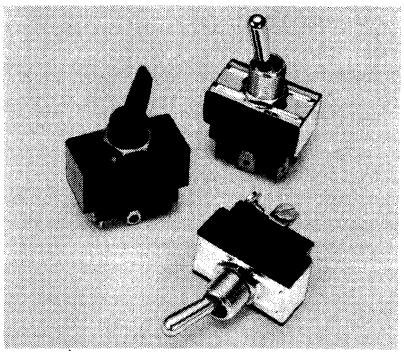
CARLINGSWITCH TOGGLE SWITCHES

"G" Series Toggle Switches



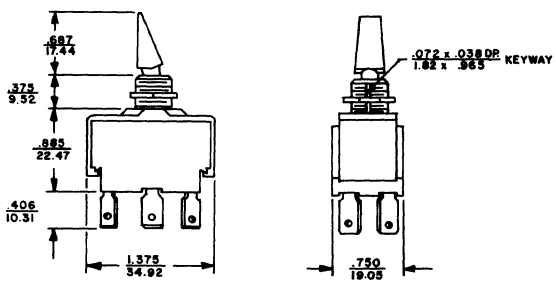
The "G" Series double pole toggle switches are available in many circuits to meet a wide range of general purpose applications. This series is offered with a variety of bat and toggle actuators with quick connect, solder lug and screw terminations in ratings up to 20 amps. Similar series switches are available in 1, 3 and 4 pole variants.

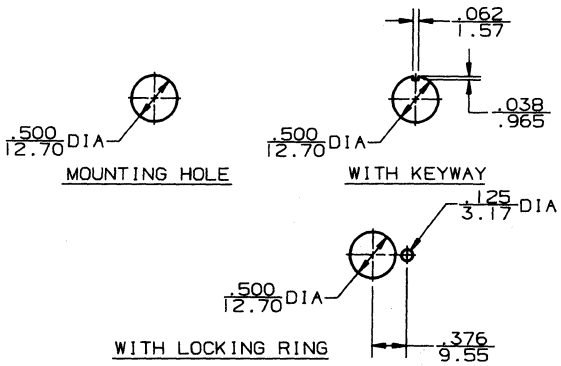
Specifications

- UL, CSA, VDE*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Base Material: Phenolic
- Actuator Material: Brass/Nickel Plate or Nylon
- Bushing Material: Brass/Nickel Plate or Nylon

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications (in/mm)





2G M 6 3 — 73

Series Type
2G Double Pole
6G Double Pole Momentary

Circuit
K DPST
L DPDT
M DPDT Center Off

Rating
6 6A 125VAC
3A 250VAC
1/4HP 125-250VAC
5 15A 125VAC
10A 250VAC
3/4HP 125-250VAC
7 12A 250VAC
17A 125VAC
1HP 250VAC
9 10A 250VAC
15A 125VAC
12(6)A 250VAC
0 20A 250VAC

Termination/Functions

Function	Solder Lug	.250 Tab	.205 Tab	.187 Tab	Screw Term	Wire Leads	PC Term
On-None-Off	0	1	2	3	4	5	6
Off-None-(On)	A	B	C	D	E	F	G
On-None-(Off)	L	M	Q	R	S	T	U
On-None-On	0	1	2	3	4	5	6
On-None-(On)	A	B	C	D	E	F	G
On-Off-On	0	1	2	3	4	5	6
On-Off-(On)	A	B	C	D	E	F	G
(On)-Off-(On)	L	M	Q	R	S	T	U

Toggle Style

Bat Toggle Length	Stem Length	Suffix No.	Neoprene Seal
13/32"	11/32"	-52	-57
9/16"	3/16"	-60	
9/16"	1/4"	-61	
9/16"	11/31"	-62	-67
9/16"	15/32"	-63	-68
11/16"	1/4"	-71	
11/16"	11/32"	-72	-77
11/16"	15/32"	-73	-78
1"	11/32"	-A3	-A8
1-1/4"	15/32"	-B3	-B8

Special Circuits

Catalog Series	Position 1	Position 2	Position 3
Single Pole Triple Throw			
2GE	On	On	On
Single Pole Single Throw			
2GA	On	None	Off
Single Pole Double Throw			
2GB	On	None	On
Single Pole Double Throw—Center Off			
2GC	On	Off	On
Momentary			
6GA	Off	None	(On)
6GC	(On)	Off	(On)
Progressive Two Circuit			
2GH	Circuit 1 On	2 Circuits On	Circuit 2 On
2GP	Off	Circuit 1 On	Circuit 2 On
2GG	2 Circuits On	Circuit 1 On	Off
6GG Mom.	2 Circuits On	Circuit 1 On	Off
Double Pole Double Throw Reversing Switch			
2GX	On	None	On
2GO	On	Off	On

For Decorator Toggles After Termination Selection, Add Suffixes:

D — 1 B — B

Decorator Toggle
D

Toggle Style
1
2
3
4

Actuator Color
B Black
R Red
W White
Y Yellow
GN Green
LU Blue

Bushing Color
B Black
R Red
W White
Y Yellow
GN Green
LU Blue

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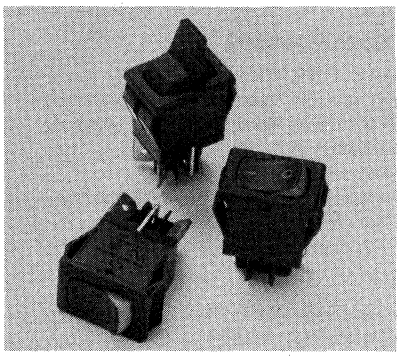
CARLINGSWITCH MINIATURE SWITCHES

Subminiature "6" Series Switches



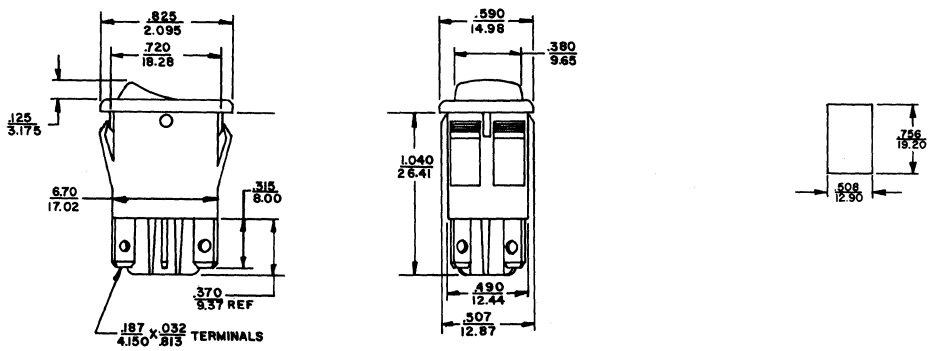
The Subminiature "6" Series snap-in switches offer electrical ratings up to 11 amps. This series is available with either a paddle, rocker or Visi-Rocker® actuator. These switches can be mounted into and are compatible with other manufacturers' cutout panel dimensions. The Subminiature "6" Series switch can be ordered with a variety of terminations and many of these switches are internationally approved.

Specifications

- UL, CSA, VDE, TUV, SEMKO*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Base Material: Nylon
- Actuator Material: Nylon

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications (in/mm)



6	21	1	5	9	1	9	—	0	—	9	—	V

Series Type
6

Actuator Type
11 Paddle
21 Curved Rocker

Actuator/Base Color

	Base	Actuator
1	Black	Black
2	Black	White
3	Black	Red
4	White	Black
5	White	White
6	White	Red
7	Red	Black
8	Red	White
9	Red	Red
0	Special	Special

Custom Colors Available, Consult Factory

Poles
1 Single
2 Double
6 Single w/High Barriers
5 Double Pole w/High Barriers

Rating
1 .4VA Max @20V Max. (AC/DC)
2 2A 250VAC
5A 125VAC Resistive
4 4A 250VAC
8A 125VAC Inductive
9 4A 250VAC
8A 125VAC Inductive
6(4)A 250VAC
3 11A 125VACH

Function
1 On-None-Off
2 On-None-On
3 On-None-(On)
6 On-Off-On
7 On-Off-(On)
8 (On)-Off-(On)

Termination
1 .250 Solder Lug
2 PC
6 .187 Solder Lug
7 PC Back Mount
8 PC Front Mount
9 .187 Tab (Q.C.)

Epoxy Sealed Terminals
E Epoxy
0 None Required

Rocker Face Legend

Molded-In	Ink Transfer Stamp
0	No Imprint 0
—	On-Off Imprint (Vertical) A
—	On-Off Imprint (Horizontal) B
8	I-O Imprint (Horizontal) D
9	I-O Imprint (Vertical) E

Molded-In Legend available only with Visi-Rocker Option

Color of Molded-In Legend and/or Visi-Rocker End
N Not Applicable
V Visired
B Black
W White
Custom Colors Available, Consult Factory

COMMENTS:
VDE available with functions 1 and 2 only.
CSA requires double pole w/high barriers (code 5).
Rating code 1 has no agency approvals.
Function 1 only available with terminations 7, 8 & 9.

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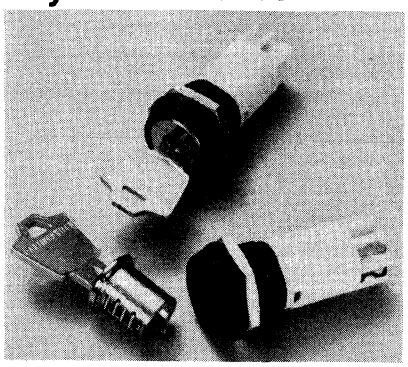
CARLINGSWITCH KEYLOCK SWITCHES

Lockette® Keylock Switches



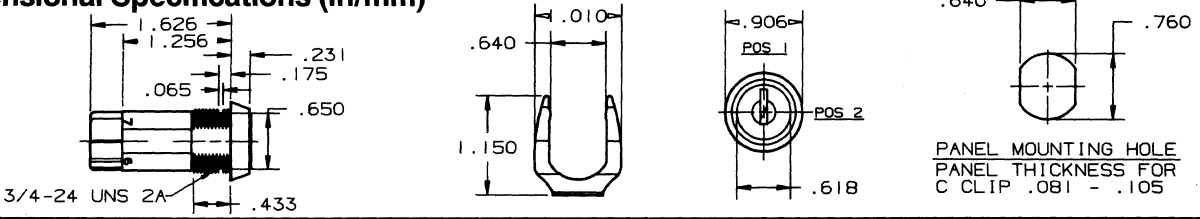
The Lockette Series rotary locking switches feature a unique replaceable lock core system that allows field changing of lock combinations. It also offers electrical ratings to 10 amps and standard 20 KV electro-static-discharge protection. The Lockette is available in popular single and double pole circuits and has a choice of quick connect, solder lug or PCB mount terminations.

Specifications

- UL, CSA*
- Dielectric Strength: 1,000V (minimum)
- Insulation Resistance: 100 megohms (minimum)
- Bezel Material: Metal or Thermoplastic
- Base: Polyester

*Due to ongoing technological advances, consult factory for agency specifications.

Dimensional Specifications (in/mm)



1 2 3 4 5 6 — 7 8 9 — 10 11 12 13

1. Series
K—Keylock—

2. Poles

CODE	NO. OF POLES AND 0° CIRCUIT
1	1 pole, no circuit at 0° position (open circuit between terminals 1 and 2)
5	1 pole "on" at 0° position (closed circuit between terminals 1 and 2)
6	2 pole "on" at 0° position (closed circuit between terminals 1 and 2, and terminals 5 and 6)

3. Rotation
Note: Maximum total degrees of rotation for 2 pole circuits is 90°—consult factory for additional keylock variations

CODE	TOTAL DEGREES	CODE	TOTAL DEGREES	CODE	TOTAL DEGREES
Z	360°	F	270°	M	180°
A	45°	G	315°	P	225°
B	90°	H	90°	T	270°
C	135°	J	135°	V	45° MOMENTARY
D	180°	L	180°	W	90° MOMENTARY
E	225°			X	SPECIAL

4. On Positions

CODE	"ON" POSITIONS	CODE	"ON" POSITIONS
A		C	
B		D	

Note: These "on" positions will exist only if within the rotation specified in selection 3; choose the first available selection which provides the "on" positions desired; numbers refer to the terminals connected—in a 2 pole switch terminals directly opposing will also be connected—consult factory for additional variations
"On" circuit at 0° specified in selection 2

5. Termination

Code	Style
A	.187 quick connects with terminal barriers
B	Solder lugs with terminal barriers
C	.080 quick connects/solder lug with terminal barriers
D	P.C. terminals
E	P.C. terminals, all available locations
F	Wire leads
M	P.C. terminals, with epoxy sealing
N	P.C. terminals, all available locations, with epoxy sealing
P	.187 quick connects, no terminal barriers
Q	Solder lugs, no terminal barriers
R	.080 quick connects/solder lug without terminal barriers
X	Special

6. Rating

Code	
1	0.4 VA max @ 20 VAC or VDC
3	3A 250VAC, 6A 125VAC, 6A 28VDC
5	5A 250VAC, 10A 125VAC, 10A 28VDC
6	1st pole: 3A 250VAC, 6A 125VAC, 6A 28VDC 2nd pole: 0.4VA max @ 20 VAC or VDC
9	1st pole: 5A 250VAC, 10A 125VAC, 10A 28VDC 2nd pole: 0.4VA max. @ 20VAC or VDC

7. Bezel

Code	
	Rounded, metal bezels
3	Nickel—removable bezel
5	Gold plated—removable bezel
	Angled, metal bezels
7	Nickel—removable bezel
9	Gold plated—removable bezel
0	Back panel mounting—decorative bezels may be ordered separately
	Matte finish thermoplastic bezels
X	Special
B	Black
W	White — Removable angled bezel —shipped unassembled
R	Red
J	Beige
G	Gray
Z	Special
C	Black
V	White — Fixed angled bezel with 4 tumbler lock core, selection 10, codes L or 4, only
S	Red
K	Beige
F	Gray

8. Mounting

Code	
1	3/4" hole mounting with hex nut
2	Clip

9. Removal

Code	4 Tumbler:	Code	5 Tumbler:
1	0°, 90°, 180°, and 270°*	5	0°, 90°, 180° and 270°
2	0° and 180° only	6	0°, and 180° only
3	90° and 270° only	7	90° and 270° only

*Note: Codes 1 & 5 are standard; key is removable at the listed positions contingent upon rotation as specified in selection 3—distributor may stock codes 1 and 5, and obtain inserts to provide key removal codes 2, 3, 6, and 7—consult factory

10. Lock Core

Code	
L	Removable 4 tumbler lock (removable at 45°)
4	4 tumbler lock
M	Removable 5 tumbler lock (removable at 45°)
5	5 tumbler lock

Note: Options L and M not available with momentary versions

11. Code Marking
Standard: key code stamped on keys.

Code	
1	No key code on lockface, 1 key
2	No key code on lockface, 2 keys (standard)
4	Key code stamped on lock face, 2 keys

Note: Keys for lock core removal will be furnished depending upon quantities of keyed-alike removable cores ordered—core removal keys may be purchased separately if additional keys are needed, or order quantity does not qualify for core removal key.

12. Core Finish

Code	
1	Nickel or bright stainless (matching finishes)
2	Black
5	Gold plated
X	Special

13. Key Variations

Code	
01	Standard code

Other variations available, consult factory.

14. Optional Suffix Code
Special order, consult factory for pricing

Code	
-S	All unused terminal openings sealed

CARLINGSWITCH, Inc., 60 Johnson Avenue, Plainville, CT 06062-1156
(203) 793-9281 • FAX: (203) 793-9231

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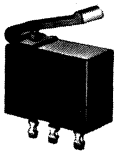
Ultra - Subminiature
DH series*

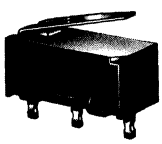


Series DH1C 50-500 mA
Series DH2C 5-50 mA

DH1C-B1AA
DH2C-B1AA
Switch body
.322" x .244"
x .106"

DH1C-B1PA
DH2C-B1PA
Switch body
.322" x .244"
x .106"

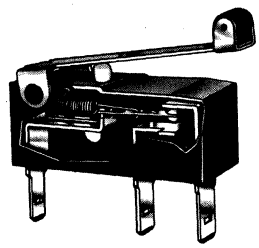
Sub - Subminiature
DG series*



Series DG1 3 amps
2 amps
Series DG2 50 mA

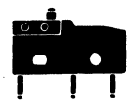
DG series
Switch body
.504" x .255" x .228"

Subminiature
DA3 series - Automated

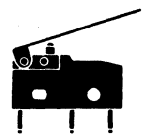


Series DA3 0.1 amps

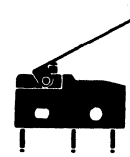
Switch body
.781" x .375" x .250"



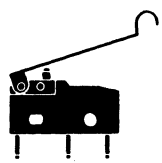
-F1AA



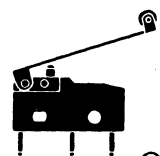
-F1LB



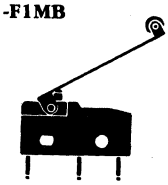
-F1MB



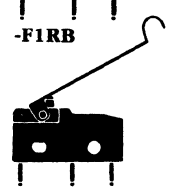
-F1SB



-F1RB

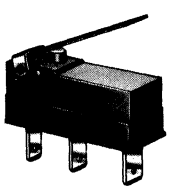


-F1TB

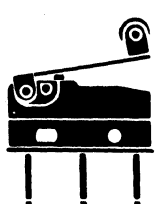


-F1UB

Subminiature International
DB series* - Automated



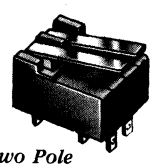
Series DB1 5 amps
Series DB2 10 amps
Series DB3 0.1 amps



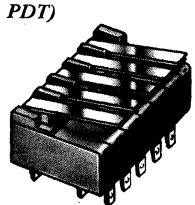
DB series
Switch body
.783" x .380"
x .256"

* Silhouettes shown actual size

Subminiature Modules
HM series



Two Pole
(2 PDT)

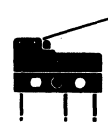


Five Pole
(5 PDT)

Series E61 5 amps
Series E62 10.1 amps
Series E63 0.1 amps

Switch body
2 PDT = .781" x .483" x .470"
3 PDT = .781" x .483" x .672"
4 PDT = .781" x .483" x .875"
5 PDT = .781" x .483" x 1.086"

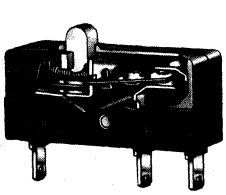
Standard Ratio



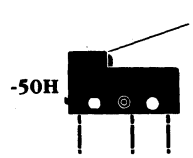
High Ratio

Subminiature
E series

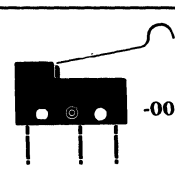
Series E61 5 amps
Series E62 10.1 amps
Series E63 0.1 amps



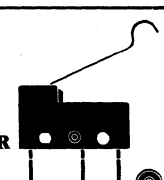
Switch body
.781" x .372" x .250"



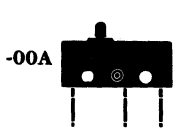
-50H



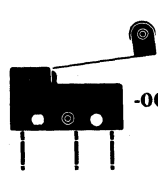
-00R



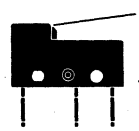
-50R



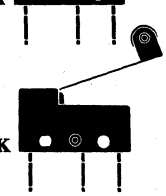
-00A



-00K



-00H



-50K

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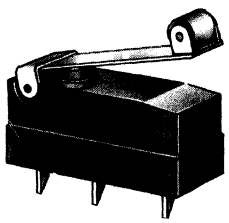
International Subminiature Waterproof



DC series

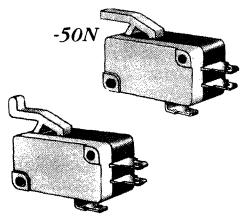
Series DC1	5 amps
Series DC2	10 amps
Series DC3	0.1 amps
Series DC4	3 amps

Solder Terminals
Switch body
.783″ x .397″
x .256″

Wire Terminals
Switch body
.783″ x .602″
x .256″

Plastic Lever Actuator

for miniature E series
Light Force and Standard Force



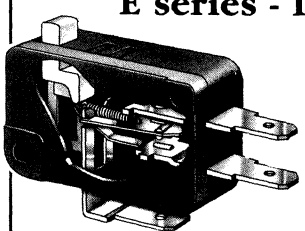
-50N

-90N

Series/prefix numbers, electrical ratings and switch body dimensions are the same as the E series models shown above.

Miniature

E series - Light Force (X Suffix)



Standard Force

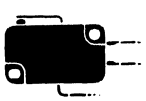
Series E21	0.1 amps
Series E22	3 amps
Series E23	5 amps
Series E31	1 amp
Series E33	10 amps
Series E34	15 amps
Series E35	20.1 amps*

*Light Force only

Switch body
1.093″ x .625″ x .406″

-00A
-00AX

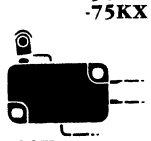
-50K
-50KX



-00H
-00HX

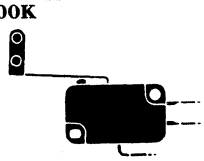
-50KL
-75KX

-50H
-50HX



-00K

-75HX



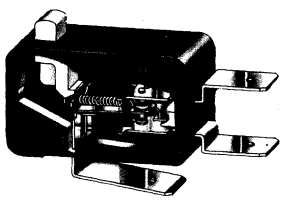
-50P

Miniature International

D4 series **Light Force** (L-Suffix)

Standard Force

(C-Suffix)

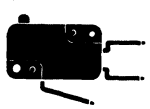


Series D41	0.1 amps
Series D42	3 amps
Series D43	5 amps
Series D44	10 amps
Series D45	15 amps

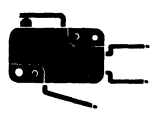
US part number suffix (straight terminals)

(International suffix) (dogleg terminals)

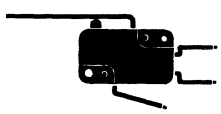
Switch body
1.095″ x .625″ x .406″
27.81 mm x 15.88 mm
x 10.31 mm



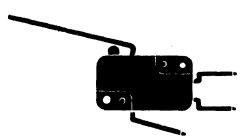
L-R1AA C-R1AA
(9-Q3AA) (3-Q3AA)



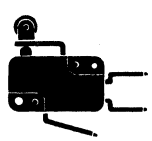
L-R1LA C-R1LA
(9-Q3LA) (3-Q3LA)



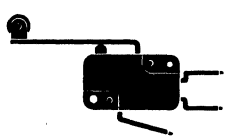
L-R1YD C-R1LB
(9-Q3YD) (3-Q3LD)



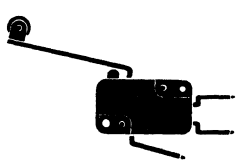
L-RIXD C-RIXD
(9-Q3XD) (3-Q3XD)



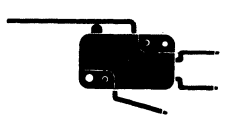
L-R1RA C-R1RA
(9-Q3RA) (3-Q3RA)



L-R1RC C-RIRC
(9-Q3RC) (3-Q3RC)



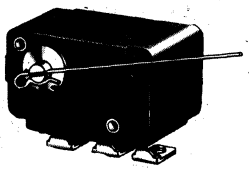
L-R1TC C-R1TC
(9-Q3TC) (3-Q3TC)



L-R1YL C-RIYL
(9-Q3YL) (3-Q3YL)

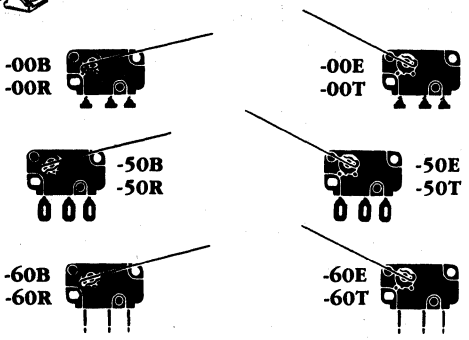
CHERRY ELECTRICAL PRODUCTS
3600 Sunset Ave., Waukegan, IL 60087
312/360-3500 • FAX 312-360-3566

Low Torque
E series

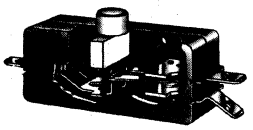


Series E51	6 amps
Series E53	0.1 amps

Switch body
1.218″ x .687″ x .580″

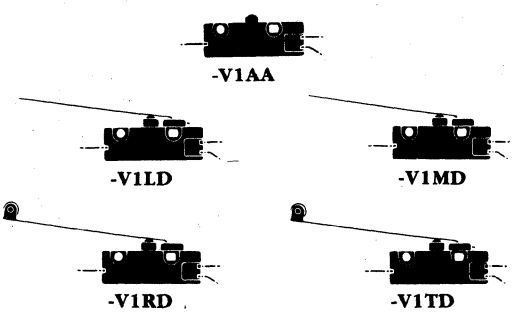


General Purpose
DL series - Automated



Series DL3	0.1 amps
Series DL4	15 amps
Series DL5	25 amps

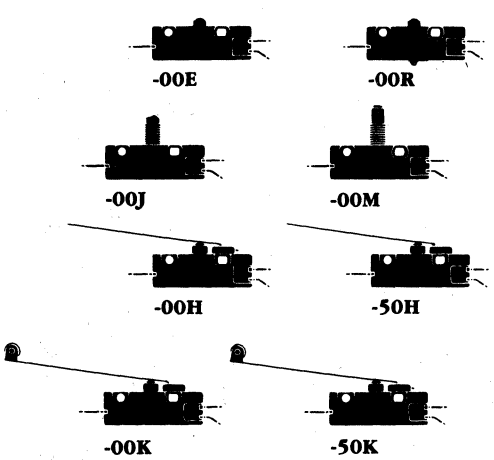
Switch body
1.823″ x .640″ x .644″



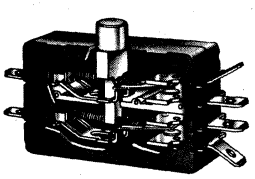
General Purpose
E series - Single Pole

Series G13	0.1 amps
Series E13	15 amps
Series E14	25 amps
Series E30	30.1 amps

Switch body
1.823″ x .640″ x .644″

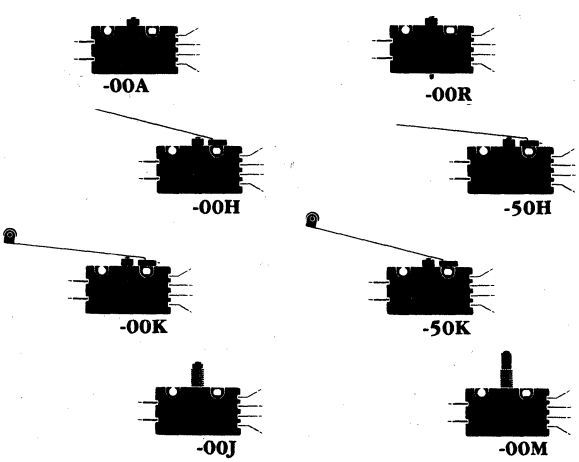


General Purpose
E series - Double Pole

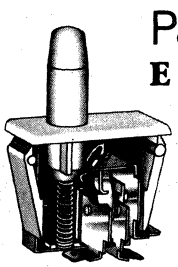


Series E19	15 amps
Series E19A	15 amps/ 0.1 amps
Series E20	20 amps
Series G20	0.1 amps

Switch body
1.813″ x 1.125″ x .640″

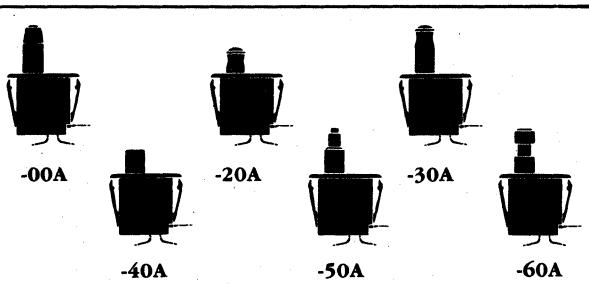


Panel Mount Pushbutton
E series - Single Pole



Series E65	16 amps
Series E68	0.1 amps
Series E69	10 amps

Switch body 1.25″ x 1.05″ x .680″



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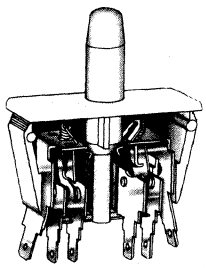
Panel Mount Pushbutton
E series - Double Pole



Series E75	16 amps
Series E77	10 amps/ 0.1 amps
Series E78	0.1 amps
Series E79	10 amps

Switch body 1.57″ x 1.05″ x .680″

-00A

-20A

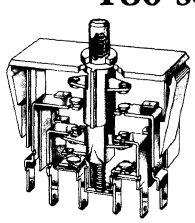
-30A

-40A

-50A

-60A

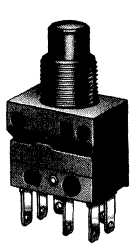
Line Interrupt
F80 series



Series F81	10 amps
Series F82	16 amps
Series F83	0.1 amps
Series F84	Combination of current ratings

Switch body 1.57″ x 1.16″ x .685″

Lighted Pushbutton Switches
P1 series

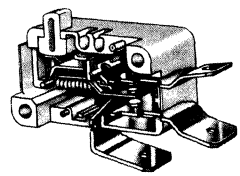


Series P162	10.1 amps
Series P163	0.1 amps

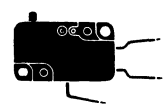
Switch body .844″ x .688″ x .578″

-C3RA Red button-LED, SPDT
-C3BU Black button-No light, SPDT
-D3RA Red button-LED, DPDT
-D3BU Black button-No light, DPDT

International Miniature
D3 series - Heavy Duty

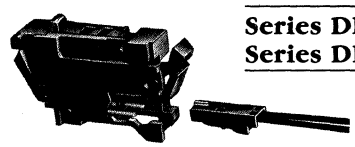


Series D36	4 amps
Series D37	10 amps
Series D38	16 amps

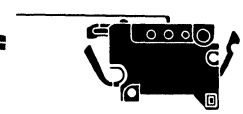


Switch body 1.094″ x .625″ x .406″

Terminator
DN series

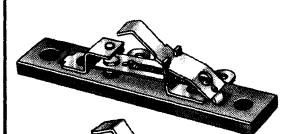


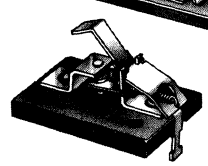
Series DN3	0.1 amps
Series DN6	3 amps



Switch body
1.337″ x .854″ x .406″

Open Switches
S series

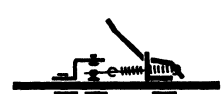




Series S23	5 amps
Series S25	10 amps
Series S30	10 amps
Series S31	0.1 amps

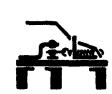
Switch body
S23, S25 2.125″ x .438″ x .094″
S30 1.062″ x .750″ x .093″
S31 1.031″ x .250″ x .062″

-00T

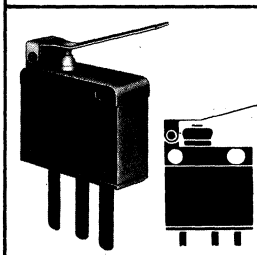

-60T

-00W

-20W


-20P

Weatherproof
E72 series



Series E72	10.1 amps
Series E73	0.1 amps

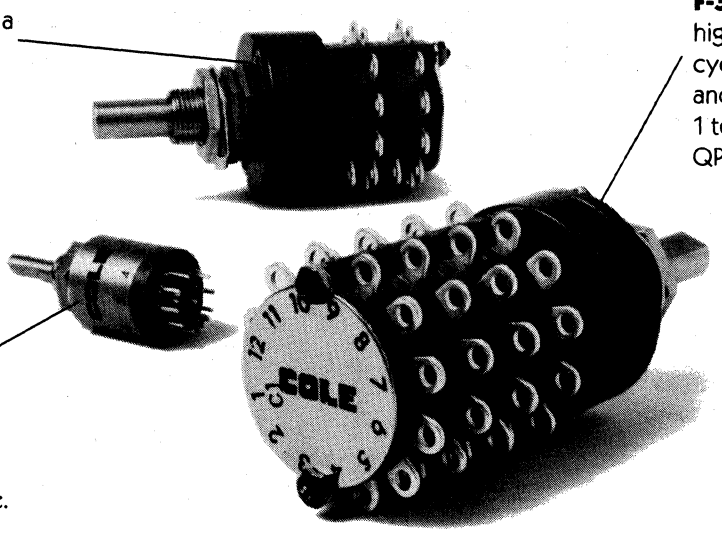
Switch body .915″ x .880″ x .385″

COLE INSTRUMENT YOUR ONLY SOURCE

Available now, COLE's '89 lineup includes a full featured line of one inch, five eighths and half inch miniature rotary switches
All flux/contaminant proof, immersible
All MIL-S-3786
COLE is the only switch manufacturer to solve the problem of flux and seepage contamination during the soldering and cleaning processes, and offer a family of QPL switches in the most needed sizes

F-2500 All the performance specs of the 3600 series in a .675" diameter envelope. MIL-S-3786.

F-3600 One inch, low and high level switching, 100,000 cycles, life 30, 36, 45, 60 and 90 degree indexing, 1 to 6 poles per deck. Fully QPL'd, MIL-S-3786.



F-1800 Half inch, low level (dry circuit) flux and contaminant proof, immersible. Solder lugs, printed circuit terminals available. Fully QPL'd, MIL-S-3786.

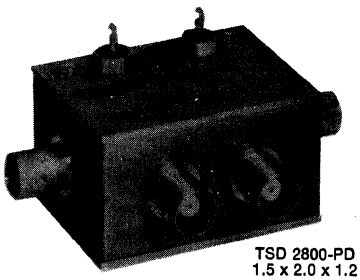
Make COLE's newly revised catalog your source for high precision aircraft and aerospace grade rotary switches—miniature, sub-miniature (to TO-5) MIL types, open frame instrumentation switches, encoded data switches, high security keylock, ordnance and specialty types.

COLE
INSTRUMENT CORP.

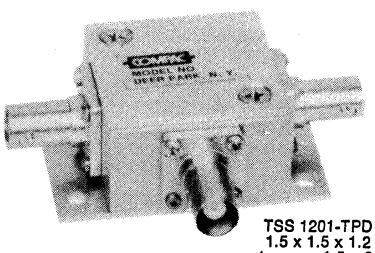
2650 SOUTH CRODDY WAY, SANTA ANA, CA 92704 (714) 556-3100
FAX 714-241-9061 TELEX 678-421

COMPAC™

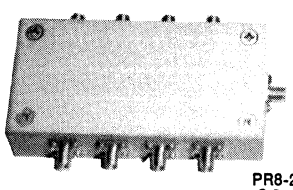
RF RELAYS & TRANSFER SWITCHES



TSD 2800-PD
1.5 x 2.0 x 1.2



TSS 1201-TPD
1.5 x 1.5 x 1.2
ext. cover 1.5 x 2.25

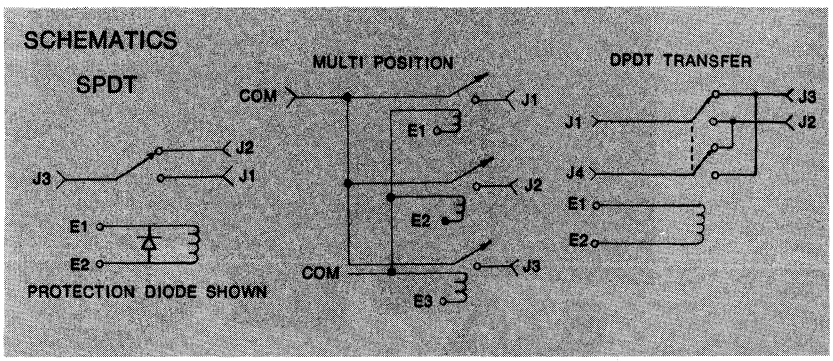


PR8-2831-TTLF
3.0 x 5.0 x 1.5
ext. cover 3 x 5.75

Single Pole 2 to 16 Position
Double Pole Double Throw Transfer
Signal and Power Lever Units

- ☐ Lightweight
- ☐ Low Cost
- ☐ Small Size

Also Available:
Custom Power Attenuators, Power Terminations, Flange mounted, no air flow required
50 — 800 watts
DC — 1 GHz



SPECIFICATIONS:

	Signal Level	Power Level
Frequency Range	DC-500 MHz	DC-400 MHz
Power Level	1 Watt	75 Watts
VSWR	1.2 Typ.	1.3 Typ.
Isolation	40 dB	35 dB
Insertion Loss	0.3 dB	0.2 dB
Switching Speed	10 m Sec	15 m Sec
Operating Range	−55C to +71C	

DETAILED SPECIFICATIONS UPON REQUEST

HOW TO ORDER

TS 4 — 28 0 1 — TPD

SWITCH TYPE
TS — Signal
PR — Power

SWITCH CONFIGURED
D — Transfer
S — SPDT
3-16 — Multi Position

COIL VOLTAGE
05, 06, 12, 18, 24, 28

CONNECTOR TYPE
0 - BNC
1 - SMA
2 - TNC
3 - N

MOUNTING
0 - Flush
1 - Extended Flange

OPTIONS
T — Termination 50 ohm ⅛W STD
PD — Protection Diode POS COM STD
TTL — TTL Interface Active High STD
C — DC Connector D Submin Type STD
L — Latching
F — Failsafe
SPECIAL CONFIGURATIONS
Other Options Available

* OTHER OPTIONS AVAILABLE. CONSULT FACTORY *

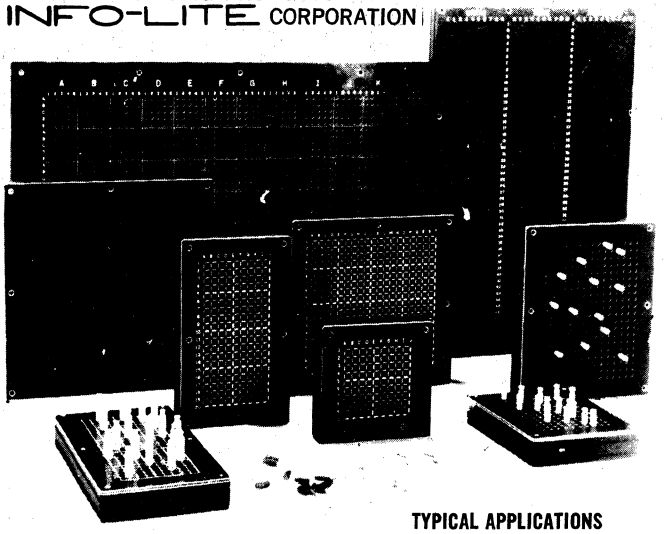
COMPAC
1320-13 LINCOLN AVENUE
HOLBROOK, NEW YORK 11741
TELEPHONE (516) 585-3400
TWX 510-227-1064

CROSSPOINT

THE PROGRAMMING PRODUCTS DIVISION OF
INFO-LITE CORPORATION

PROGRAMMING PRODUCTS

MATRIX PINBOARDS



INFO-LITE has developed a most convenient, compact and economical system for reliable programming and switching • The Matrix Program Board allows a wide variety of switching/programming functions to be performed by simply inserting programming pins (shorting or diode type) into a 2 to 10 deck contact matrix • No accessories such as "read" "write" equipment are required • Matrix Board features have led them to be favored over such devices as patchboards, card readers, toggle and thumbwheel switches, mag/punched tape and electronic memories • The two basic uses for Matrix Program Boards are: (1) Cordless patching (input-output switching), using shorting pins; (2) Programmable diode matrices (logic memories), using diode pins • Units with up to 100 x 100 crosspoints can be supplied to meet your requirements, whether for prototype or production quantities.

See Data Sheet MB3 for detailed specifications.

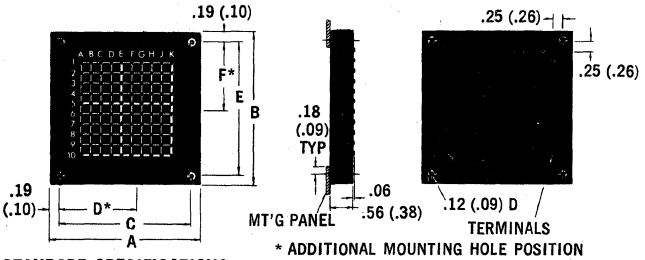
FEATURES

- Reliable closed entry contacts
- Rugged programming pins that will not bind
- Rapid and convenient method of programming/switching
- Permits insertion of components into network without soldering
- Replaces costly complex switching hardware
- Attractive and compact package
- Low capacitance for high frequency applications
- Ease of visual program checking

TYPICAL APPLICATIONS

Numeric Controlled Equipment
Logic Memories
Power Distributors
Circuit/Component Test Programmers
Lighting Systems
Code Generators
Programmable Diode Matrices
Communications Distributors
Status Indicators
Data Logging
Vending Machine Control
Thermo-Couple Selectors
Batching Programmers
Function Generators
Sequence Programmers
Pulse Code Programmers

STANDARD SPECIFICATIONS & STOCK MATRICES FOR 1000 & 2000 SERIES



* ADDITIONAL MOUNTING HOLE POSITION

Matrix Size	Dash #	2000 Series — .250" Grid						1000 Series — .130" Grid					
		A	B	C	D	E	F	A	B	C	D	E	F
10 x 10	—1	3.69	3.69	3.25	—	3.25	—	2.02	2.02	1.82	—	1.82	—
10 x 15	—2	3.69	4.94	3.25	—	4.50	—	2.02	2.67	1.82	—	2.47	—
10 x 20	—3	3.69	6.19	3.25	—	5.75	2.75	2.02	3.32	1.82	—	3.12	—
10 x 25	—4	3.69	7.44	3.25	—	7.00	3.50	2.02	3.97	1.82	—	3.77	1.82
10 x 50	—5	3.69	13.69	3.25	—	13.25	4.50	2.02	7.22	1.82	—	7.02	3.51
20 x 20	—8	6.19	6.19	5.75	2.75	5.75	2.75	3.32	3.32	3.12	—	3.12	—
25 x 25	—9	7.44	7.44	7.00	3.50	7.00	3.50	3.97	3.97	3.77	1.82	3.77	1.82
50 x 50	—10	14.44	14.19	14.0	7.00	13.75	7.00	**7.48**	**7.35**	**7.28**	**7.15**	**3.64**	**3.51**

STANDARD SPECIFICATIONS

1 — Contact Type: Closed Entry
2 — Contact Material: Be-Cu, Alloy 25
3 — Contact Finish: a - .0002" Ag over Cu Flash
b - .00002" Min. Au over Ni Flash
4 — Contact Support Material: Silicone Rubber
5 — Contact Resistance: .040 Ohm, typ.
6 — Contact Capacitance: 1 uuf [2 uuf]/in. at 1 MHz, typ.
7 — Bussing: 1st (top) Deck Vertical; 2nd Deck Horizontal
8 — Breakdown Voltage: 1000 VRMS
9 — Current Rating: 5 [2] Amps standard; 10 [4] Amps available
10 — Terminals: Combination Taper Pin Socket/Solder Cup [Solder Cup]
11 — Panel Material: Black XX Grade Phenolic
12 — Panel Marking: Alpha-Numeric/Grid, White Epoxy Ink Screened

NOTE: Values in brackets [ ] are for 1000 Series if two values are given.

SPECIFYING PART NUMBERS

X000-X - X X

.130" GRID 1
.250" GRID 2

MATRIX SIZE (SEE TABLE)

S SILVER CONTACT FINISH
G GOLD CONTACT FINISH

A SCREENED FRONT PANEL
B BLANK FRONT PANEL

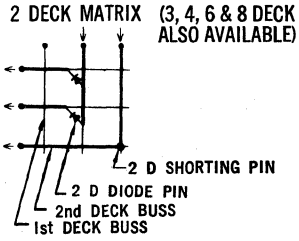
EXAMPLE: A 20 x 20, .250" grid matrix with silver contacts and blank front panel would have Part Number 2000-8-BS. U.S. Patent No. 3,631-374

Programming Pins Diode Pins 1000 Series (.13" Grid)	Specifications Diode	Anode Tot
1020S-CS0001/-CS0002	1N4151	Tip/Sleeve
1020G-CS0003/-CS0004	1N4151	Tip/Sleeve
2000 Series (.25" Grid)	† On Std. Matrices Tip makes W/2nd Deck	
2020S-CS0006/CS0007	1N270	Tip/Sleeve
2020S-CS0010/CS0011	1N4151	Tip/Sleeve
2020G-CS0012/CS0025	1N4151	Sleeve/Tip
2020S-CS0014/CS0024	1N4004	Sleeve/Tip
Shorting Pins 1010G & 2010GA		

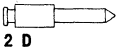
† Sold in multiples of 25 pieces.

SCHEMATIC

2 DECK MATRIX (3, 4, 6 & 8 DECK ALSO AVAILABLE)



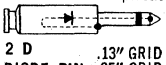
PROGRAMMING PINS



2 D SHORTING PIN

.13 GRID: #1010G
.25 GRID: #2010GA*

*2010GA has straight shank with undercut on grip end (without plastic cap).



2 D DIODE PIN

X020X-CSXXXX

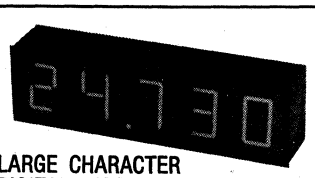
.13" GRID 1
.25" GRID 2

SILVER S
GOLD G

DEFINES DIODE & ORIENTATION. SEE TABLE ON LEFT

Diode orientation shown: Anode to Sleeve (1st Deck)

OTHER INFO-LITE PRODUCTS



LARGE CHARACTER DIGITAL DISPLAYS

MULTI-MESSAGE LIGHTED INDICATORS

DIGITAL INSTRUMENTS & SYSTEMS

SEE OUR PAGES IN EEM SECTION 2450

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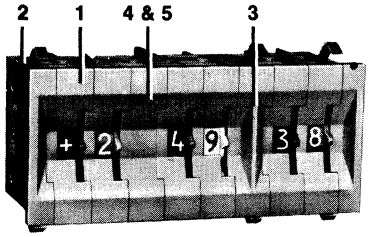
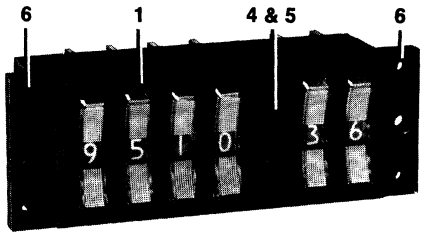
Digital Switches - LED Readouts

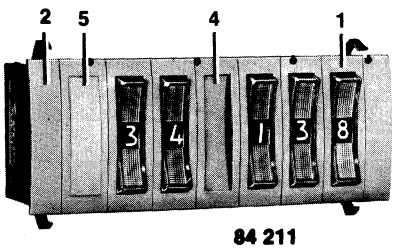
Rocker & Thumbwheel



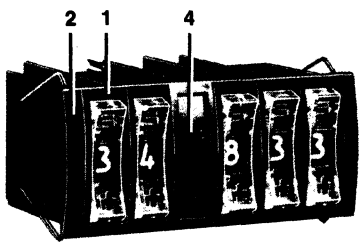
84 210
Thumbwheel Series
Panel Mount



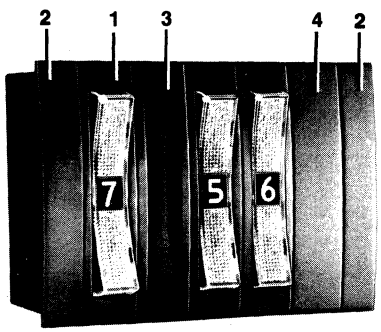
84 213
Rocker Series
Rear Mount



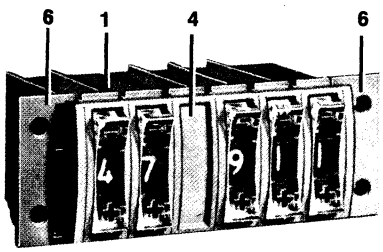
84 211
Rocker Series
Panel Mount



84 214
Rocker Series
Miniature Panel Mount



84 212
Rocker Series
Large Size Panel Mount



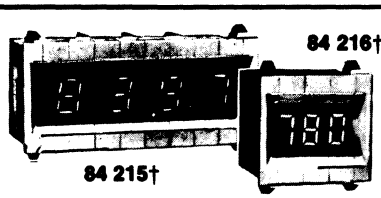
84 218
Rocker Series
Miniature Rear Mount

A Fully Modular System

1. **Basic Module:** Enables data input in coded form.
2. **End Caps:** Snap into place to complete module assembly. Complete with 4 panel clips.
3. **Separator:** Used to fit 2 switch assemblies into one unit. They come with 2 clips.
4. **Spacer:** Blank module used to replace a module assembly.
5. **Encoded "Dummy" Module:** Enables a simultaneous switching to two circuits from one digital switch. It is driven by the adjacent module via a coupling shaft.
6. **End Caps:** For rear mounting of module assembly. They come in pairs.

LED Readouts

- Compatible with Crouzet Rocker* and Thumbwheel† switches
- Easy to assemble snap-on modules
- With or without decoding/memory
- Two sizes available



84 215†

84 216†

84 217*

Crouzet Controls, Inc.
1083 State Parkway, Schaumburg, IL 60173-5419
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HEARST ENGINEERING SOFTWARE

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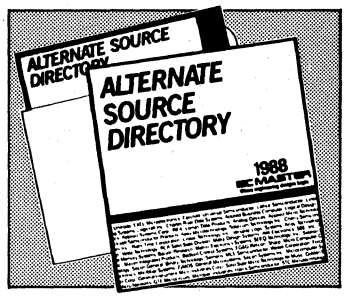
If you've used the IC MASTER, you know what the Alternate Source Directory is. Engineers tell us that it's one of the most valuable sections of the Master. The Alternate Source Directory...ASD...is now available in floppy disk form.



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The electronic ASD is FLEXIBLE! You can add ICs and you can add comments. You can add part numbers, prices, technical notes or anything else you like. You can customize the ASD to fit your needs and the needs of your company.

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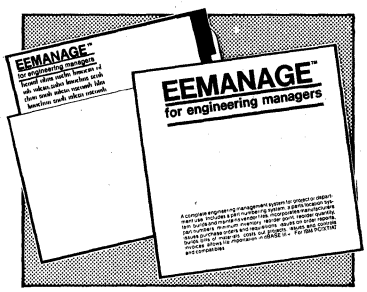

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CTS® CORPORATION

SERIES 288 COMMERCIAL MINIATURE 16MM STYLE ROTARY SWITCH/ENCODER

- Miniature 16mm style
- Bushing mounted with PC terminals. Shaft parallel or perpendicular to PC board.
- Compatible with CTS 280 series variable resistors
- Molded or metal shafts
- Single or multiple section units
- Low cost

General Information

Power Rating	100 milliwatts
Voltage Rating	Operating maximum—depends on switch configuration
Temperature Range	−25°C to +100°C.
Contact Resistance	5000 ohms static closed circuit maximum 1 megohm minimum open circuit

Rotary Encoder

Continuous rotation.
Nondetented or detented action with 16 and 36 detents revolution maximum.
Binary, gray and custom switching codes available.

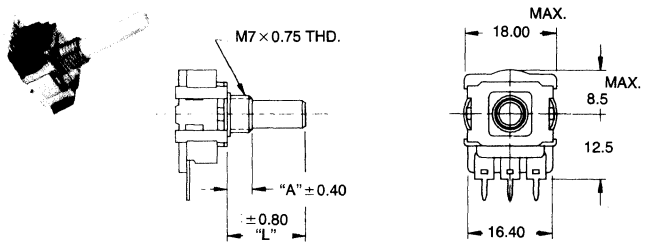
Selector Switch

Switching schemes can be made to suit your special circuit needs.
Shorting and nonshorting configurations available 10,000 cycle life.
Continuous or partial rotation.

XM 288

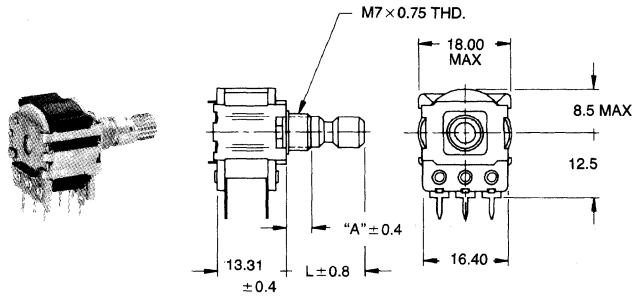
TYPICAL 2-BIT ENCODER CONSTRUCTION

UNIT: MM



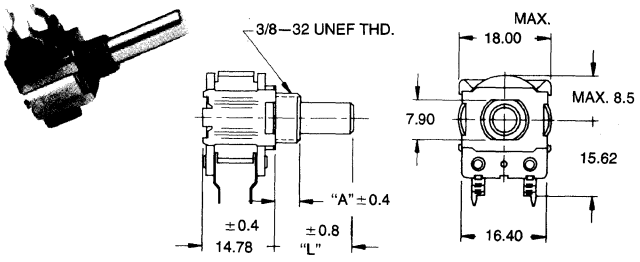
X2-288

TYPICAL 4-BIT BINARY ENCODER CONSTRUCTION



2-288

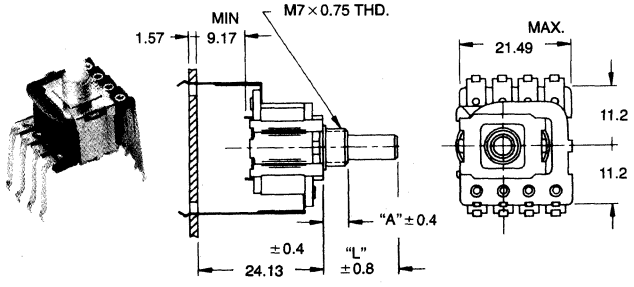
ELECTRONICS TUNER SWITCH CONSTRUCTION



Note: For the foot print information, please refer to 280 series

ZVM2-288

TYPICAL 4-POSITION 2 POLE SELECTOR SWITCH CONSTRUCTION



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CTS® CORPORATION*

SWITCH DIVISION, PASO ROBLES

CTS SERIES 207 AUTO-DIP™ SWITCH

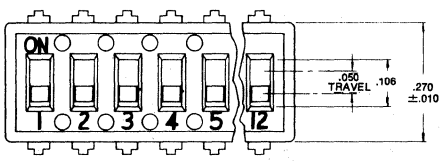
AUTOMATICALLY INSERTABLE, WAVE SOLDERABLE, BOARD WASHABLE DIP SWITCH

FEATURES

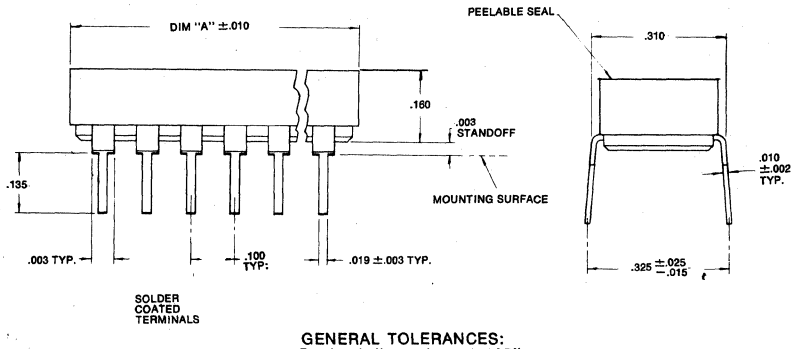
Optimized Contact System
- Redundant, wiping contacts
- Contactor does not rub on plastic or deflect during actuation

Optimized Mechanical Features
- Fully sealed to withstand insertion shock, wave solder temperatures, board washing
- Positive detent separate from contactor
- Closed windows prevent particle contamination
- .050″ actuator travel
- Molded .300″ integrated circuit package outline

Premium Materials
- Gold contacts, solder coated terminals
- Beryllium copper contactor
- 260°C housing heat deflection temperature assures contact and seal integrity after wave soldering
- All plastics rated UL 94 V-0
- Permanent laser marking

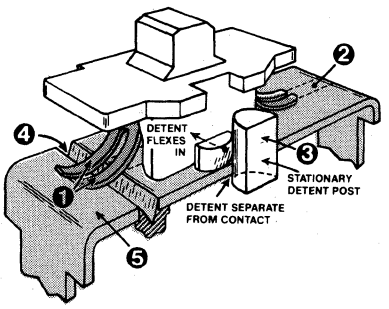


"A" Overall Dim.	No. of Switch Sections	Part No.
.258	2	207-2LPST
.358	3	207-3LPST
.458	4	207-4LPST
.558	5	207-5LPST
.658	6	207-6LPST
.758	7	207-7LPST
.858	8	207-8LPST
.958	9	207-9LPST
1.058	10	207-10LPST
1.158	11	207-11LPST
1.258	12	207-12LPST



GENERAL TOLERANCES:
Decimal dimensions ±.005″

Switch reliability that is the best ever!



1. Redundant gold contacts dramatically enhance contact reliability.
2. Positive wiping contacts assure low and consistent contact resistance. (.050″ travel)
3. Detent function separated from contacts to optimize both designs.
4. Gold contacts never abraded or contaminated by sliding over polymer surfaces. Contacts never touch a nongold surface.
5. No contactor deflection for the life of the switch. Constant contact force eliminates overstressing of contacts for greater reliability.

ELECTRICAL AND MECHANICAL SPECIFICATIONS

Contact Resistance
25 milliohms maximum initial
50 milliohms maximum at end of life

Actuation Life
5000 cycles switching
50 mA @ 6 VDC or 2 mA @ 50 mVDC

Nonswitching Rating
100 mA or 50 VDC

Insulation Resistance
1 x $10^9\Omega$ minimum between insulated terminals

Dielectric Strength
200 VAC minimum

Switch Capacitance
5 pF maximum between adjacent closed switches

Temperature Range
0 to 85%C operating
−40 to 70°C storage

Allowable Wave Solder Time
Up to 4 seconds with 260°C solder

Shock
No mechanical damage or changes of switch settings with 25 G applied for 6 milliseconds

Vibration
No mechanical damage or changes of switch settings during or after testing, when tested in 3 mutually perpendicular planes at 10-50 Hz sweep or at 60 Hz constant vibration. Amplitude .06″

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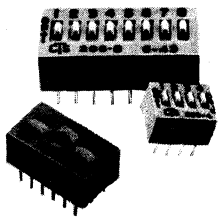
SWITCH DIVISION, PASO ROBLES

CTS SERIES 206

CTS DIP PROGRAMMABLE SWITCHES



FEATURES

- Contact wiping on make and break
- Suitable for flow soldering on PC board or mounting with standard DIP sockets
- Long term contact corrosion resistance provided by gold plated contact arms
- All U.L 94V-O plastic used
- Integral terminal and contact locked into plastic base rails
- Crisp, positive slide actuators
- Types 206-02 through -10 approved to MIL-S-83504/4 upon request
- Available with flush (low profile) actuators — SPST styles

Description

From 2 thru 12 SPST; 1 thru 6 SPDT; 1 thru 6 DPST; 1, 2 or 3 DPDT and 1, 2 or 3 4PST slide switches per switch package on .100″ x .300″ DIP centers

Initial Contact Resistance

50 milliohms

Maximum Contact Resistance

100 milliohms after 10,000 cycles switching 50 mA @ 24 VDC

Maximum Non-Switching Rating

100 mA or 50 VDC

Insulation Resistance

Across open switch and between adjacent closed switches: 1 x 10^9 ohms

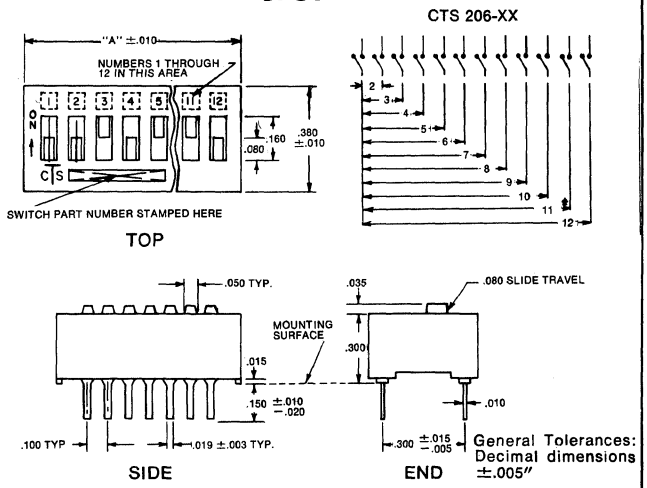
Dielectric Breakdown

Between adjacent switches minimum: 500 VDC

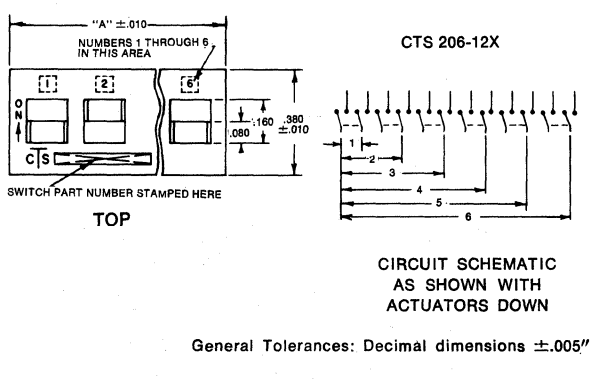
Switch Capacitance

Between adjacent switches maximum: 5.0 pF

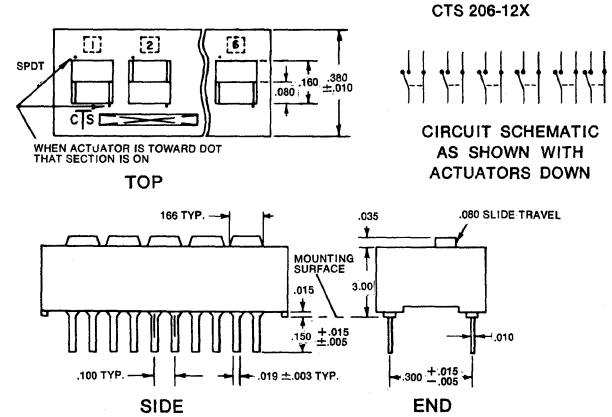
SPST



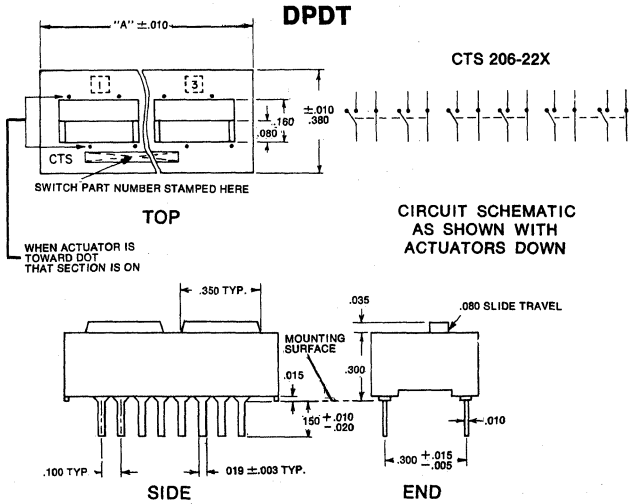
DPST



SPDT



DPDT



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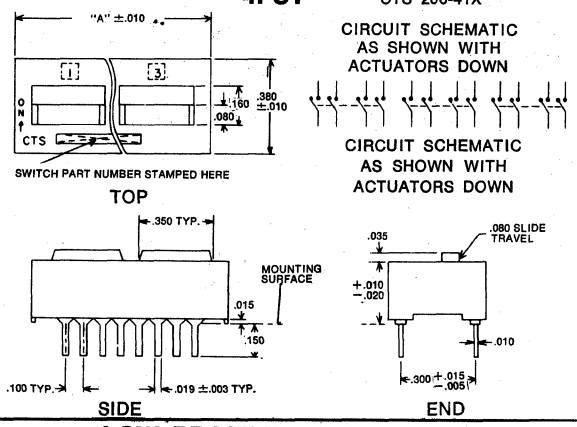
SWITCH DIVISION, PASO ROBLES

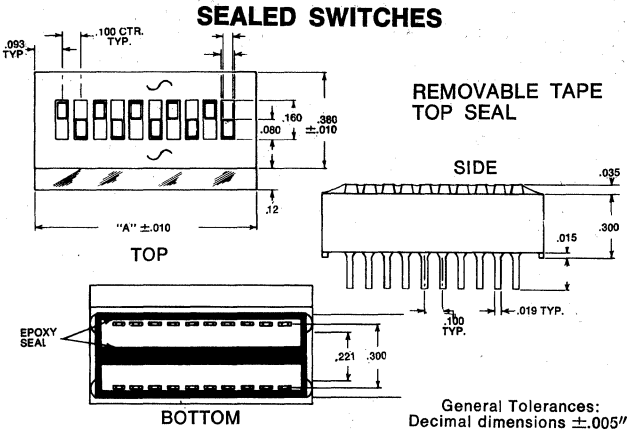
CTS DIP PROGRAMMABLE SWITCHES

4PST

CTS 206-41X

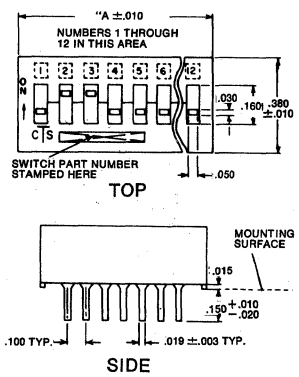


SEALED SWITCHES



General Tolerances: Decimal dimensions ±.005″

LOW PROFILE ACTUATORS

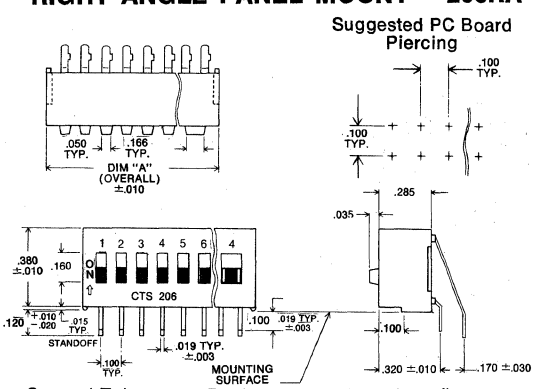


TO ORDER LOW PROFILE ACTUATOR SWITCHES

206-XXX-LP

Standard CTS Part Number — Low Profile Actuators

RIGHT ANGLE PANEL MOUNT — 206RA



General Tolerances: Decimal dimensions ±.005″

STANDARD "OFF THE SHELF" PART NUMBERS

"A" Overall Dimension	Number of Switch Sections	Actuation	Part Number	Low Profile Bottom & Top Sealed	Both Bottom & Top Sealed	Right Angle Mount Sealed Bottom & Top
.286	2	SPST	206-2	206-2LPST	206-2ST	206-2RAST
.386	3	SPST	206-3	206-3LPST	206-3ST	206-3RAST
.486	4	SPST	206-4	206-4LPST	206-4ST	206-4RAST
.586	5	SPST	206-5	206-5LPST	206-5ST	206-5RAST
.686	6	SPST	206-6	206-6LPST	206-6ST	206-6RAST
.786	7	SPST	206-7	206-7LPST	206-7ST	206-7RAST
.886	8	SPST	206-8	206-8LPST	206-8ST	206-8RAST
.986	9	SPST	206-9	206-9LPST	206-9ST	206-9RAST
1.086	10	SPST	206-10	206-10LPST	206-10ST	206-10RAST
1.286	12	SPST	206-12	206-12LPST	206-12ST	206-12RAST
.286	1	SPDT	206-121		206-121ST	206-121RAST
.486	2	SPDT	206-122		206-122ST	206-122RAST
.686	3	SPDT	206-123		206-123ST	206-123RAST
.886	4	SPDT	206-124		206-124ST	206-124RAST
1.086	5	SPDT	206-125		206-125ST	206-125RAST
1.286	6	SPDT	206-126		206-126ST	206-126RAST
.286	1	DPST	206-211		206-211ST	206-211RAST
.486	2	DPST	206-212		206-212ST	206-212RAST
.686	3	DPST	206-213		206-213ST	206-213RAST
.886	4	DPST	206-214		206-214ST	206-214RAST
1.086	5	DPST	206-215		206-215ST	206-215RAST
1.286	6	DPST	206-216		206-216ST	206-216RAST
.486	1	DPDT	206-221		206-221ST	206-221RAST
.886	2	DPDT	206-222		206-222ST	206-222RAST
1.286	3	DPDT	206-223		206-223ST	206-223RAST
.486	1	4PST	206-411		206-411ST	206-411RAST
.886	2	4PST	206-412		206-412ST	206-412RAST
1.286	3	4PST	206-413		206-413ST	206-413RAST

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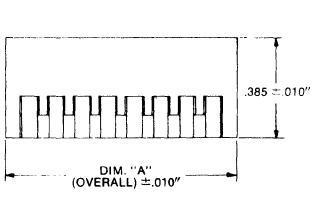
CTS SERIES 194
CTS DIP SWITCHES



SPST Switches

"A" Overall Dimensions	Number of Switch Sections	Standard Bottom Sealed Part Number	Bottom and Top Sealed Part Number
.286	2	194-2MS	194-2MST
.386	3	194-3MS	194-3MST
.486	4	194-4MS	194-4MST
.586	5	194-5MS	194-5MST
.686	6	194-6MS	194-6MST
.786	7	194-7MS	194-7MST
.886	8	194-8MS	194-8MST
.986	9	194-9MS	194-9MST
1.086	10	194-10MS	194-10MST
1.286	12	194-12MS	194-12MST

FEATURES

- Electrical switching occurs at 50% of actuator rotation angle
- Contact wiping on make and break
- Enclosed actuators shield contacts from foreign particles throughout life of switch
- The gold plated, over-center design provides positive detent action
- Reliable tape top seal optional/ bottom epoxy seal standard
- Insert molded base halves of thermoset material ensure mechanical integrity of contacts and terminals through soldering operations
- All U.L. 94 V-O plastics used

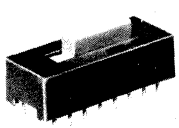
Description
Side actuated 4, 8 or 10 section SPST switching functions per package on .100″ x .300″ DIP centers

Initial Contact Resistance
50 milliohms maximum

Insulation Resistance
Across open switch and between adjacent closed switches: 1 x 10^9 ohms minimum

Maximum Contact Resistance
100 milliohms after 7000 cycles switching 50 mA @ 24 VDC

CTS SERIES 197



FEATURES

- Designed for automatic insertion
- Integral terminal and contact locked into thermoset base rails
- Contact wiping on make and break
- Break before make contacts
- Useful in "service/operate" applications, low level signal routing, digital circuit programming, etc.
- Long term contact corrosion provided by gold plated/inlaid contacts
- All U.L. 94 V-O plastics used

Description
4PDT slide actuated switch package on .100″ x .300″ DIP centers

Initial Contact Resistance
50 miliohms maximum

Maximum Contact Resistance
100 milliohms after 2000 cycles switching 50 mA @ 24 VDC

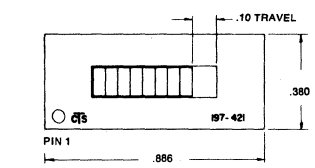
Insulation Resistance
Across open switch and between adjacent closed switches: 1 x 10^9 ohms minimum

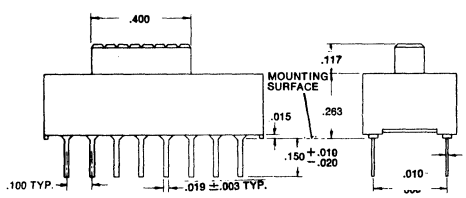
Dielectric Breakdown
Between adjacent switches minimum: 500 VDC

Switch Capacitance
Between adjacent switches maximum: 5.0 pF

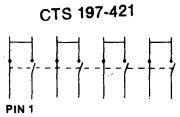
STANDARD "OFF THE SHELF" PART NUMBERS

Function	Part Number
4 pole double throw	197-421





CTS 197-421



TOP VIEW

General Tolerances: Decimal dimensions ±.005″

SWITCH DIVISION • 500 Linne Road • Paso Robles, California 93446 • (805) 238-0350 • FAX: (805) 238-9663
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CTS® CORPORATION*

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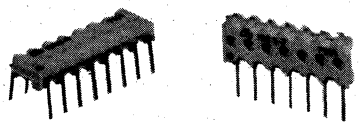
CTS SERIES 198

CTS PROGRAMMABLE DIP/SIP SHUNT NETWORKS



Description
Low cost matrix programming. DIPs offered in 4-24 terminal configurations; SIP's in 2-12 terminal packages

Current Rating
1.0 amp maximum

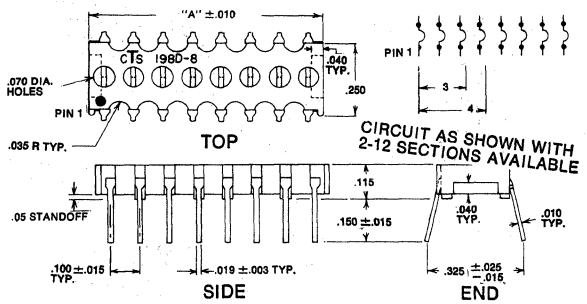
Insulation Resistance
1 x 10^{11} ohms minimum between any 2 electrically isolated terminals

Dielectric Breakdown Voltage
500 VDC minimum between any 2 electrically isolated terminals

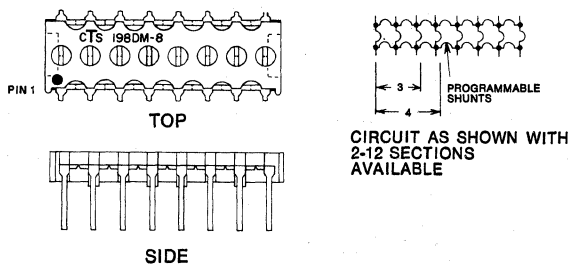
Insulation
UL recognized 94 V-O rated high temperature thermoplastic

Metal Parts
Solder plated copper alloy. (Gold plated terminals optional)

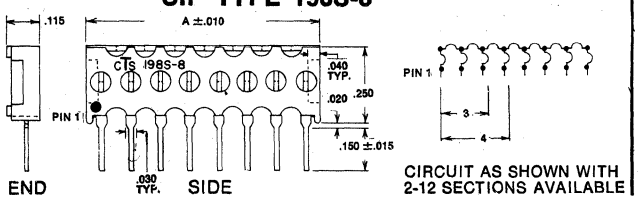
DIP TYPE 198D-8



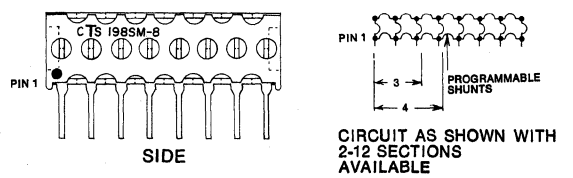
DIP TYPE 198DM-8



SIP TYPE 198S-8



SIP TYPE 198SM-8



No. of Sections	2	3	4	5	6	7	8	9	10	11	12
"A" DIM.	.200	.300	.400	.500	.600	.700	.800	.900	1.000	1.100	1.200

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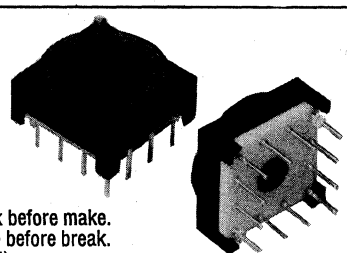
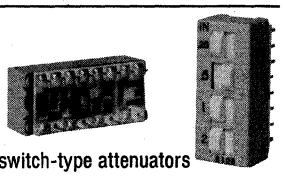
SERIES 235
Enclosed Miniature .500" Square Rotary Switches



Switch Functions:
1. Single pole, 11 positions, break before make.
2. Single pole, 11 positions, make before break.
3. Binary up to hexadecimal (0-15).
4. Other functions and combinations are available with special tooling.

Electrical and Mechanical Specifications:
1. Contact resistance varies with switch style: Typical values for 11 positions break before make. 0.1 ohm initial contact resistance, 0.15 ohm after 1000 cycles of 360° rotation.
2. Standard operating temperature range: −55°C to +85°C.
3. Rotational life: 1000 cycles of 360° rotation.
4. Wiping action on contact.
5. 360° rotation.
6. Small size: .5" x .5" square.
7. 250" profile from mounting plane to top of package.
8. Enclosed construction excludes dust and foreign material.
9. Terminal pull strength: 5 lbs. minimum.

SERIES 196
Switchable DIP Attenuator



- Reliable replacement for thumbwheel switch-type attenuators (at substantial savings)
- 75 ohm and 600 ohm unbalanced PI or T configuration networks
- .100" x .300" DIP packages
- Standard thick film ceramic modules; custom thin film modules available upon request
- Sealed bottom or top/bottom versions optional; assures contaminate-free switch operation after flow soldering and cleaning
- Standard values from .1 dB to 16 dB in increments of .1 dB to 2 dB

Electrical and Environmental Specifications
(all are absolute maximum ratings)

Electrical:
Impedance Tolerance ..... ±2%
Power Rating (maximum input signal) ..... 20 dBm
Insertion Loss ..... .02 dB

Environmental:
Storage Temperature ..... −40°C to +85°C
Operating Ambient Temperature ..... 0°C to +70°C
Lead Temperature (soldering 10 seconds) ..... 300°C maximum

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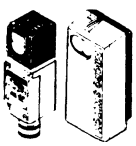
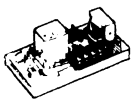
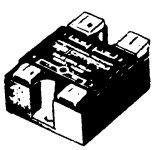
TOGGLE SWITCHES

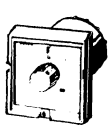

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

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BUD

CIRCUIT BREAKERS
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Heinemann
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Idec
Lumberg
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Welcon/Wells

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Engler
Hecon
IVO
Kessler-Ellis
Master Electronics
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Redington
Red Lion
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Stemco
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FILTERS
Curtis

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Allied Controls
American-Zettler
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AT&T
Bosch
C.P. Clare
Coto
Crydom Controls
EAC
Elec-Trol
Fujitsu
Gordos
Grayhill
Guardian
Hi-G
Idec
ITT
Line Electric
Magnecraft
Master Electronics
MEC
Midtex
Omron
Potter & Brumfield
RBM
Schrack
Siemens
Sigma
Standex
Stantel
Struthers-Dunn
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American Switch
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Omron
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Skan-A-Matic

PROXIMITY
Agastat
Electro
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ATC
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Antex
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Eagle Signal
Guardian
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Master Electronics
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National Controls
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Syracuse Electronics

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TRIMMERS & POTS
Beckman Ind.

SOLENOID
Dormeyer
Guardian
Line Electric

TERMINAL BLOCKS
Beau
Buchanan
Curtis
Electrovert
Kulka
Magnum
Marco
RDI
Underwriters Safety
Vernitron-Beau

TRANSFORMERS
Dormeyer
Microtran
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Thordarson
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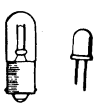
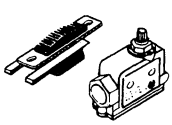
CIRCUIT BREAKERS FUSES & FUSEHOLDERS

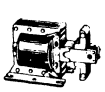
KNOBS


LAMPS & LEDS

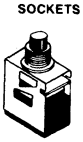

SWITCHES

RELAYS

INDICATOR LIGHTS

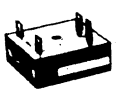

SOLENOIDS

SOCKETS


PUSHBUTTON SWITCHES

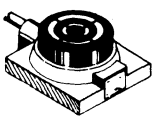
PADDLE SWITCHES

TRANSFORMERS


TIMERS

COUNTERS

FANS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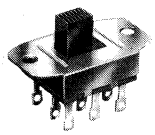
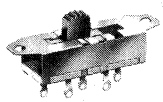
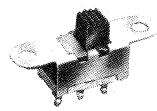
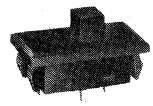
Slide Switches

	 Standard Switches	 Miniature Switches	 Micro Miniature Switches	 Fully Enclosed Micro Miniature Switches
Circuitries	SPST, SPDT, DPST, DPDT, 3PDT, 4PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, DP4POS.	SPST, SPDT, DPST, DPDT, 3PDT, SP3POS, DP3POS, 3P3POS, 4P3POS, SP4POS, DP4POS, DP5POS.	SPST, SPDT, DPDT, SP3POS.	SPST, SPDT (Plug-in or snap-in versions)
Ratings	3A AC/.5A DC @ 125V through 13A AC/.5A DC @ 125V	.5A AC/.5A DC @ 125V through 8.5A AC/.5A DC @ 125V	.5A AC/.5A DC @ 125V	.5A AC/.5A DC @ 125V
Momentary Versions	SPST, SPDT, DPDT, 3PDT. Also, SP3POS, DP3POS and 3P3POS are available momentary in only one direction.	SPST, SPDT, SP3POS, DP3POS.	SP3POS (momentary both directions to center)	Not Available
Side Actuated Versions	SPDT (maintained or momentary), DPDT, DP3POS.	SPDT, DPDT, 3PDT, SP3POS, DP3POS, SP4POS, DP4POS, DP5POS.	SPDT	SPST
Terminal Options	Solder, Wirewrap, PC, Faston	Solder, Wirewrap, PC.	Solder, Wirewrap, PC.	Solder, PC, Faston
Button Options	.344″ (Standard) .031″ through .750″ (optional). Black is standard; optional colors available.	.200″ (Standard) .125″ through .453″ (optional). Black is standard; optional colors available.	.120″ through .250″ Black is standard; optional colors available.	.110″ through .250″ Black is standard; optional colors available.
Agency Listings	UL, CSA	UL, CSA	UL	UL, CSA
Endurance	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum) 6,000 cycles rated load (minimum)	10,000 cycles no load (minimum)	6,000 cycles at rated load (minimum)
Bifurcated/Redundant Contacts	DPDT, 4PDT. Make before break or break before make.	SPDT (maintained or momentary), DPDT, SP3POS. Make before break or break before make.	Not Available	Not Available
CW Catalog	S2120-II/S2120-VIIA	S2120-III/S2120-VII	S2120-IV	S2120-V

All CW switches are available with a complete range of options including: unique ratings, button height and color, markings, and glamour caps. Contact factory for literature requests or your unique requirement.

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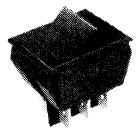
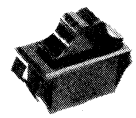
NEW WORLD'S FIRST 16A 125V/250V AC MINI-ROCKER SWITCHES

Panel Mount Power Switches

	"Mini-Rocker" Switch	"Soft-Styled" Rocker Switch	 "Hi Gloss" Rocker Switch	 Panel Mount Slide Switch
Circuitries	SPST, SPDT, DPST, DPDT, SPDT-Center Off, DPDT-Center Off	SPST, SPDT, SPDT-Center Off	SPST, SPDT, DPST, DPDT	SPST, SPDT
Mounting	Pop-In	Pop-In	Pop-In	Pop-In or Chassis Mount
Ratings	8A @ 125V AC/4A @ 250V AC 13A @ 125V AC/10A @ 250V AC 1/2HP @ 125V-250V AC 16A @ 125V AC/16A @ 250V AC 3/4HP @ 125V-250V AC 10A @ 14V (T)/3A @ 125V (L) 10 (4)A 250 ~ (VDE)	8A @ 125V AC/4A @ 250V AC 13A @ 125V AC/10A @ 250V AC 1/2HP @ 125V-250V AC 5A @ 14V (T)/6A @ 125V (L) 16A @ 125V AC/12A @ 250V AC 3/4HP @ 125V-250V AC 10A @ 14V (T) 12 (6)A 250 ~ (VDE)	8A @ 125V AC/4A @ 250V AC 13A @ 125V AC/10A @ 250V AC 1/2HP @ 125V-250V AC 5A @ 14V (T)/6A @ 125V (L) 16A @ 125V AC/12A @ 250V AC 3/4HP @ 125V-250V AC 10A @ 14V (T) 12 (6)A 250 ~ (VDE)	8A @ 125V AC/4A @ 250V AC 13A @ 125V AC/10A @ 250V AC 1/2HP @ 125V-250V AC 5A @ 14V (T)/6A @ 125V (L) 16A @ 125V AC/12A @ 250V AC 3/4HP @ 125V-250V AC 10A @ 14V (T) 12 (6)A 250 ~ (VDE)
Panel Cutout	.756" x .508"	.550" x 1.125"	.550" x 1.125" (Single Pole) .872" x 1.071" (Double Pole)	.550" x 1.125" (Pop In) 1.125" Mounting Centers (Chassis Mount)
Panel Thickness	.050" To .150"	.025" To .180" (up to .170" for Center Off and Illuminated)	.025" To .180" (Single Pole) .025" To .150" (Double Pole)	.025" To .180"
Momentary Versions	SPST, SPDT, DPST, DPDT, SPDT-center off, DPDT—center off	SPDT—center off	Not Available	Not Available
Illuminated Versions	SPST, SPDT, DPST, DPDT	SPST	Not Available	Not Available
Lamp Options	Neon 125V (STD) Neon 250V Incandescent 14V	Neon 125V (STD) Neon 250V Incandescent 14V	Not Available	Not Available
Agency Listings	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE	UL, CSA, VDE
Endurance	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC) 10,000 cycles rated load @ 16A 250V AC	100,000 cycles no load, minimum 25,000 cycles rated load (up to 16A 125V AC)	100,000 cycles no load, minimum 25,000 cycles rated load	100,000 cycles no load, minimum 25,000 cycles rated load
Button/Rocker Options	Color, Markings	Color, Markings	Color, Markings	.260" Button (std.); .344", .500", .625", .750" also available/ Color/Markings/Toppers Available
Housing Options	Color, Markings	Color, Markings	Color, Markings	Pop-In Mount or Chassis Mount, Color, Markings
Insulation Barriers	Optional	Optional	Optional	Optional
For additional information request Catalog S212186-Rev A-87				

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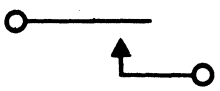
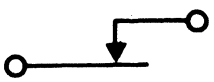
eem

MINIGLOSSARY
RELAY CONTACT FORMS

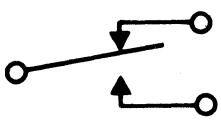
A
Make
SPST-NO



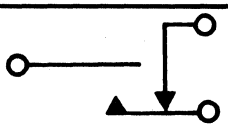
B
Break
SPST-NC



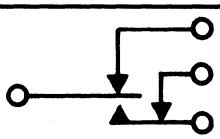
C
Break, Make
(Transfer)
SPDT



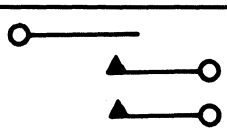
D
Make, Break
(Continuity
Transfer)



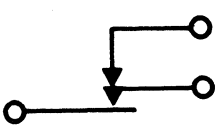
E
Break,
Make,
Break



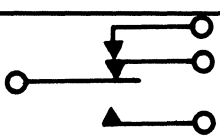
F
Make,
Make



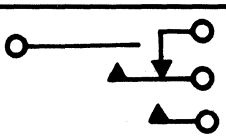
G
Break,
Make



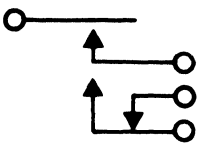
H
Break,
Break,
Make



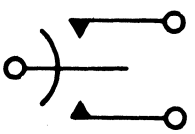
I
Make,
Break,
Make



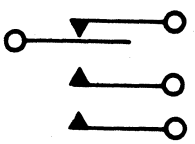
J
Make,
Make,
Break



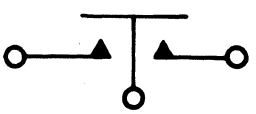
K
Center off
SPDT



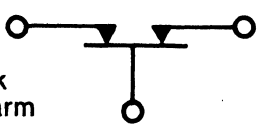
L
Break,
Make,
Make



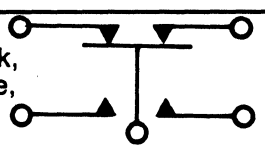
U
Double
make
Contact
on arm



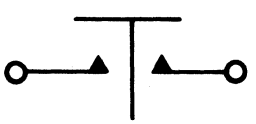
V
Double break
Contact on arm



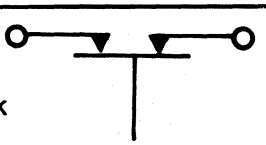
W
Double break,
Double make,
Contact
on arm



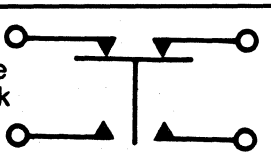
X
Double
make



Y
Double break



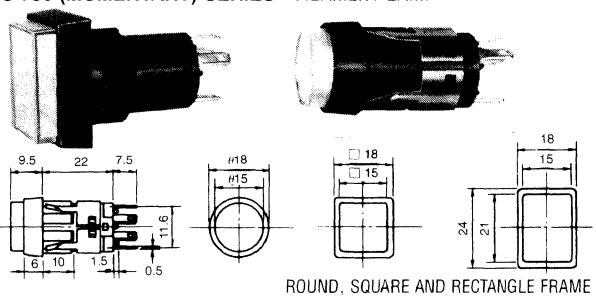
Z
Double make
Double break
SPDT-DB



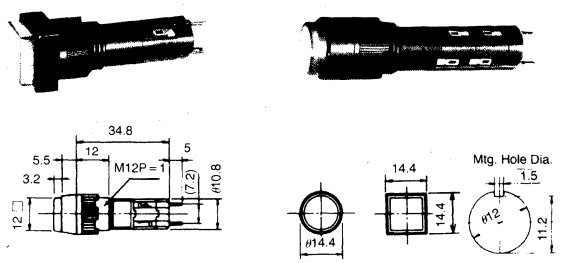
QUALITY SWITCHES of MIYAMA DSA

ILLUMINATED SWITCHES. Long Life (Electrical 50,000 Operations, Mechanical 100,000 Operations.)

MS-720 (ALTERNATE) SERIES LED
MS-730 (MOMENTARY) SERIES FILAMENT LAMP

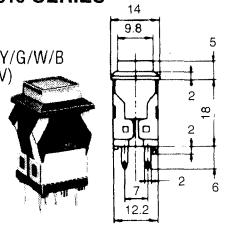


DS-700 (ALTERNATE) SERIES LED
DS-710 (MOMENTARY) SERIES FILAMENT LAMP

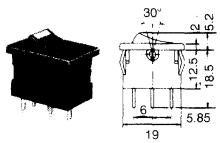


MS-800, 810 SERIES

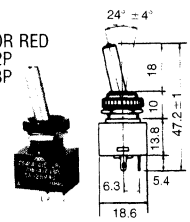
LED; R/Y/G
F. LAMP; R/Y/G/W/B
(6V, 12V, 28V)



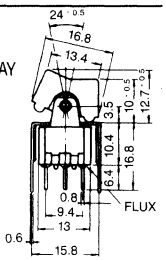
SNAP-IN ROCKER
W/LED DS-850
FRAME: BLK, WHT or GRAY



LED
GREEN OR RED
DS-415 2P
DS-417 3P

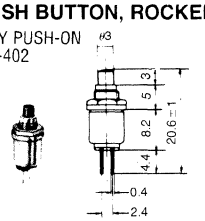


MS-500-W2-P
BLACK, WHITE, GRAY

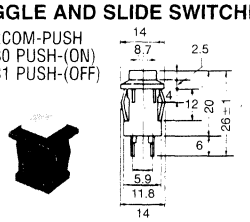


PUSH BUTTON, ROCKER, TOGGLE AND SLIDE SWITCHES

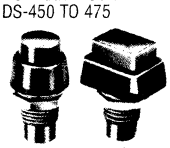
TINY PUSH-ON
MS-402

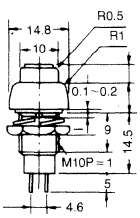


INTERCOM-PUSH
DS-430 PUSH-(ON)
DS-431 PUSH-(OFF)



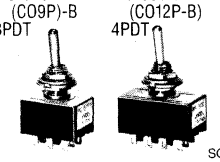
P-SERIES
DURABLE-PUSH
DS-450 TO 475

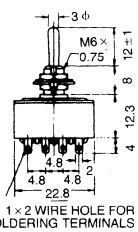




MS-500M(9P)
MS-500N
(CO9P)-B
3PDT

MS-500P(12P)
MS-500R
(CO12P-B)
4PDT

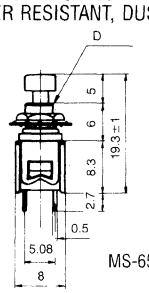


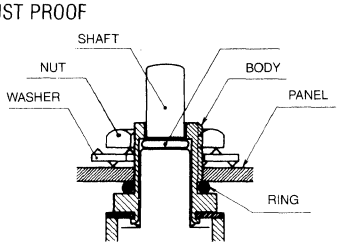


PUSH-BUTTON SWITCHES

MINIATURE WATER RESISTANT, DUST PROOF

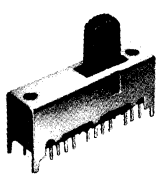
MS-650L





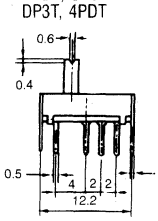
MS-651 GOLD PLATED LOW CURRENT CONTACTS

SLIDE SWITCHES

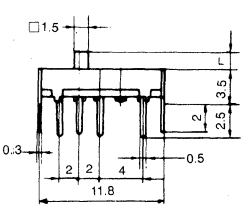


SLW; 4P3T, 6P3T
8P3T, 10P3T

SLV: SPDT,
DPDT, SP3T
DP3T, 4PDT



SLJA: SPDT, SP3T



Part No.	DS-700 (alt) DS-710 (mom)	MS-720 (alt) MS-730 (mom)	MS-800 (alt/mom) MS-810 (alt/mom)	DS-850	DS-415 DS-417	MS500W2P	MS-402	DS-430 DS-431	P-Series DS-450	MS-500M MS-500P	MS-650 MS-651	Slide Switches
Model Type	Illuminated Push Button Switches LED (Red, Green, Yellow) Filament Lamp (6V, 12V, 28V) R/G/Y/W/B Available also W/O Lamp or LED			Rocker LED Color: Red, Yellow, Green	Toggle LED/red, green	—	Push-button	Push-button	Push-button	—	—	Available in vary size, pole position
Rating	1A 250V AC 3A 125V AC	1A 250V AC 3A 125V AC	0.1A 30V DC	3A 250VAC 5A 125VAC	3A 125VAC	6A 125V AC	0.5A 125V AC	1A 125VAC 0.5A 250V	3A 125VAC 1A 250VAC	6A 125V AC	3A 125V AC 0.4VA (MS-651)	DC30V 0.03A DD12V 30.1A (SLV/SLH) many type of Slide Switches are available PLS Call
Circuit	SPDT DPDT	SPDT DPDT	A DPST off-on B DPST off-(on) C DPST on-off D DPST on-(off)	2P SPST	2P (SPST) on-off 3P (SPDT) on-on	—	2P (SPST)	2P (SPST) DS-430 Push-(on) DS-431 Push-(off) Color: R/B/W	2P (SPST) DS-450-462 on-off DS-463-475 Push-(on) R/W/B/Slvr	—	—	
Switching Function	on-on Alternate on-(on) Momentary		E SPDT on-on F SPDT on-(on)	on-off		on-on on-(on) on-off-(on)	Push-(on) Momentary			off-on on-on on-off-on	off-(on) on-(on)	
Contact Resistance	2.5VDC 1A 10mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 10mA 50mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 20mΩ max.	20mΩ max.	2.5VDC 1A 20mΩ max.	2.5VDC 1A 10mΩ max.	2.5VDC 1A 20mΩ max.	20mΩ max.	50mΩ max.	DC5V, 1A 20mΩ max.
Insulation Resistance	DC.500V 100MΩ min.	DC.500V 100MΩ min.	DC.500V 500MΩ min.	DC.5000V 100MΩ min.	DC.500V 100MΩ min.	DC500V 100MΩ min.	DC.500V 100MΩ min.	DC.500V 100MΩ min.	DC.500V 100MΩ min.	DC500V 100MΩ min.	DC500V 100MΩ min.	DC.500V 100MΩ min.
Voltage Breakdown	AC 1500V 1 minute	AC 1500V 1 minute	AC 500V 1 minute	AC.1000V 1 minute	AC.1000V 1 minute	AC 1000V min.	AC1000V 1 minute	AC1500V 1 minute	AC1500V 1 minute	AC 1000V min.	AC 1000V min.	AC500V 1 minute
Mounting Hole Dia. mm	12	16	12.6 square	13 × 19	12	—	5.2 dia.	12.4 × 11.2	All Model 10.2 dia.	6.2	5	vary size

DSA offers a complete line of switches including Slide, Multi-Push, Subminiature, Lever, Rocker, Toggle and Illuminated Types. For Complete Information on our Wide Range of Products Please Contact:
For more information please call: 212-691-9050

SEE DSA PAGE IN EEM-SECTION 2100.

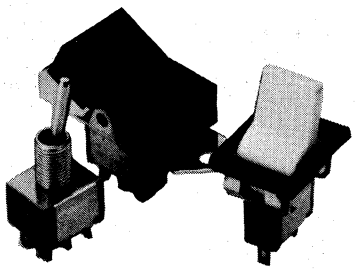
TOLL FREE-1-800-DSA-1616

DSA INC. 150 Fifth Avenue, Suite 845, New York, NY 10011 **FAX 212-807-1598**

DIALIGHT SWITCHES

PASSIVE COMPONENTS, ACTIVELY ENGINEERED

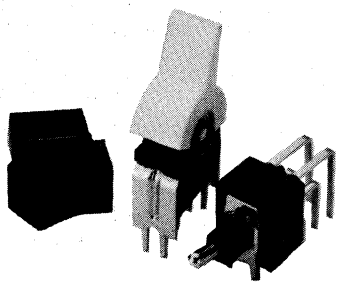
MINIATURE ROCKER/ TOGGLE SWITCHES



Available in over one million combinations, our miniature rocker, toggle and lever switches (Series 570) offer maximum design flexibility. Choose from low-level, 5-ampere and combination ratings; up to four poles; nine switching functions; nine colors and numerous mounting and terminal styles to meet your unique parameters. Miniature size saves valuable space, particularly where PC boards are utilized. Ideal for telecommunications, industrial control, computer peripherals and many other applications where high reliability, easy visual identification of switch functions, and low cost are prime objectives. U.L. listed and CSA certified.

Specifications
Electrical Ratings
Standard, Low-level and Combination up to 5 amps resistive at 120 VAC or 28 VDC; 2 amps resistive at 250 VAC.
Electrical Life
Up to 100,000 operations.
Materials
Gold and/or silver contacts and terminals, stainless steel housing, chrome plated brass toggle and nylon rockers and levers.

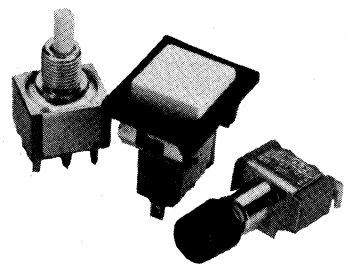
SEALED ROCKER/ TOGGLE SWITCHES



Three-way sealing process utilizing epoxy, rubber o-rings and ultrasonics allows our rocker, toggle and lever switches (Series 578) to be wave soldered and cleaned without contamination. They install easily into PC boards along with other components, reducing labor costs. And they can be used as direct replacements for unsealed switches, eliminating the need for redesign. They also come in a wide variety of styles, colors, contact ratings, functions and mounting configurations.

Specifications
Electrical Ratings
Standard, Low-level and Combination up to 7.5 amps resistive at 120 VAC or 28 VDC; 3 amps resistive at 250 VAC.
Electrical Life
40,000 operations.
Materials
Gold and/or silver contacts and terminals, high temperature U.L. approved plastic case, chrome plated brass toggle and nylon rockers and levers.

MINIATURE SNAP-ACTION PUSHBUTTON SWITCHES



The extremely short pre-travel of our miniature pushbutton switches (Series 580) offers near-instant response. While their snap-action mechanism provides positive user feedback. Small in size, they have a minimum rear projection, too. Available with numerous mounting options, including rear-panel and front snap-in. Can be used with or without four attractive snap-on caps available in a choice of 9 colors. All switches also come with epoxy-sealed terminals to prevent flux entry from the rear of the switch during soldering. U.L. listed.

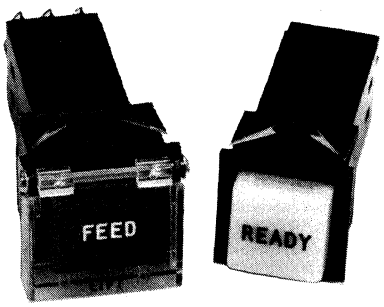
Specifications
Electrical Ratings
Combination and Low-level up to 1 amp resistive at 120 VAC or 28 VDC.
Electrical Life
60,000 operations minimum.
Travel
.025″ typical.
Materials
Gold or gold over silver contacts and terminals, stainless steel housing and glass filled polyester plunger.

DIALIGHT COMPANY A Division of North American Philips (201) 223-9400

DIALIGHT·KULKA·HHSMITH

Engineering is the only commodity we sell.

COMPUTER GRADE ILLUMINATED PUSHBUTTON SWITCHES



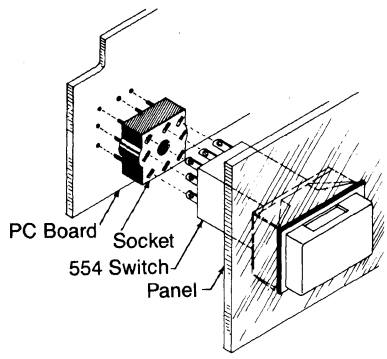
Ideal for all types of equipment, in addition to computers, our computer grade illuminated pushbutton switches (Series 554) offer long life, independent incandescent or LED illumination and outstanding design flexibility. Bright cap illumination provides quick identification of switch status, while independent lamp circuitry can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Available in a wide variety of combinations. Choose from four contact ratings (including Solid State Hall Effect), ten cap styles (including LED illumination and split screen), momentary or alternate action mechanisms, matching indicators and two mounting styles. Optional wave-solderable and washable sockets are available for PC board applications. Optional side barriers and Kap-Guard™ device minimize the chance of accidental actuation. U.L. listed. CSA certified.

Specifications

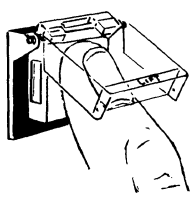
Electrical Ratings
Snap-action silver, snap-action gold, wiping-action gold and solid state up to 7 amps at 125 VAC or 30 VDC; 2 amps at 250 VAC.

Operating Life
750,000 operations (momentary), 250,000 (alternate action) and 1,000,000 operations minimum (solid state).

Materials
Gold plate and/or silver contacts, high temperature U.L. approved plastic housing and high impact plastic caps.



Protective Kap-Guard™



COMMERCIAL GRADE ILLUMINATED PUSHBUTTON SWITCHES

Highly dependable contact mechanisms and rugged metal bodies make our commercial grade lighted pushbutton switches (Series 513) ideal for applications requiring more rigid switch construction. Bright cap illumination provides quick identification of switch status, while independent incandescent illumination can be used to denote required operator action. Fingertip grips on caps also simplify lamp replacement in the field. Choose from thousands of combinations, including momentary, snap or non-snap, alternate action; two contact ratings; over 100 cap styles; ten cap colors; engraving, hot stamping or replaceable film legends; and snap-in or rear-panel mounting. U.L. listed.

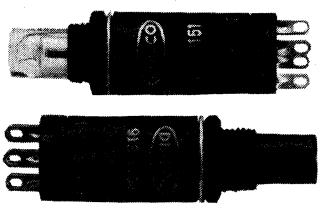
Specifications

Electrical Ratings
Standard and Low-level up to 5 amps resistive at 125 VAC or 30 VDC.

Operating Life
Up to 100,000 operations.

Materials
Gold plated coined silver contacts, anodized aluminum housing and high-impact plastic caps with a nickel plated brass shank.

LED AND NEON ILLUMINATED PUSHBUTTON SWITCHES



Our led and neon illuminated pushbutton switches (Series 913) feature a high brightness LED with current-limiting resistor for 5 VDC operation, or neon lamp for 125 VAC operation. Their integral cap prevents unintentional removal. While their highly reliable momentary switching mechanism has a typical life of one million actuations. Specifically designed for attractive rear-panel mounting, these switches require no sub-panels and a minimum of hardware, reducing both material and labor costs.

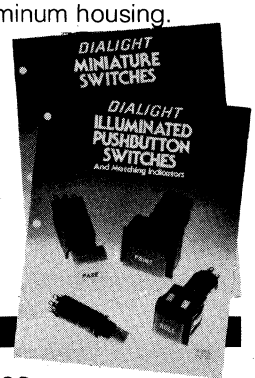
Specifications

Electrical Ratings
0.1 amp resistive at 125 VAC or 30 VDC.

Operating Life
1,000,000 operations.

Materials
Gold plated contacts and black anodized aluminum housing.

For complete specifications, mounting diagrams, ordering information, etc., send for our free product catalogs. **Dialight Co., 1913 Atlantic Avenue, Manasquan, NJ 08736. Or call *(201)223-9400***



DIALIGHT COMPANY A Division of North American Philips

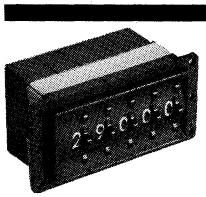
(201) 223-9400

DIALIGHT·KULKA·HHSMITH

Engineering is the only commodity we sell.

PRESENTING THE LONGEST-RUNNING SERIES IN THE BUSINESS

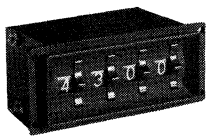
Innovative, Quality-Engineered Thumbwheel Switches Available Off-The-Shelf At Unbeatable Prices.



29000 SERIES
ECONOMY MINISWITCH

An economical miniswitch for high package density. Extra large in-line character readout. Width, .350" (8.9) and cutout height 1.020" (25.9)

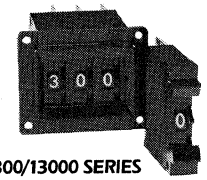
- 10, 12 or 16 Dial Positions
- Many Output Codes and Configurations
- Message Units for Longer Legends
- Optional Dial Stops to Limit Rotation
- Rear-Mounted



43000/44000/45000 SERIES
MINISWITCH

These low cost switches feature optional LED lighting and snap-together assembly. Field installable stops to limit dial rotation. Printed circuit boards with solder or pin terminations.

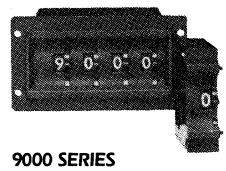
- Available in Most Popular Codes
- 10 Dial Positions
- .200" High, Up-Front Dial Characters
- 43000 —
- 500" (12.7) W x .980" (24.89) H
- 44000 —
- .315" (8.0) W x 1.220" (31.0) H
- 45000 —
- .315" (8.0) W x .961" (24.4) H



300/13000 SERIES
GENERAL PURPOSE DIGISWITCH

One of the most widely used thumbwheel switches, with more available options, output codes and special termination features than any other switch.

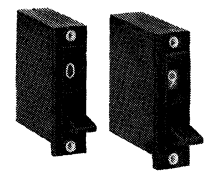
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Easy to Replace MIL-Spec Lighting
- Message Units for Longer Legends
- 13000 is Front-Mounted Version
- 300 —
- .500" (12.7) W x 1.380" (35.05) H
- 13000 —
- .500" (12.7) W x 2.00" (50.8) H



9000 SERIES
DIGISWITCH

The 9000 offers more available options, output codes and special termination features than any other fully-sealed MIL-spec switch. Rear-mounted, qualified to MIL-S-22710/12.

- 8, 10, 12, or 16 Dial Positions
- RFI Shielding Available
- Optional Replaceable MIL-Spec Lighting
- Dial Stops to Limit Dial Rotation
- Dimensions —
- .600" (15.24) W x 1.375" (34.93) H



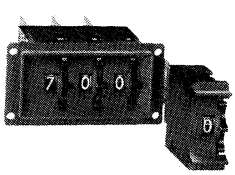
24000/28000 SERIES
LEVER SWITCH

24000: Bi-directional front panel sealed switch built to perform in any hostile environment qualified to MIL-S-22710/24.

- Optional, Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 24000 —
- .480" (12.19) W x 1.175" (29.84) H

28000: Minilever commercial switch that can be actuated in either direction.

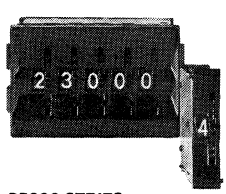
- "Upper" or "Lower" Window Location
- 90° Full Lever Travel
- 10 and 12 Dial Positions
- 28000 —
- .500" (12.7) W x .980" (24.89) H



200/700/8000 SERIES
MINISWITCH

Small switches for hostile environments, virtually impervious to sand, dust, oils, high humidity, salt spray and explosive atmospheres. Series 200 has potted wire leads, 700 — P.C.B. both qualified to MIL-S-22710/15 and /20.

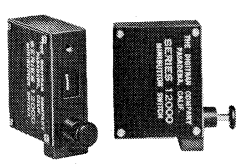
- 8, 10, 12 or 16 Dial Positions
- RFI Shielding Available
- Optional, replaceable MIL-Spec Lighting
- 8000: Commercial Version
- Dimensions:
- .500" (12.7) W x .980" (24.89) H



23000 SERIES
"SNAP-IN" SLIMSWITCH

For applications where maximum panel density, good reliability and error-proof positive setting action are required. Switch width only .315" with cutout height of 1.221."

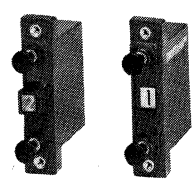
- 10 Dial Positions
- Snap-in, Front Mount — No Tools Required
- Large (.170" High) In-Line Characters



12000/53000 SERIES
MINIBUTTON

Reliable, contamination-proof switches for applications requiring panel sealing per MIL-S-22710. No supplemental panel cover or boot is required for sealing.

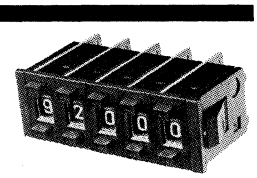
- Individually Mounted Switches
- Glass Window that Seals Switch Interior
- Metal Case —
- Facilitates R.F.I. Shielding
- Optional Replaceable MIL-Spec Lighting
- 12000 Series:
- Qualified to MIL-S-22710/17
- 12000 —
- .500" (12.7) W x .83" (21.08) H
- 53000 —
- .350" (8.89) W x 1.020" (25.91) H



63000/64000 SERIES
BI-DIRECTIONAL MINIBUTTON

Two-button bi-directional switches designed to meet all performance requirements of MIL-S-22710. Rear-mounted, panel sealed.

- 63000 — 8, 10, 12 Dial Positions
- 64000 — 16 Dial Positions
- Metal Case —
- No RFI Shielding Required
- Optional Replaceable MIL-Spec Lighting
- Individually Mounted Switches
- 63000 —
- .410" (10.41) W x 1.230" (31.25) H
- 64000 —
- .460" (11.68) W x 1.312" (33.53) H



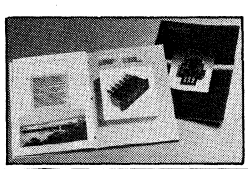
92000/93000/62000 SERIES
DOUBLE PUSHBUTTON

These commercial switches are designed for applications where speed and ease of settings are important.

- Snap-together Assembly
- L.E.D. Lighting Available (92000)
- Low Cost, High Quality, High Reliability
- 10 and 16 Dial Positions Available
- Dial Stops to Limit Dial Rotation
- 92000 —
- .300" (7.62) W x .551" (14.2) H
- 93000 —
- .300" (7.62) W x .886" (22.5) H
- 62000 —
- .315" (8.00) W x .945" (24) H

NOTE: Numerals in brackets indicate millimeter equivalents.

More military and commercial thumbwheels and greater code selection than anybody else. And it's all under one roof to maintain the very highest standards of product quality and delivery.



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DIGITRAN®
A DIVISION OF XCEL CORPORATION
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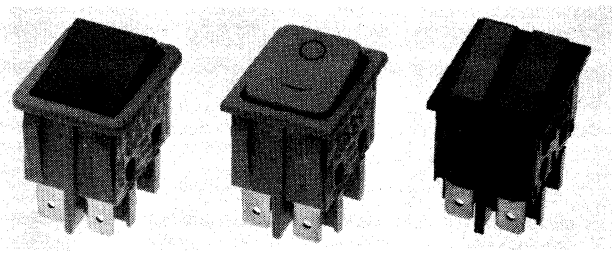
Dreefs

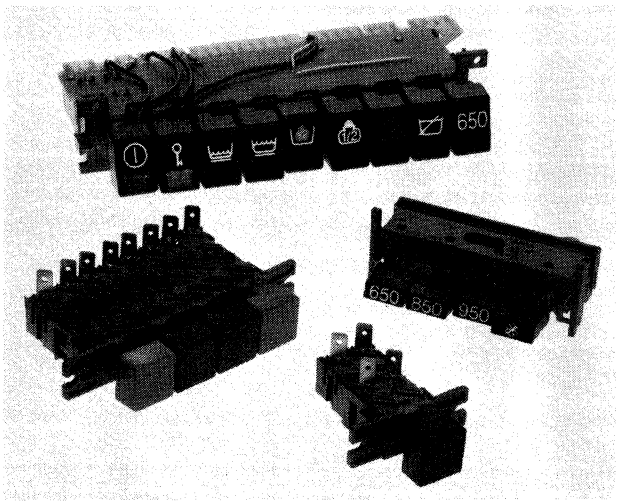
The Worldwide Choice

Rocker Switches



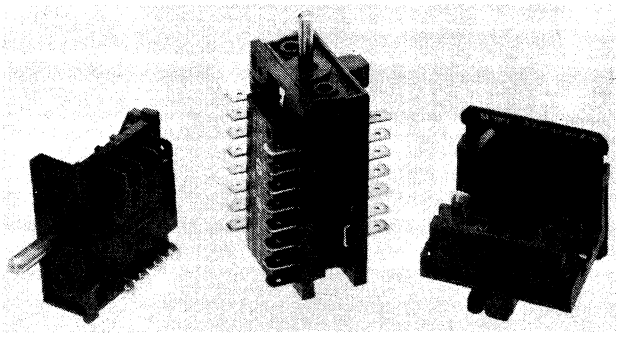
The Dreefs line of power rocker switches ranges from subminiature to full size. Shown above are a few configurations standard within the Dreefs 2WiXII Series. Rated at 16 (4) amperes @250 VAC INDUCTIVE, or 25 amperes @125 VAC INDUCTIVE, this series features an inrush capability of up to 125 amperes (typical). A wide variety of bezel styles and colors, along with many choices for standard and customized rockers (illuminated or non-illuminated) are available.

Pushbuttons

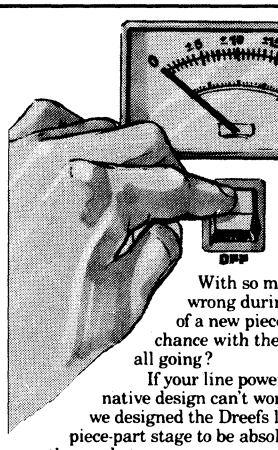


The unique terminal arrangement and building block technique used in the design of these pushbuttons allows easy accommodation of special switching requirements. Each terminal station along the standard heavy-duty thermoplastic housing contains its own set of double contacts, for high reliability and great versatility in switching applications. Each terminal station is rated at up to 16 amperes @125/250VAC. Solid silver, AgCd0 or Au contacts are standard. Operation is momentary, push-push, interlock or cancelling action.

In-Line, Cam Actuated Switch System



The camshaft technique of rotary-to-linear conversion to open spring-loaded NC contacts provides the crisp action, reliability and weld-breaking advantages of make/break contacts, along with high inrush and high current-carrying capabilities. Up to 26 separate SPST switches, each controlling an individual circuit, may be actuated along a single cam, with one to 26 rotational positions. Contacts are rated at 16 amperes @125/250 VAC. High-inrush or dry circuit contacts are available.



What *happened?*

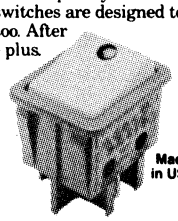
With so many other things that can go wrong during the design and development of a new piece of equipment, why take a chance with the one component that gets it all going?

If your line power switch fails, the most imaginative design can't work! With that thought in mind, we designed the Dreefs line of Power Rockers from the piece-part stage to be absolutely the **BEST** available on the market.

All switches carry a wide array of international approvals, including **VDE, UL** and **CSA.**

Electrical and mechanical specifications are fully described in a newly updated catalog. A telephone call or a note from you will get one into your hands quickly.

By the way, the *outside* of these switches are designed to make your control panel look great too. After the hard part gets done, that's a nice plus.



Dreefs Switch Inc.
3782 Hawthorn Court, Waukegan, IL 60087
312-662-7667 or 800-323-9605
Fax: 312-662-0906

SABS MITI AUS

For complete information on the products shown above, contact: Ed Magiera, **Dreefs Switch Inc.**, 3782 Hawthorn Court, Waukegan, Il. 60087. (312) 662-7667 or 800-323-9605. FAX: 312-662-0906

Hermetic Switches & Sensors

Tilt
Motion Sensing
Position Sensing
Specials/Assemblies

DURAKOOL INC
An American Electronic Components Company

From Standards to Specials, Durakool Engineers a Dependable Switch to Fit Your Application.

When your application calls for a switch with long contact life and quiet, dependable performance, ask for Durakool. The industry leader in mercury technology and hermetic sealing for over 50 years, Durakool has established a reputation of quality and engineering expertise which gives added value to *your* product.

When you choose a Durakool switch, you can be confident that it has been manufactured using the most modern, cost-effective methods and equipment. Durakool also utilizes modern quality assurance procedures including Statistical Process Control (SPC).

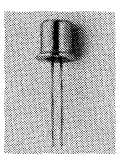
So, whether you need motion sensing, position sensing, or general power switching capabilities, Durakool sales engineers will work with you to provide the switch that best suits your application.

The products listed below are representative of hundreds of available designs.

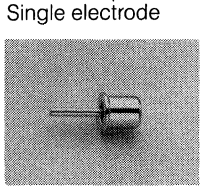
A 1/2 Series

Applications:
Small appliances (Electronic irons)
Auto vanity mirror light
Auto door handle control switch
Man-down alarms
Geophone Position Sensor

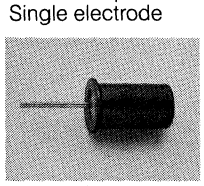
A 1/2 Short-4770
Tip-over/position
Dual electrode



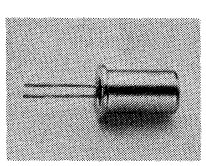
A 1/2 Short-4929
Tilt/motion/position
Single electrode



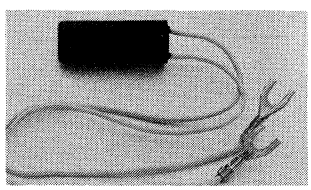
A 1/2 N-3677
Tilt/motion/position
Single electrode



A 1/2-4859
Tilt/motion/position
Dual electrode



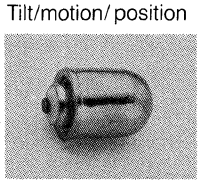
A 1/2-001
Tilt/motion/position
(Cased)



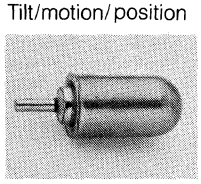
A1 Series

Applications:
Auto trunk light
Freezer lid light
Gas and water meter tamper sensor
RV automatic leveling device
Auto cruise control deceleration sensor
Outboard motor ignition safety shut-off

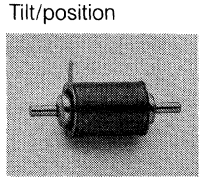
A1 Short-009
Tilt/motion/position



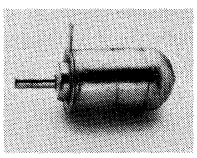
A1N-2622
Tilt/motion/position



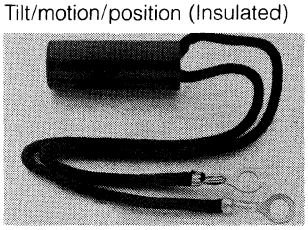
A1-SPDT-3619
Tilt/position



A1-3018
Anti-vibration/ tilt



A1-001
Tilt/motion/position (Insulated)



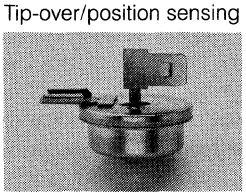
G-Series

Applications:
Tilt switches for general power switching
7 amps to 65 amps

TO3 Series

Applications:
Space heater safety shut-off
Auto seat belt activation sensor
Spotlight on/off power control
Dangerous incline indicator for lawn equipment/RV
Gasoline pump impact safety shut-off

TO3-1016
Tip-over/position sensing

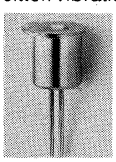


TO3-Specials
Tip-over/ motion sensing

TO7 Series

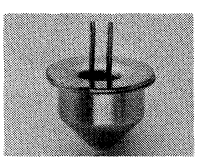
Applications:
Fence perimeter alarm sensor
Parking meter tamper sensor

TO7-4765
Jitter/vibration · Single electrode



TO8 Series

Applications:
Telephone privacy/mute switch
Auto seat belt activation sensor
Gas meter tamper sensor
Vending machine tamper sensor
VCR theft alarm

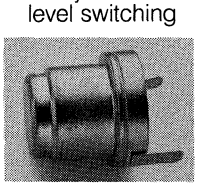


TO8-4539
Tip-over
Omni-directional

TO8-Specials · Motion sensors

Wide Angle Series

Wide hysteresis for liquid level switching



4236 Wide angle tilt

Specialty Switches and Custom Molded Assemblies

Applications:
Liquid level control for sump pumps
Military gyro systems
Liquid level control for gasoline and misc. fluids

For information on the full line of Durakool hermetic switches and sensors, or for engineering or selection assistance, contact Durakool today.

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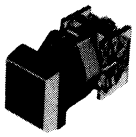
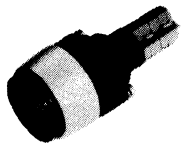
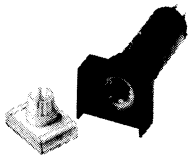
OIL AND WATERTIGHT SWITCHES — Mounting holes of 7/8", 5/8"



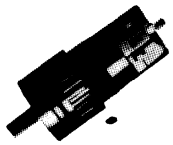
Series 04
Minature Oil and Watertight 7/8"
Round hole mounting
Round or Square Face
10 AMP, 600 Volts, up to 8 Poles
Pushbutton, Lever, Keylock,
Emergency Stop Actuators



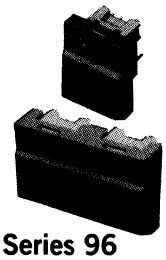
Series 14
Rugged 04 Front,
Small back of Panel Depth.
5A 250 VAC, Low Level
or Electronic Switching
Keylock, Lever, Round
Pushbutton Actuators



Series 51
Highly Styled Round,
Square, or Rectangular
Front 9 Lens Colors,
4 Switch Elements,
Sealed to IP 65

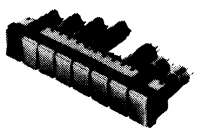


Series 52
Companion to Series 51
in a Lighted Rotary
Switch with all the same
Switch Elements



Series 96
Sealed to IP 67 standards,
compatible terminals.
1 or 2 LED Illumination.
Wave Solderable and
Washable. Series 98
also available

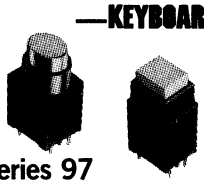
INTERLOCKS



Series 30
Mechanical Interlock
All Metal Construction,
1,000,000 Operations
2–20 Pushbutton Stations
5 Interlock Combinations
4 Switch Element Choices

P.C. BOARD MOUNTABLE —KEYBOARD SWITCHES

All Rated 100 mA 50 VAC, 72 VDC
All have Momentary and Maintained Action



Series 97
Small Round or Square
LED Illuminated
Excellent where small size
is essential
1 or 2 N. O. Contacts

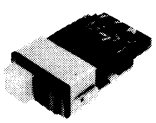
Series 99
Lighted Keyboard Switch
1 or 2 Pole N.O. or N.C.
Single, Dual, or Triple Width

See Oil and Watertight for Series 96

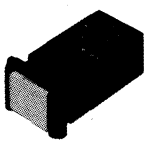
POWER SWITCHES

10 AMP, 380 VAC

Series 02
S.P.D.T. or D.P.D.T. Action
Maintained or Momentary
3 Bezel Shapes, 9 Lens Colors
Large Display Screen
Keylock Available



Series 03
Two Lamp Illumination
Two Button Interlock Available
Single or 2 Button Operation
S.P.D.T. or D.P.D.T.
Maintained or Momentary



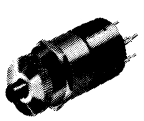
Series 22
Front panel mounting
by one person
10Amp 380 Volts AC
Sealed to IP 65 standards
Mushroom cap available

See Series 04 for Additional Power Switching

MINIATURE

Series 19
Mounts in 3/8" Round Hole
Round or Square Bezel
Low Level Switching 100 mA
at 50 VAC or 72 VDC
Maintained or Momentary Action

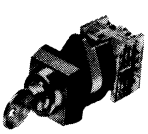
Series 11
Round Lens Mounts in 5/8"
Round Hole from rear of Panel
1–3 Pole Switching
4 Elements
Lamps and LED's
Front Replaceable



Series 21
Non-Illuminated
Small back of Panel Depth
5A, 250 VAC, Low Level or
Electronic Switch Element
Momentary or
Maintained Action

KEYLOCKS

Series 31
Two and Three Position Keylock Switches
4 Switching Elements 5A, 250 VAC, Low Level
2 Hall Effect Electronic Switches
2 Security Levels
Round, Square, Rectangular Bezel
Mounts in a 5/8" Round Hole

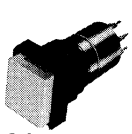


Series 04
Power Switching 10 AMP, 600 VAC
2 and 3 Position Switches
Round and Square Face
7/8" Round Hole Mount

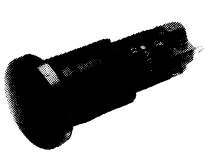
Additional Keylock Series 02, 03, 14, 22, 30, and 51

ALL PURPOSE PANEL SWITCHING PRODUCTS

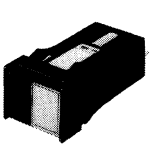
Lamps are Stationary on all EAO Switch Designs.



Series 31
Round, Square, Rectangular Front
with 5/8" Round Hole Mounting
9 Lens Colors, Concave or Flat,
Transparent, Translucent
4 Switch Elements, 5A, 250 VAC,
Low Level and Electronic
Indicators, Pushbuttons, Buzzers,
Flashers, Fuse-Switch, Keylock, Read-out



Series 01
Round, Square, and Rectangular with
Larger Bezel Design
9 Lens Colors
Momentary or Maintained,
Position Indicating
Front Lens and Lamp Removable



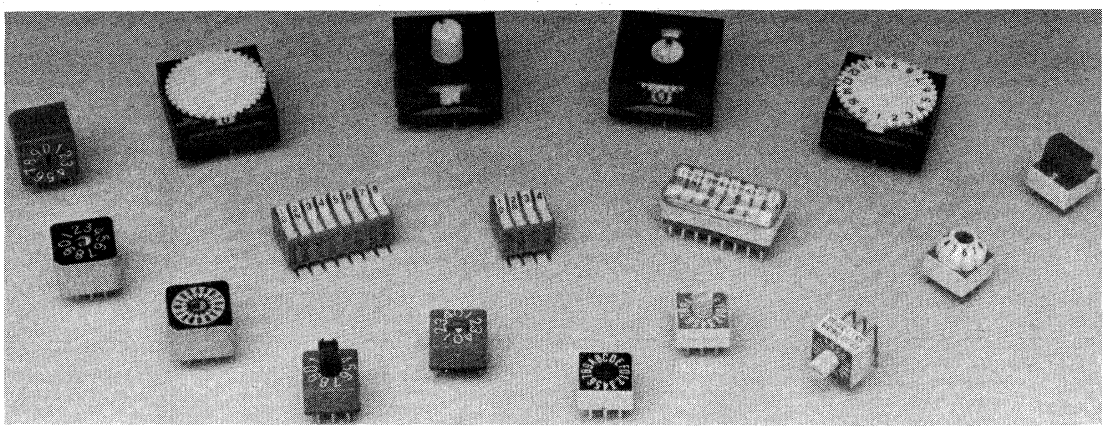
Series 41
Dual Lamp Switch,
Wired Independently
Full or Split Screen
Snap-in Mount
4 Switch Elements

Design in EAO & Save — you can feel the difference!

eao ■

EAO SWITCH CORPORATION
198 PEPE'S FARM RD. P.O. BOX 552, MILFORD, CT 06460.
203/877-4577 TELEX: EAOSWITCHMFRD 964347. FAX: 203/877-3694

EECO® PCB SWITCHES



2300 Series MICRO-DIP®

Advanced in concept, the 2300 Series rotary coded switch is a space-saving yet economical device for equipment programming. Ideal for address encoding or presetting of PROM's and data entry devices.

Number of Positions ..... 10 and 16
Life ..... 10,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.100 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V ..... 250 V rms
Dimensions
Height ..... 0.239- 0.394 (6.07 -10.01)
Width ..... 0.376 - 0.450 (9.55 - 11.43)
Length .... 0.396 - 0.450 (10.06 - 11.42)
Actuation Method
Screwdriver ..... Standard
Shaft ..... Available
Binary Coded Output ..... Standard

2100 Series STRIPSWITCH®

The most economical method of handsetting coded values. Requires a minimum of space, no mounting hardware, and can be "ganged" up to four stations in a strip. Two legend locations provide readability.

Number of Positions ..... 10 and 16
Life ..... 250,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V ..... 500 V rms
Dimensions
Height 0.430 (10.92)
Width 0.775 (19.68)
Length 0.800 (20.32)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Shaft ..... Optional
Binary Coded Output ..... Standard

3300 Series MICRO-DIP®

A low-profile, fully-sealed version of the original 2300 Series MICRO-DIP switch, this switch has all of its features, plus full sealing to withstand automated soldering and cleaning processes.

Number of Positions ..... 10 and 16
Life ..... 10,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.100 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V ..... 250 V rms
Full Environmental Seal ..... Standard
Dimensions
Height 0.190 (4.83)
Width 0.380 (9.65)
Length 0.380 (9.65)
Actuation Method
Screwdriver ..... Standard
Shaft ..... Available
Binary Coded Output ..... Standard
Seal ..... Yes

2200 Series STRIPSWITCH®

This switch offers all of the features of the proven 2100 Series STRIPSWITCH in a low-profile, fully-sealed unit. The easy-to-read thumbwheel has a built-in screwdriver slot.

Number of Positions ..... 10 and 16
Life ..... 100,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V ..... 500 V rms
Full Environmental Seal ..... Standard
Dimensions
Height 0.360 (9.14)
Width 0.790 (20.07)
Length 0.790 (20.07)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Binary Coded Output ..... Standard
Seal ..... Yes

2400 Series MINI-DIP®

The exclusive gold-on-gold cleaning/ wiping action contacts assure low contact resistance while allowing end stackability and maintaining .100-in. pin centers. The fully sealed model allows actuation and position identification through a clear, flexible membrane.

Number of Positions ..... 2 to 10
Life ..... 2,000 Detents
Electrical Rating
Non-Switching Load ..... 1.0 Amp
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.050 Ohm
Dielectric Withstanding V ..... 500 V rms
Full Environmental Seal ..... Optional
Dimensions
Height 0.375 (9.52)
Width 0.385 (9.78)
Length ..... 0.200 - 1,000 (5.08 - 25.4)
Actuation Method ..... Rocker
Standard Options
Special Marking ..... Yes
Seal ..... Yes
Surface Mountable ..... Yes

NEW 2700 Series STRIPSWITCH®

The 2700 unit withstands enormous temperature variations and maintains an impervious seal to contamination. This switch is available in multiple configurations to meet your custom mounting needs. Thumbwheel adjust and large characters allow easy manipulation and position identification.

Number of Positions ..... 10 and 16
Life ..... 100,000 Detents
Electrical Rating
Non-Switching Load ..... 3.0 Amps
Switching Load ..... 0.125 Amp
Contact Resistance ..... 0.100 Ohm
Dielectric Withstanding V ..... 500 V rms
Full Environmental Seal ..... Standard
Dimensions
Height 0.430 (10.92)
Width 0.790 (20.7)
Length 0.790 (20.7)
Actuation Method
Thumbwheel ..... Standard
Screwdriver ..... Standard
Binary Coded Output ..... Standard
Seal ..... Yes

EECO®

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EECO/Maxi-Switch • 5436 W. Latham St., Phoenix, AZ 85043-1736 • Phone: (602) 272-5645 • Telex 910-950-0196
EECO Membrane Switch Operations • 5436 W. Latham St., Phoenix, AZ 85043-1736 • Phone: (602) 272-5645 • Telex 910-950-0196
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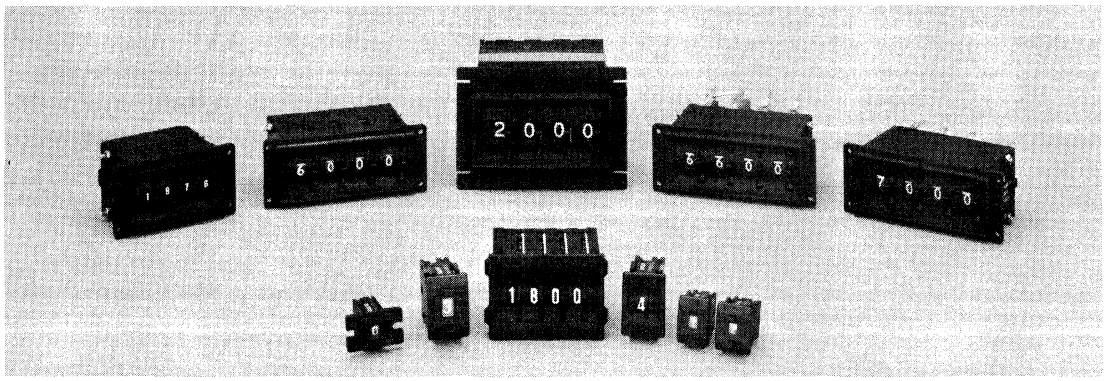
EECO® THUMBWHEEL SWITCHES



1100 Series Thumbwheel or Pushwheel Switch

With a narrow .236 width design and front mount configuration, the 1100 Series switch offers space saving dimensions in an attractive black matte finish.

Number of Positions 10
Life . . . . . 300,000 Detents
Electrical Rating
Non-Switching Load . . . . . 0.500 Amp
Switching Load . . . . . 0.100 Amp
Contact Resistance . . . . . 0.200 Ohm
Dielectric Withstanding V . . . . 500 V rms
Seal . . . . . Dust
Panel Mount . . . . . Front
Dimensions, Module
Height 0.708 (17.98)
Width 0.236 (5.99)
Depth, Behind Panel 0.905 (22.99)
Actuation Method
Thumbwheel/Push/Pen/Lock-Set . . Std.

1400 Series Thumbwheel or Pushwheel Switch

Thumbwheel, Push-Set or Lock-Set, the 1400 Series switch with its high reliability, easy snap-together assembly and variety of binary or decimal codes gives design flexibility to the user.

Number of Positions . . . . . 10 and 16
Life . . . . . 1,000,000 Detents
Electrical Rating
Non-Switching Load . . . . . 1.000 Amp
Switching Load . . . . . 0.100 Amp
Contact Resistance . . . . . 0.200 Ohm
Dielectric Withstanding V . . . . . 500 VDC
Seal . . . . . Dust
Panel Mount . . . . . Front
Dimensions, Module
Height 0.945 (24.00)
Width 0.315 (8.00)
Depth, Behind Panel 1.338 (33.99)
Actuation Method
Thumbwheel/Push/Lock-Set . . . . . Std.

1776/1976 Series Thumbwheel Switch

Revolutionary in design, the 1776 Series .500 wide thumbwheel switch, and the slimmer (.350) 1976 Series switch, offer optional notched terminals for mounting directly to motherboards.

Number of Positions . . . 8, 10, 12, and 16
Life . . . . . 1,000,000 Detents
Electrical Rating
Non-Switching Load . . . . . 3.000 Amps
Switching Load . . . . . 0.125 Amp
Contact Resistance . . . . . 0.100 Ohm
Dielectric Withstanding V . . . 1000 V rms
Seal . . . . . Dust
Panel Mount . . . . . Rear
Dimensions, Module
Height 1.200 (30.48)
Width 0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel 1.508 (38.30)
Actuation Method . . . . . Thumbwheel

Dimensions in inches (mm)

2000 Series Thumbwheel Switch

EECO's largest thumbwheel switch, the 2000 Series offers over 50 codes in 8-, 10-, and 16-positions. Available with a sealed option, plus extra large legend.

Number of Positions . . . 8, 10, 12, and 16
Life . . . . . 1,000,000 Detents
Electrical Rating
Non-Switching Load . . . . . 3.000 Amps
Switching Load . . . . . 0.125 Amp
Contact Resistance . . . . . 0.100 Ohm
Dielectric Withstanding V . . . 1,000 V rms
Seal . . . . . Optional
Panel Mount . . . . . Rear
Dimensions, Module
Height 2.100 (53.34)
Width 0.500 (12.70)
Depth, Behind Panel 2.030 (51.56)
Actuation Method . . . . . Thumbwheel

7000 Series Military Thumbwheel Switch

Qualified to the rigid standards of MIL-S-22710/15, this Military-grade switch offers a completely sealed contact area, impervious to dust, high humidity and salt spray. Can be used safely in explosive environments.

Number of Positions . . . 8, 10, 12, and 16
Life . . . . . 1,000,000 Detents
Electrical Rating
Non-Switching Load . . . . . 3.000 Amps
Switching Load . . . . . 0.125 Amp
Contact Resistance . . . . . 0.100 Ohm
Dielectric Withstanding V . . . 1,000 V rms
Seal . . . . . Environmental
Panel Mount . . . . . Rear
Dimensions, Module
Height 1.150 (29.21)
Width 0.500 (12.70)
Depth, Behind Panel 1.570 (39.88
Actuation Method . . . . . Thumbwheel

THUMBPOT® Digital Voltage Divider

This unit is available in .500 or .350 wide models and electrically divides the input voltage into precise, incremental voltage output values. The major feature of the unit is exacting repeatability.

Number of Positions 10
Life . . . . . 1,000,000 Detents
Electrical Rating
Std. Res. Range . . . . 1,000-100K Ohms
Std. Res. Tolerance . . . . . ±1%
Dielectric Withstanding V . . . . 500 V rms
Ins. Res. (@ 500 VDC) . . 1,000 Megohms
Seal . . . . . Dust
Panel Mount . . . . . Rear
Dimensions, Module
Height 1.200 (30.48)
Width 0.500 (12.70), 0.350 (8.89)
Depth, Behind Panel 1.250 (31.75)
Actuation Method . . . . . Thumbwheel

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EECO® MEMBRANE SWITCHES

Used in reliability-critical designs for eight years

EECO membrane switch panels have been successfully used in critical process control and computer peripheral designs since 1978.

Tight process controls produce consistent electronic reliability. Complete technical graphics and color matching facilities produce high quality graphic overlays. Design options include embossing, backlighting/deadfronts/lenses, and selective texturing on polyester or polycarbonate films. Additional features include:

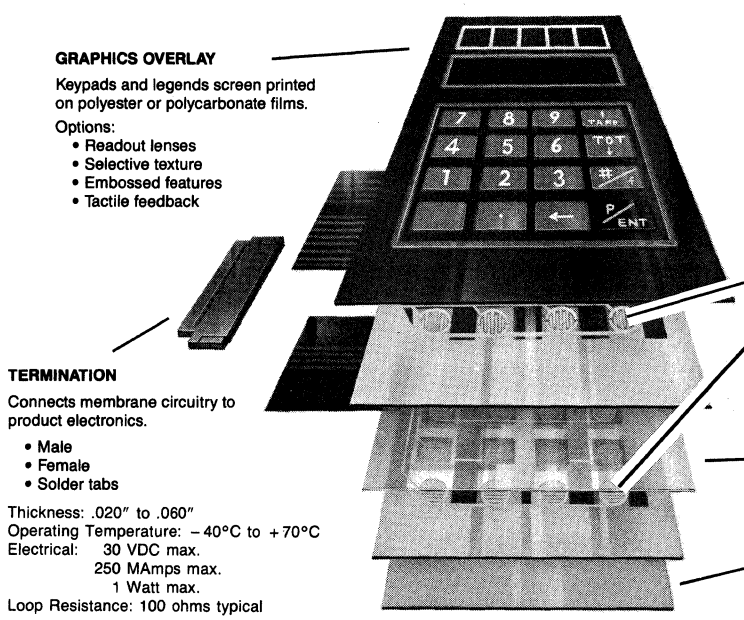
- CAD generated designs for consistent registration and quick response.
- ESD/EMI protection using a wide range of materials. On-site ESD test capability.
- In-house PC board capability. Facilities for short-run or volume electronic assembly.
- Aluminum or plastic support panels, including mounting hardware.
- Tactile feedback utilizing formed polyester domes or metal domes.
- Fully sealed construction.

Applications

Agricultural and industrial controls
- Chemical controllers
- Irrigation systems
- Flow monitors

Computer peripherals
- Printers
- Tape drives
- Modems

Point-of-sale products



GRAPHICS OVERLAY

Keypads and legends screen printed on polyester or polycarbonate films.

Options:
- Readout lenses
- Selective texture
- Embossed features
- Tactile feedback

TERMINATION

Connects membrane circuitry to product electronics.
- Male
- Female
- Solder tabs

Thickness: .020″ to .060″
Operating Temperature: −40°C to +70°C
Electrical: 30 VDC max.
250 MAmps max.
1 Watt max.
Loop Resistance: 100 ohms typical

CIRCUITS

Two layers of stabilized polyester with screen printed silver conductors.

Options:
- Matrix or common bus
- ESD/EMI
- Tactile feedback

SPACER

Dielectric layer separating circuit halves. Internal venting standard.

MOUNTING ADHESIVE

Pressure sensitive acrylic — mating surface matched.

Call or write for a free Membrane Switch Designer's Specification Guide. Test data and standard switch specifications are also available from The Maxi-Switch Company, 5436 West Latham Street, Phoenix, AZ 85043-1736. Telephone (602) 272-5645.

EECO

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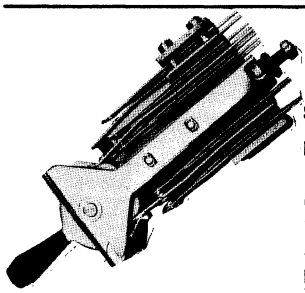
EC EnTech CORPORATION
17A Herman Drive, Simsbury, CT 06070
203 - 651-9557 FAX 203 - 658-2740

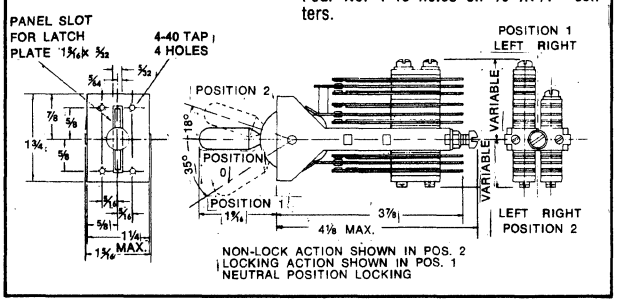
QUALITY FEATURES

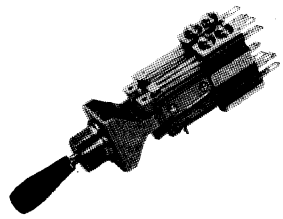
● Non-ferrous metals, amply protected against corrosion by heavy plating or protective finishing. ● Non-corrosive metals for parts that cannot be plated. ● Strong frame construction for longer life, more constant adjustment. ● Top grade phenolics (conforming to Army, Navy and Air Force specifications) with high break-down ratings. ● Contact spring assemblies tightened under pressure, securely anchored with high tensile strength screws. ● Higher contact pressures with self-cleaning wiping action. ● Tinned terminals for easy soldering.



SERIES 4100

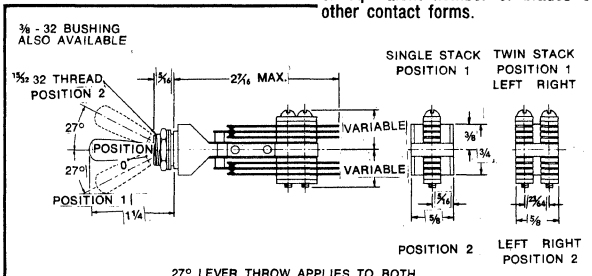
A heavy duty lever switch with positive locking mechanism. Applications include Transmitters, Power Plants, Fire Alarm Systems, Machine Tools, Test Equipment, etc. Series 4102 is a two position switch, locking only, without neutral. Series 4103 is three position, locking, non-locking or no-throw in Positions 1 and 2. Position 0, neutral, is locking only. Also available on special order in four and five position construction and with rotary action. Contacts 10 or 20 Ampere. Any contact combination may be used up to 15 contacts in each of the four stacks. Mounting-Four No. 4-40 holes on 5/8"x1 1/4" centers.

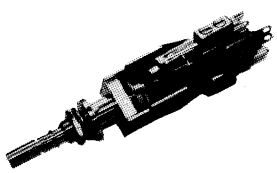




SERIES 4703

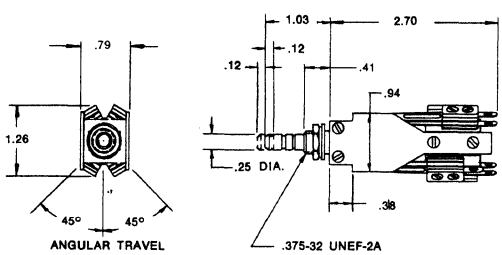
A simply constructed three position toggle type lever switch for switching multiple circuits in electronic and communication equipment. A unique feature permits easy operation of the lever in Positions 1 and 2. Position 0 is always locking. Contacts are 3 Amp Palladium Standard, 5 Amp available. Either one or two contact stacks may be mounted on both sides of the frame resulting in a contact capacity up to 20 Form A or equivalent number of blades of other contact forms.

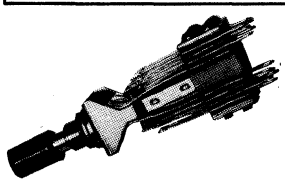




SERIES 4400

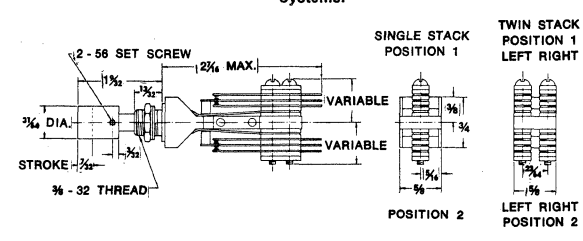
This recently developed rugged multi-function switch combines compact size with great flexibility. Available in Push-Pull, left turn and right turn with or without latching functions. Standard contacts are 3 Amp Palladium. Terminals can be solder or quick connect Taper Tab. Custom Knobs and an optional dust cover can be provided.

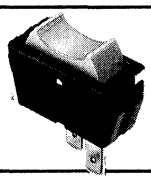




SERIES 5500

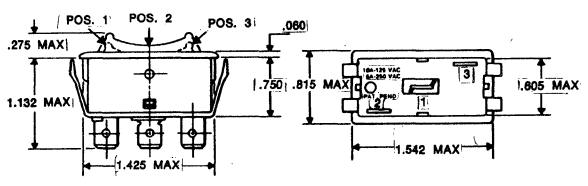
A compact momentary action Push Button Switch. Either single or double contact pile-ups may be mounted on both sides of the frame, resulting in a contact capacity up to 20 Form A or equivalent number of other contact forms. Contacts-3 or 5 Amp Palladium. Optional bifurcated Gold or Palladium contacts. Applications include Computer and Signal Systems.

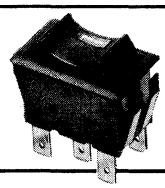




SERIES 790

Compact-"Snap Action" rocker with snap in mounting for panels .030" to .156" thick. Rated (resistive) 10A 125Vac, 5A 250Vac, 10A 12VDC. Available with momentary, maintained and progressive on circuits in single pole configuration. Recommended mounting hole is .625" X 1.437". Custom hot stamped rockers available. Terminals .250 quick connect.

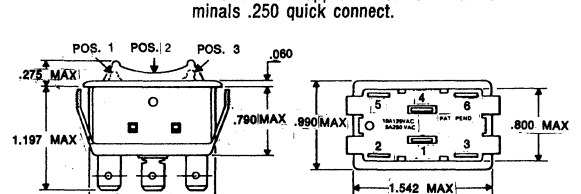




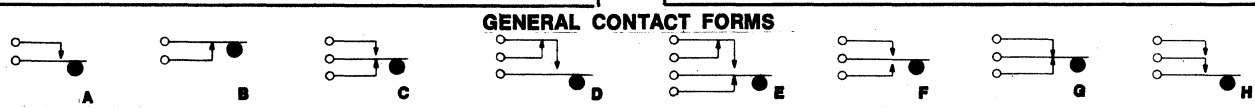
SERIES 791 and 792

A complete range of "Snap Action" maintained or momentary circuits in single or double pole. 791 Series is lighted with 6V, 14V or 28V incandescent bulbs or 120V, 240V neon bulbs.

792 Series is identical in size but is unlighted. Contact rating same as 790 series. Recommended mounting hole is .812" X 1.437" and panel thickness is .030" to .156". Highest quality polycarbonate construction. UL approved on selected circuits. Terminals .250 quick connect.



GENERAL CONTACT FORMS



electro-mech
LIGHTED PUSH-BUTTON SWITCHES

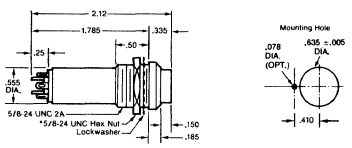
DISPLAY ASSEMBLIES/ INTERLOCK SWITCH ASSEMBLIES/ INDICATORS

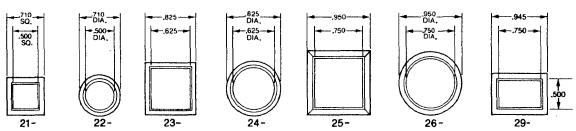
ELECTRO-MECH provides a perfect blend of quality standard products with in-depth experience in answering unique requirements. Proven engineering designs are illustrated by the excellent performance characteristics of each ELECTRO-MECH lighted push-button switch, indicator, and display assembly. Low-bounce, long-life contacts, new innovations in legends, displays, field-service, packaging– all standard features. Whatever your applications, ELECTRO-MECH is prepared to answer your specific needs. Choose from any of the most popular models.

Technical specifications apply to all ELECTRO-MECH Switch models unless otherwise specified:

- **Ratings: 30 Volts DC or 115 Volts AC; 2 amps resistive, 1 amp inductive**
- **Weight: 0.8 oz. (approx.)**
- **Operating Pressure: 2 lbs. + 1 lb.**
- **Plunger Travel: 3/16" (approx.)**
- **Actuations: 100,000**
- **Accommodates all "switchlines" standard lenses. Uses one T1-3/4, AN3140-327, 328, 330 bulb or neon lamp, 3 actuation modes standard**
- **Lenses: Available in ½" to 1" round and square, plus various rectangular sizes.**

MOUNTING SPECIFICATIONS





SWITCH FUNCTIONS	SPST N.O.	SPST N.C.	DPST N.O.	DPST N.C.	DPST 1 N.O., 1 N.C.	SPDT	DPDT
MOMENTARY	2*-128	2*-129	2*-130	2*-131	2*-132	2*-149	2*-150
PUSH-ON PUSH-OFF	2*-228	2*-229	2*-230	2*-231	2*-232	2*-249	2*-250
PUSH-ON REMAIN-IN PUSH-OFF	2*-828	2*-829	2*-830	2*-831	2*-832	2*-849	2*-850
N.O. POS	2-5		1-2, 4-5		1-2	1-2	1-2, 4-5
N.C. POS		2-5		2-3, 5-6	5-6	2-3	2-3, 5-6
COMMON POS			2, 5	2, 5		2	2, 5

*—Indicate style of switch (21- through 26, and 29)

FEATURES:

- **Momentary or alternate action**
- **Mounts in a ⅝" dia. round hole**
- **High density mounting ability—less than ¾" centers**
- **Low profile appearance in one unitized housing**

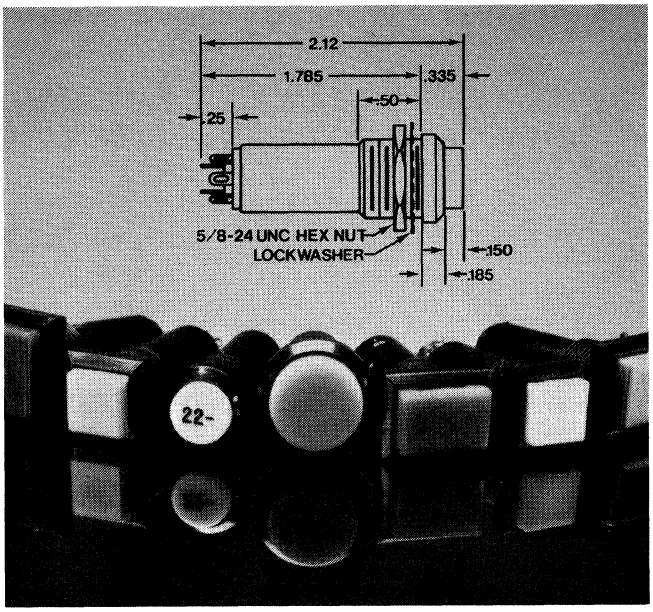
ELECTRO-MECH's Series 20 Switches are provided in display configurations.

These low profile units are available in any switching mode with independent circuitry from SPST to DPDT including a separate indicator circuit. The all plastic, unitized housing assures ease in handling (no adapters, clamps or brackets). Just drop in round hole and secure with a nut from behind panel.

Series 20 Switches have the same internal parts as the all metal 6100 Series Switches including positive action, reliable circuitry and proven low bounce characteristics made possible by our unique design concept of silver slide bar action.

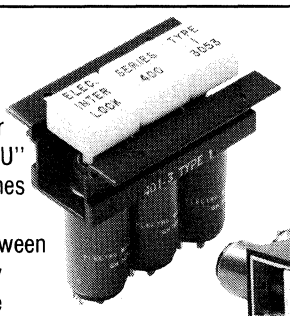
Available options include gold plating for dry circuit applications. Round slotted nuts for mounting switches on close centers.

SERIES 20
A NEW CONCEPT OF FAST EASY SWITCH INSTALLATION AND DISPLAY DESIGN VERSATILITY



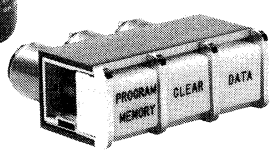
SERIES 400
MULTI-STATION SUB-PANEL ASSEMBLIES

Multi-station switch assemblies designed for sub-panel mounting by means of a flanged "U" channel. All standard ELECTRO-MECH switches can be incorporated with several types of mechanical interlocking/lockout actions between stations. Up to 12 stations in one or two row configurations. The standard center distance between switches is ⅝", ¾", ⅞" and 1".



SERIES 500
INTERLOCKING SWITCH ASSEMBLIES

Added beauty and long-lasting appearance with handsome chrome barriers between each switch or indicator. Independent or interlocking action. Ten types of tracking action and switching sequences. Up to 12 switches in single or dual row, ⅞" or 1" centers.



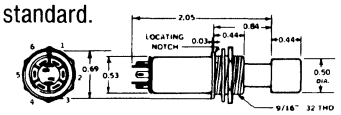
ELECTRO-MECH COMPONENTS, INC. • 1826 N FLORADALE AVE. • SO. EL MONTE, CA 91733 • (818) 442-7180 • FAX: (818) 350-8070 • TWX: 510-601-8764

electro-mech
LIGHTED PUSH-BUTTON SWITCHES

COMMUNICATIONS/INDUSTRIAL CONTROLS/DISPLAYS
COMPUTER PERIPHERALS/INSTRUMENTATION

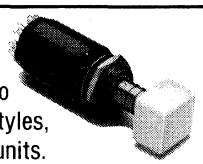
SERIES 2100

This version of our standard illuminated Pushbutton Switch features silver slide bar action. Add BR after part number for mounting on ⅝" centers. Utilizes AN3140-T 1¾"or Neon bulb. All other specifications same as standard.

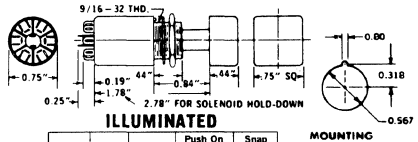


	1 PST		2 PST		1 N.O.		
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.C.	1 PDT	2 PDT
Momentary Push-on/ Push-off	2128	2129	2130	2131	2132	2149	2150
	2228	2229	2230	2231	2232	2249	2250

SERIES 2600



Standard models are available from 2PST to 6PDT in 116 different styles, including non-lighted units. Virtually any standard ELECTRO-MECH lens may be used with the 2600 Series.



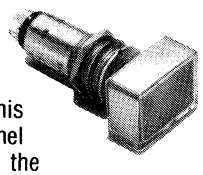
ILLUMINATED

	Mom.	Push On Push Off	Push On Remain In Push Off	Snap Feel Mom.
2 PDT	2650	2750	2850	2550
3 PDT	2651	2751	2851	2551
4 PDT	2652	2752	2852	2552
5 PDT	2653	2753	2853	2553
6 PDT	2654	2754	2854	2554

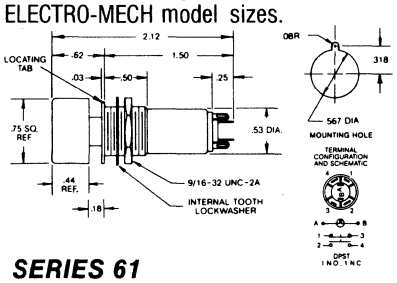
SERIES 3000

Illuminated Pushbutton switches with an integral hold-down coil which is activated with switch. Holds the push-button in the depressed position until coil is de-energized returning it to relaxed position. Available in all circuit configurations up to 6 PDT. Same specifications as standard model.

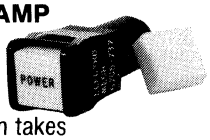
SERIES 6100



High-density packaging requirements are answered with this shorter, front panel mount, providing the same quality design as standard ELECTRO-MECH model sizes.

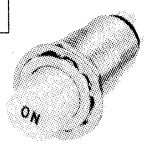


SERIES 4000 10 AMP



Low profile matches standard industry models. Momentary or Alternate Action design takes any standard lens size. 30 VDC or 115 VAC, 10 A Resistive, 5 A Inductive.

SERIES 5000



An exceptionally short momentary switch available in circuit configurations up to 2 PDT.

	1 PST		2 PST				
	N.O.	N.C.	2 N.O.	2 N.C.	1 N.O. 1 N.C.	1 PDT	2 PDT
MOMENTARY	5128	5129	5130	5131	5132	5149	5150

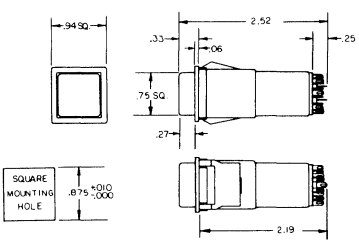
Designer Group Switches

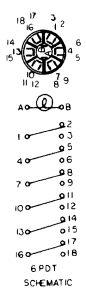
¾" sq., ¾" x 1½", ¾" x ⅞", ½" sq.

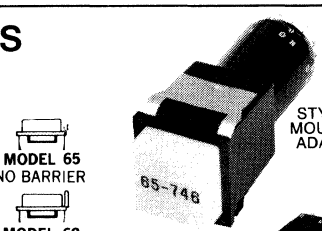
These ELECTRO-MECH Standards feature typical switch functions and mounting options for design flexibility. A choice of dual/quad display units are also available.

All Designer Group units feature:

- **1PST TO 6PDT**
- **Momentary; Alternate action; push-on remain-in; push-on, push-off and momentary snap-feel.**





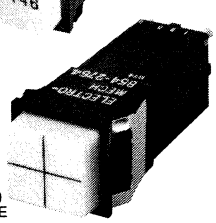


STYLE 65 MOUNTING ADAPTER

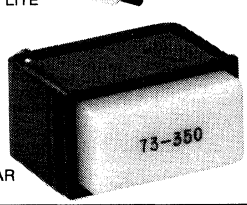
MODEL 65
NO BARRIER

MODEL 68
SINGLE BARRIER (L OR R)

MODEL 67
DOUBLE BARRIER

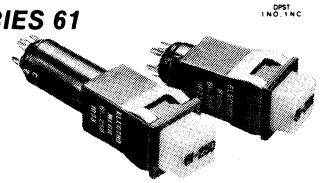


MODEL 600/800 DUAL/QUAD LITE SWITCH



MODEL 73
¾" x 1½"
RECTANGULAR

SERIES 61



ELECTRO-MECH's Series 61 switches are provided in ½-inch square, snap-in or hardmount configurations. Each low-profile unit is available in any function from SPST to 2PDT, each controlled with an independent circuit. The all plastic, unitized housing, helps insulate switch from other surrounding components. The 61 Series is also available in a standard PC Board mounting configuration.

SERIES 60
MOMENTARY SWITCH

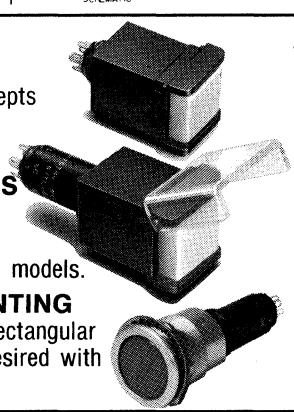
Rear mounted "U" bracket accepts switch installation from front of panel.

LG SERIES SAFETY LENS

Available on all 67-single-station, double-barrier lighted push-button bezel switch models.

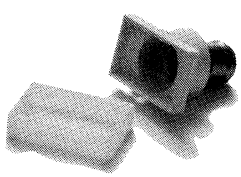
EL SERIES FLUSH MOUNTING

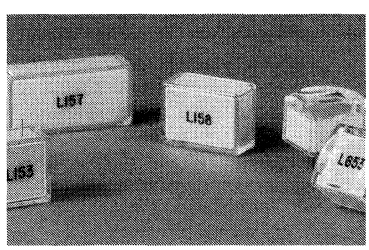
Available in round, square or rectangular styles. Specify switch model desired with "EL" suffix (i.e. 73 EL-2654).



SERIES 150
INTERCHANGABLE LENSES/FILTERS

Displays may be changed or buttons replaced. Non-wearing, clear-acrylic lens and filter buttons. Available in standard, Opaque or Contour.





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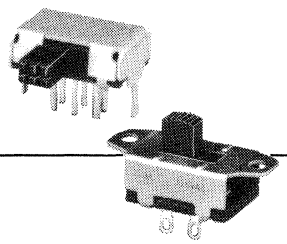
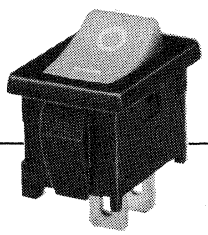
The big SWITCH is on to...

ELECTRONIC COMPONENTS GROUPE

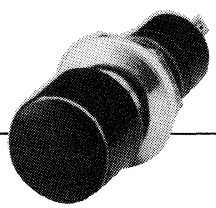
Our new products are just one reason.



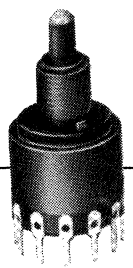
SA Slide Switches



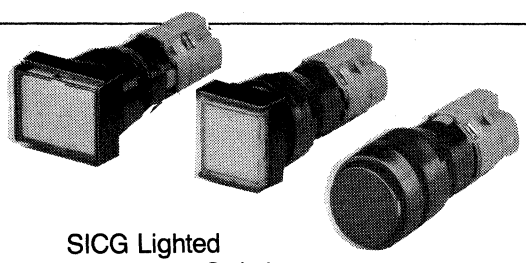
RS Rocker Switches



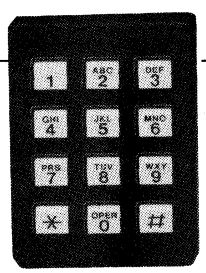
PS Pushbutton Switches



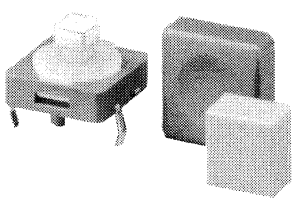
Rotary Switches



SICG Lighted Pushbutton Switches



JP Keyboards



TL Tact Switches

Another reason is our broad product line featuring:

- TA Series modular Electro-Mechanical switches
- MTK Series miniature short stroke push switches
- MEC Series pushbutton modular PCB or panel mount switches
- Sigmatast Series miniature input switches
- 320 Series dynamic single pole momentary switches
- Mini-Tast Series digital electronics switches

For samples or pricing information call toll-free **800/826-8719**

Our switches are being used in a variety of applications in many industries...Instrumentation, Test equipment, Telecommunications, Computer, Automotive, Appliance and many others. Call or write for information on our complete line of switch products.

Subsidiary of Stein Industries, Inc.

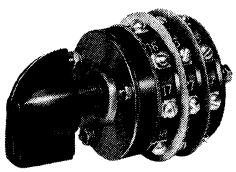
ELECTRONIC COMPONENTS GROUPE

26 North Fifth Street, Minneapolis, Minnesota 55403
Phone 612/375-9639 • FAX 612/375-1905

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

selection guide
rotary switches

Detent-Action Switches



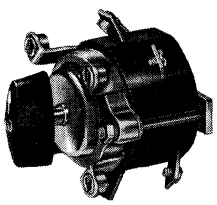
Heavy-duty, multi-pole rotary switches of modular design suitable for a wide variety of complex applications.

Double-side, double-wiping contacts are self-cleaning, shock-proof and virtually bounce-proof.

Variety of options available (spring-return, waterproof mount, key-lock, push-to-turn, etc.)

Continuous ratings from 5 to 30 amps at 600 volts. Up to 75 poles . . . to 16 positions.

Snap-Action Switches

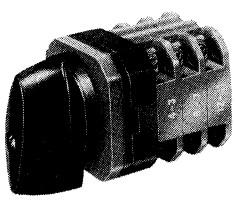


Best for direct current (DC) switching capability where high-speed transfer time is desirable. Transfer time is independent of the speed at which the handle shaft is turned (i.e. "tease-proof").

Available with non-shorting, shorting or "sweep" contacts for single to four-throw switching. Several options available.

Continuous ratings from 20 to 200 amps at 600 volts. Up to 12 poles . . . to 4 positions.

Cam-Actuated Switches

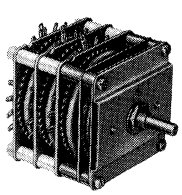


For use with direct motor control with compactness of design.

Wide choice of options include single or two-hole mount, base and door mount, key operation, tandem and gear driven, multi-rated combinations, etc.

Continuous ratings from 12 to 200 amps at 600 volts. Up to 24 poles . . . to 12 positions.

Low-Level Switches



Ruggedly built for low-level switching with Mil-Spec integrity. Positive detent action with field adjustable stops. Also available to meet full Mil-S requirements.

Options include P.C. mount, spring-return, dual concentric shafts, pre-wired leads or components, key-operation, rear mounted potentiometer, etc., etc.

Up to 48 positions . . . to 24 poles. Up to 10 amps continuous rating.

ELECTROSWITCH
UNIT OF ELECTRO SWITCH CORP.

Weymouth, Massachusetts 02188
Telephone: 617/335/5200 • FAX: 617/335/4253

ELECTROSWITCH

SOUTHERN OPERATION

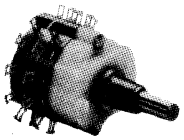
UNIT OF ELECTRO SWITCH CORP.

QUICK REFERENCE GUIDE

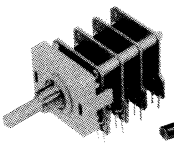
APPLICATIONS INCLUDE:

- COMPUTERS
- INDUSTRIAL
- TEST EQUIPMENT
- COMMUNICATIONS
- MEDICAL ELECTRONICS

SERIES 80
Subminiature, environment-proof rectangular rotary switch



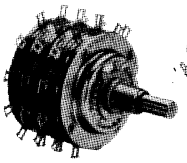
SERIES 100
1½-in. diameter environment-proof rotary switch



SERIES 300
Open Deck

NEW!

SERIES 400
8 @ 12 Pin PCB switch



SERIES 600
1⅝-in. diameter environment-proof rotary switch

NEW!

SERIES 900A
Economy

SPECIFICATIONS*

	SERIES 80	SERIES 100	SERIES 300	SERIES 400 12 PIN	SERIES 600	SERIES 900A
TYPE	**ENCLOSED**	**ENCLOSED**	**OPEN**	**ENCLOSED**	**ENCLOSED**	**ENCLOSED**
Electrical Rating (Resistive) With Silver Plated Contacts	.10A @ 125 vac .25A @ 28 vdc	.3A @ 125 vac .5A @ 28 vdc	.5A @ 125 vac .5A @ 25 vdc	.1A @ 125 vac .25A @ 28 vdc	.5A @ 125 vac 1.0A @ 28 vdc	1A @ 125 vac 1A @ 28 vdc
With Silver Alloy Contacts	.20A @ 125 vac .25A @ 28 vac	.5A @ 125 vac 1.0A @ 28 vdc	—	—	1.0A @ 125 vac 2.0A @ 28 vdc	—
Current Carrying Capacity	6A	15A	2A	6A	25A	5A
Maximum Temp. Rise	30°C	30°C	30°C	30°C	30°C	30°C
Voltage Breakdown (Sea Level)	600 vac min.	1000 vac min.	1000 vac min.	1000 vac min.	1000 vac min.	1000 vac min.
Contact Resistance (Initial)	.005 ohms max.	.003 ohms max.	.050 ohms max.	.030 ohms max.	.003 ohms max.	.020 ohms max.
With Silver Alloy	.004 ohms max.	.002 ohms max.	—	0.25 ohms max.	.002 ohms max.	—
Insulation Resistance Silver Plated Brass	10,000 megohms min.	10,000 megohms min.	500 megohms min.	10,000 megohms min.	10,000 megohms min.	15,000 megohms min.
Rotational Torque	5 to 30 in. oz. variable	12 to 96 in. oz. variable	15 in. oz. nominal	5 to 30 in. oz. variable	12 to 48 in. oz. variable	15 in. oz. nominal
Stop Strength Acetal Housing Material	3.5 in. lbs.	10 in. lbs.	4.5 in. lbs.	N/A	10 in. lbs.	4.5 in. lbs.
Metal Housing Material	8 in. lbs.	25 in. lbs.	N/A	8 in. lbs.	25 in. lbs.	N/A
MIL-S-3786 Requirements Explosion Proof	N/A	Yes	N/A	N/A	Yes	N/A
Low-Frequency Vibration	N/A	Yes	N/A	N/A	Yes	N/A
Shock (Type M)	N/A	Yes	N/A	N/A	Yes	N/A
Minimum Mechanical Life	25,000 cycles	25,000 cycles	10,000 cycles	25,000 cycles	25,000 cycles	25,000 cycles
Index Angles Available 15°	N/A	N/A	N/A	N/A	Yes	N/A
22½°	N/A	Yes	N/A	N/A	N/A	N/A
30°	Yes	Yes	Yes	Yes	Yes	Yes
36°	N/A	Yes	Yes	N/A	N/A	N/A
45°	N/A	Yes	N/A	N/A	N/A	N/A
60°	Yes	Yes	N/A	Yes	Yes	N/A
90°	Yes	Yes	N/A	Yes	Yes	N/A
180°	N/A	Yes	N/A	N/A	N/A	N/A
Poles Per Deck Available With 15° Index	N/A	N/A	N/A	N/A	12 max.	N/A
With 22½° Index	N/A	Consult Factory	N/A	N/A	N/A	N/A
With 30° Index	6 max.	6 max.	4 max.	6 max.	6 max.	4 max.
With 36° Index	N/A	5 max.	1 max.	N/A	N/A	N/A
With 45° Index	N/A	Consult Factory	N/A	N/A	N/A	N/A
With 60° Index	3 max.	3 max.	N/A	3 max.	3 max.	N/A
With 90° Index	2 max.	2 max.	N/A	2 max.	2 max.	N/A
With 180° Index	N/A	1 max.	N/A	N/A	N/A	N/A
Material & Finishes Front Housing	Acetal or Die-Cast Zinc	Acetal or Die-Cast Zinc	Flame Retardant Polyester	Die-Cast Zinc	Acetal / Zinc Plated Steel	Acetal
Bushing	Brass or Die-Cast Zinc	Brass or Die-Cast Zinc	Brass —	*Brass or Die-Cast Zinc	Brass / Brass	Acetal
Detent Balls	2-Steel Alloy	2-Steel Alloy	2-Steel Alloy	2-Steel Alloy	2-Steel Alloy / 1-Steel Alloy	N/A
Detent Spring	Coil Piano Wire	Coil Piano Wire	Coil Piano Wire	Coil Piano Wire	Coil / Flat Steel	
Detent Mechanism	Tin Plated Steel	Zinc Plated Steel	Flame Retardant Polyester	Tin Plated Steel	Zinc Plated Steel	Acetal
Shaft	Brass	Brass	Nylon	Brass	Brass	Acetal
Retaining Clip	*Zinc Plated Steel	*Zinc Plated Steel	N/A	*Zinc Plated Steel	*Zinc Plated Steel	N/A
Rivets	Aluminum	Aluminum	N/A	Aluminum	Aluminum	N/A
Screws	*Zinc Plated Steel	*Zinc Plated Steel	Zinc Plated Steel	*Zinc Plated Steel	*Zinc Plated Steel	N/A
Fixed Contacts	Silver Plated Brass	Silver Plated Brass	Zinc Plated Copper	Silver Plated Brass	Silver Plated Brass	Silver Plated Brass
Movable Contacts	Spring Silver Alloy	Spring Silver Alloy	Silver Plated Brass	Spring Silver Alloy	Spring Silver Alloy	Silver Overlay Brass
Movable Contact Rotor	Acetal	Acetal	Nylon	Acetal	Acetal	Acetal

*Standard Material or Finish (Options Available). Keylock Versions Also Available.

Electroswitch Southern Operations, 2510 N. Boulevard, Raleigh, NC 27604 • (919) 833-0707, TWX 9102404611, FAX (919) 833-8016

ELMA

ELMA Electronic Inc.

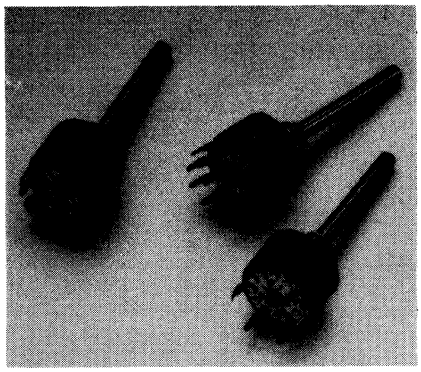
25 JAHRE ANNÉE YEARS ELMA Electronic

High Quality Modular Rotary, Keylock and Coded Switches

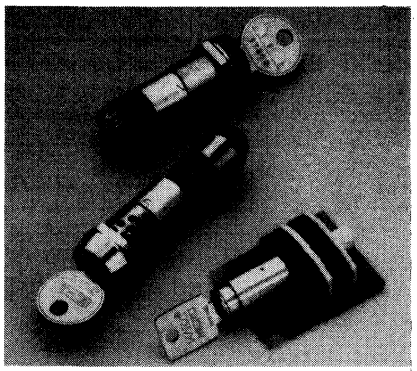
A Member Of The Sulzer Group, 41440 Christy Street, Fremont, CA 94538 • (415) 656-3400

All ELMA products are available off-the-shelf and REASONABLY PRICED

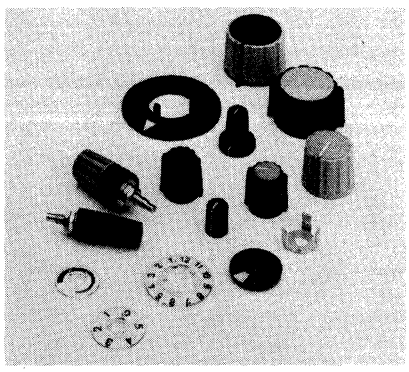
ELMA—Experience and precision for every High Quality switch application



TYPE 01



TYPE 01 AND 06 KEYLOCK



COLLET KNOBS

All **ELMA** switches are designed and manufactured to ensure high reliability and long life. They are in keeping with the strict standards required in medical technology and communications. Common areas of application include process and manufacturing control, measuring and monitoring equipment.

ELMA switches are available in the following forms:

—a broad standard range of rotary switches of different sizes with solder lug terminals or for PCB mounting

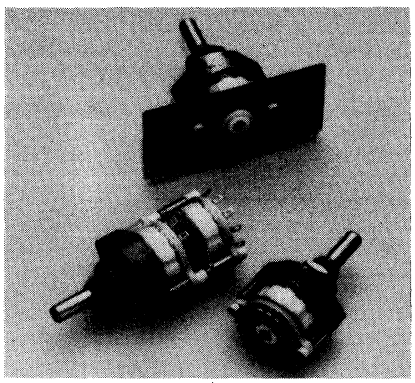
—Binary coded rotary switches for PCB mounting

—Binary coded rotary switches for PCB mounting with mounting dimensions according to IC 297/ DIN 41494 standards.

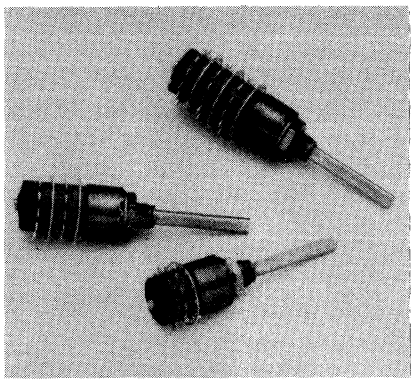
ELMA switches are mainly used in industrial electronics and are especially suitable for switching medium loads, logic levels and dry circuits.

Consequently they are offered with a choice of contact material—gold flashed silver and 3 or 5 μm hard gold. These materials plus the design of the contact ensure high and constant electrical conductivity and good resistance to corrosion and abrasion.

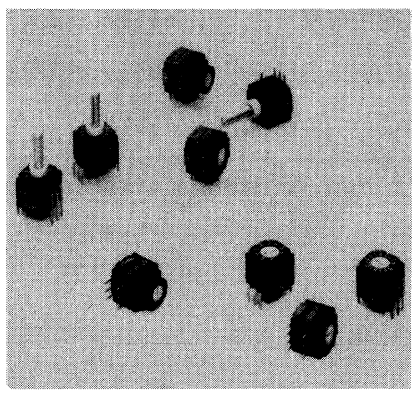
The **ELMA** rotary, PCB, code and key switches are guaranteed to be of the finest quality and to exhibit high reliability and repeatability over many years—this is what has earned us our world wide reputation for excellence.



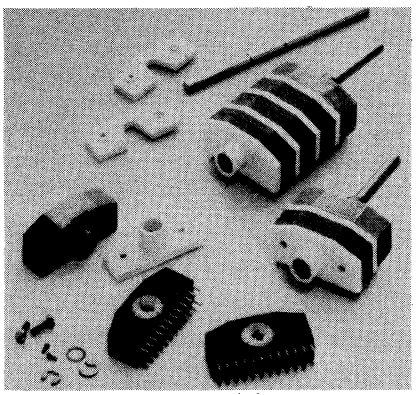
TYPE 04



TYPE 06



TYPE 07 — CODED DIP



TYPE 08

COLLET KNOBS:
For every switch ELMA manufactures the ideal collet knob. They are available ex stock in many different sizes and colors with numerous modular accessories such as pointers, stators, figure dials, etc.

MAXIMUM FLEXIBILITY FOR CUSTOM EXECUTIONS!

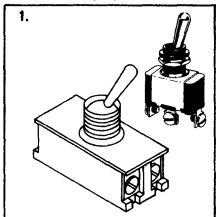
See section 1400 (Cabinets, Enclosures, Racks & Chassis), section 2025 (Computers-Mini/Micro) and section 2400 (Panel Hardware-Bezels, Dials, Knobs, etc.) for additional ELMA products!

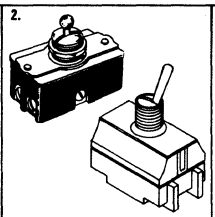
ONE COMPLETE SOURCE FOR

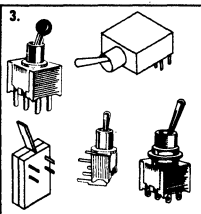
all types of switches, control devices...

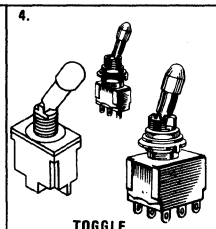
For all items shown below—Send for FREE Illustrated Catalog No. 30EEM

AEROSPACE – COMMERCIAL —

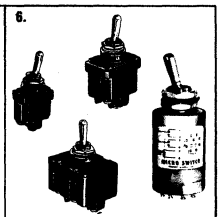
1. 
TOGGLE
General Purpose

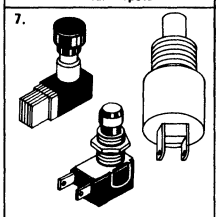
2. 
TOGGLE
High Capacity

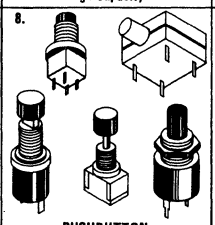
3. 
TOGGLE
Miniature & Ultra Miniature

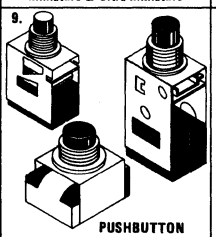
4. 
TOGGLE
Locking Lever

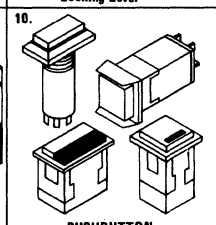
5.
TOGGLE
Precision

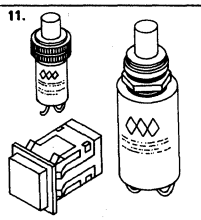
6. 
TOGGLE
Environmentally Sealed

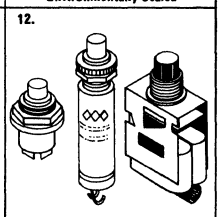
7. 
PUSHBUTTON
General Purpose

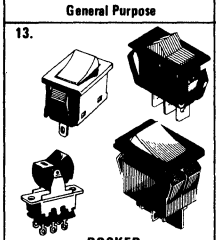
8. 
PUSHBUTTON
Miniature & Ultra Miniature

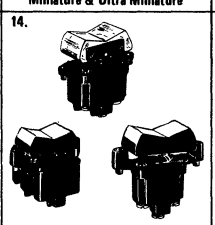
9. 
PUSHBUTTON
Precision

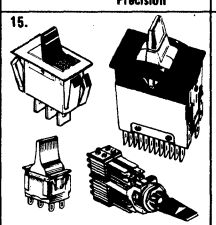
10. 
PUSHBUTTON
Lighted

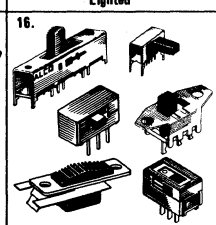
11. 
PUSHBUTTON
Reed & Solid State

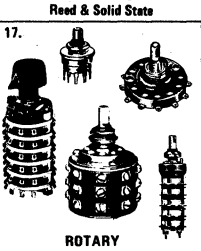
12. 
PUSHBUTTON
Enviromentally Sealed

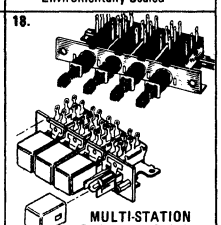
13. 
ROCKER
Lighted & Unlighted

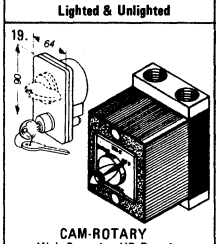
14. 
ROCKER
Heavy Duty / Sealed

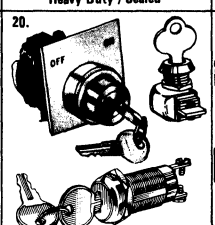
15. 
PADDLE

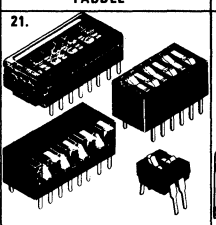
16. 
SLIDE

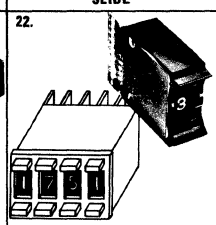
17. 
ROTARY
Electronic Duty

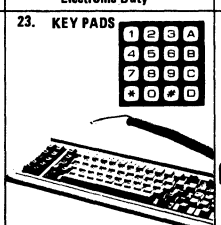
18. 
MULTI-STATION
Push Button Switches
Make to Spec.

19. 
CAM-ROTARY
High Capacity HP Rated
Make to Spec.

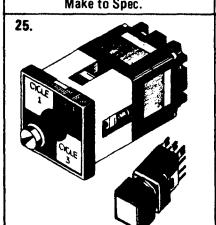
20. 
KEY LOCK

21. 
DIP SWITCH

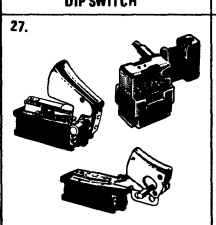
22. 
PB/ROTARY THUMBWHEEL
Programmable Code Switch

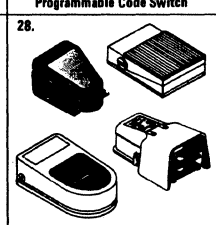
23. KEY PADS 
KEYBOARDS

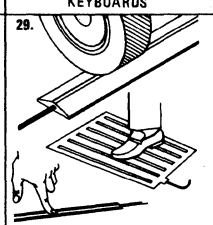
24.
Oil Tight
Splash Proof
PANEL
CONTROLS

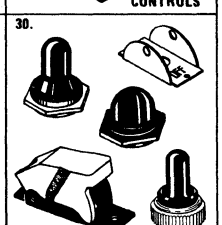
25. 
Lighted - Oil Tight
PANEL CONTROLS

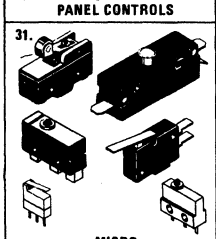
26. PALM
JOYSTICK
PENDANT

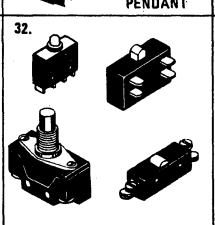
27. 
TOOL HANDLE

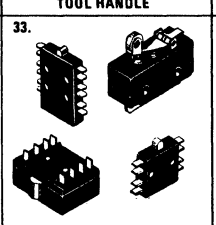
28. 
FOOT SWITCH

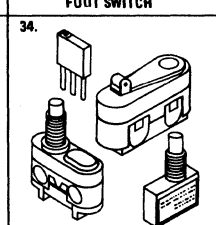
29. 
TAPE/AIR SWITCHES

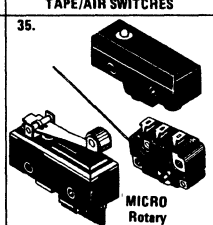
30. 
SWITCH GUARDS & SEALS

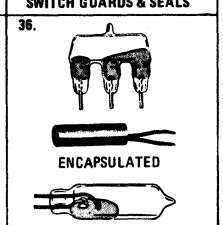
31. 
MICRO
Single Break

32. 
MICRO
Double Break

33. 
MICRO
2 & 3 Poles

34. 
MICRO
Sealed & Hi-Temperature

35. 
MICRO
Rotary
MICRO
High DC Capacity
Magnetic Blow-Out Switches

36. 
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...motor controls & replacement parts

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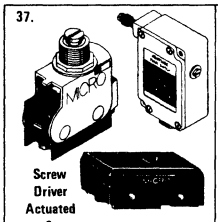
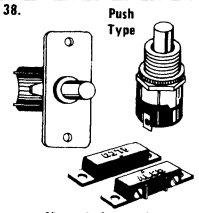
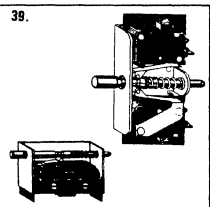
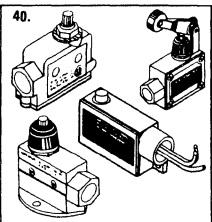
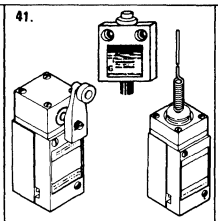
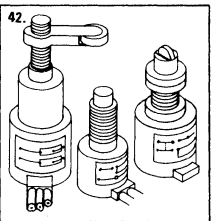
37. 
Screw Driver Actuated & PULSE SWITCHES

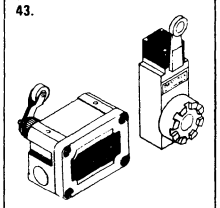
38. 
Push Type
Magnetic Actuated DOOR SWITCHES

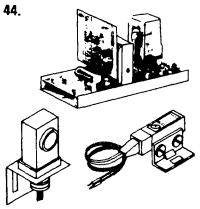
39. 
DOOR INTERLOCK

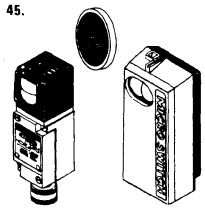
40. 
ENCLOSED SWITCHES

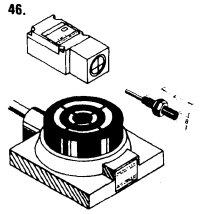
41. 
LIMIT SWITCHES

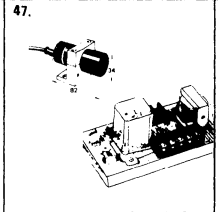
42. 
LIMIT SWITCHES
Sealed & Hi-Temperature

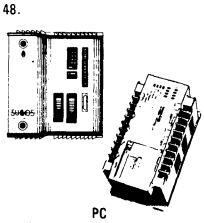
43. 
LIMIT SWITCHES
Explosion Proof

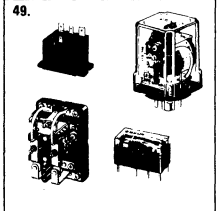
44. 
PHOTO–ELECTRIC CONTROLS
Fiber Optics-LED-Incandescent

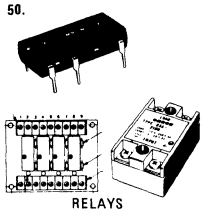
45. 
PHOTO-ELECTRIC CONTROLS
Self- Contained

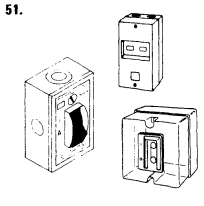
46. 
PROXIMITY CONTROLS

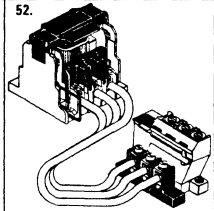
47. 
LIQUID LEVEL CONTROLS
Capacitance & Resistance Type

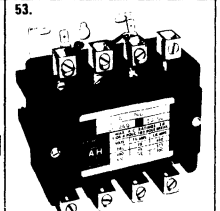
48. 
PC
Programmable Controllers

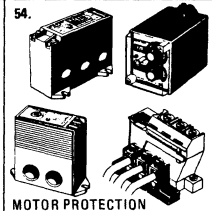
49. 
RELAYS
Electro-Mechanical

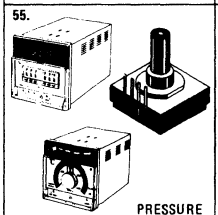
50. 
RELAYS
I/O Modules/Board
Reeds & Solid State

51. 
MANUAL MOTOR STARTERS

52. 
MAGNETIC MOTOR STARTERS

53. 
MAGNETIC CONTACTORS

54. 
MOTOR PROTECTION
Thermal - OverCurrent
Open & Reverse Phase

55. 
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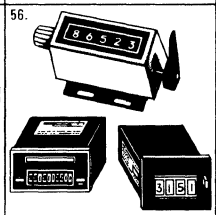
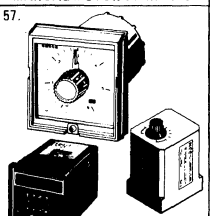
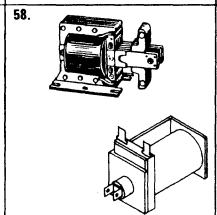
TRANSDUCERS
TEMPERATURE CONTROLS

56. 
COUNTERS

57. 
TIMERS

58. 
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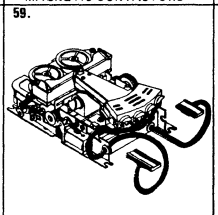
59. 
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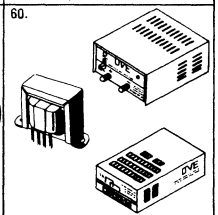
60. 
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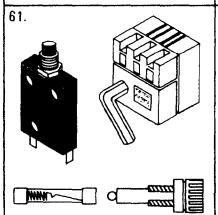
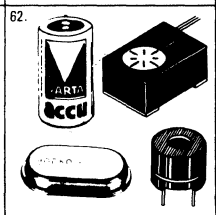
POWER CONDITIONERS

61. 
CIRCUIT PROTECTION
FUSES & FUSEHOLDERS

62. 
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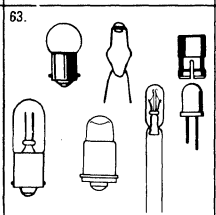
Audio Transducers

63. 
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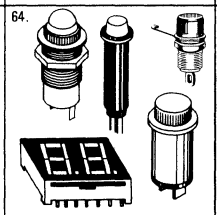
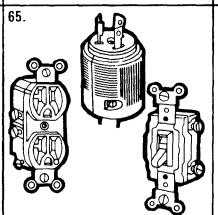
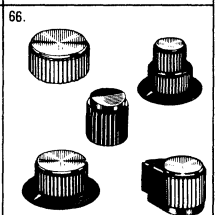
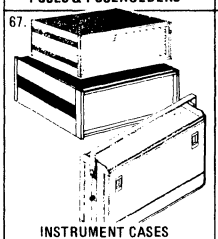
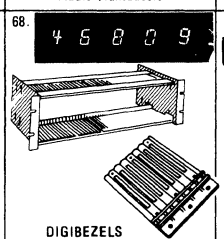
Incandescents Mini-Lamps

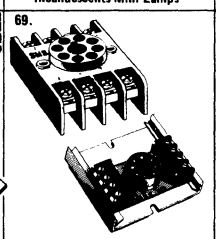
64. 
INDICATOR LIGHTS
LED DISPLAYS

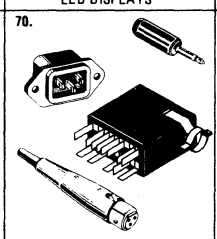
65. 
WIRING DEVICES

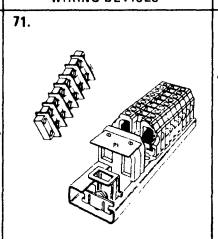
66. 
INSTRUMENT KNOBS
Commercial & Military

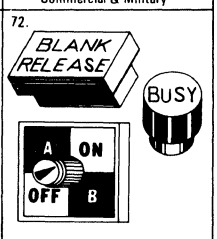
67. 
INSTRUMENT CASES
BAILS & HANDLES

68. 
DIGIBEZELS
PC RACKS & BOARDS

69. 
SOCKET SNAP–TRACKS

70. 
PLUGS JACKS & CONNECTORS

71. 
TERMINAL BLOCKS

72. 

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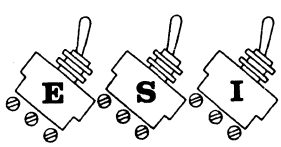

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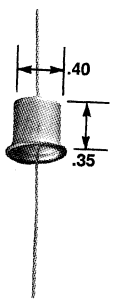
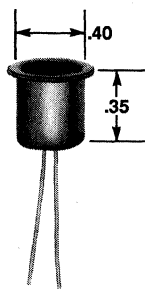
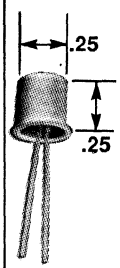
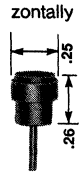
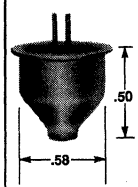
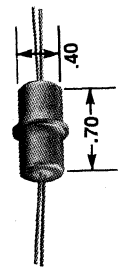
Miniature Mercury Tilt Switches

- **Versatile** — Available to sense, tilt, vibration or impulses for commercial, industrial or military applications
- **Reliable** — Hermetically sealed, oxygen-free atmosphere provides typical life of 250,000 operations and more
- **Rugged** — Welded metal cases
- **Wide choice** — Omnidirectional or planar
- **Precise** — Operate to tight tolerances

Notes:

1. Response speed depends on the damping fluid used, and is related to jitter reduction. Rated on a scale of 0 to 5, with 5 being heavily damped (longest response time).
2. Switches with other dampening factors are available. Consult factory.
3. Jitter is tendency for switch to change state 3° from operational point. Ranked on a scale of 0 to 5, with 5 being very susceptible to vibrations.
4. Values shown are for switch viewed so that pins are side by side. For values with pins in line (one behind the other) ask for product data sheet.

	Omnidirectional (NO)			Omnidirectional (NC)		Miniature Omni-directional (NC)	Single Plane	Omni-directional (NC) Snap Action	Double Ended	
Dimensions							Mounts Hori-zontally 		Mounts Horizontally 	
Part Number	**TS7-0**	**TS7-0J**	**TS7-10**	**TS7B-0**	**TS7B-10**	**TS8**	**TS66**	**STS411**	**2TS7B-0**	**2TS7B-10**
Operating Angle (°) (to close from 0°)	16±8	18±8	6±5	25±12 (4)	25±12 (4)	7±5 (4)	+1.5±3	42±6 (4)	65±12 (4)	65±12 (4)
Operationg Angle (°) (to open from 0°)	12±8	12±8	4±5	35±12 (4)	35±12 (4)	13±10 (4)	−2±3	55±6 (4)	55±12 (4)	55±12 (4)
Uncontrolled angle (°) (total included)	0	20±20	0							
Switching Hysterysis (°)	4±4	6±4	2±3	10±6	10±6	6±5 (4)	3.5±2	13±5	10±6	10±6
Typical Repeatability (±°)	3	3	3	2	2	3	1	2	3	3
Load Current (resistive)										
@ 115 VAC (amps)	0.5	0.5	0.5	0.5	0.5	0.2	0.1	1.0	0.5	0.5
@ 12 VDC (amps)	1.0	0.5	1.0	1.0	1.0	0.5	0.2	2.0	1.0	1.0
Insulation Resistance @ 500 VDC (megohms)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Breakdown Voltage (VAC)	1000	1000	1000	750	750	600	1000	1000	750	750
Typical Contact Resistance @1 MA (ohms)	0.3	0.7	0.5	0.15	0.50	0.25	0.5	0.1	0.15	0.50
Maximum Operating Temperature (°C)	125	125	125	125	125	125	135	125	125	125
Minimum Operating Temperature (°C)	−35	−35	−20	−35	−20	−35	−35	−35	−35	−20
Speed of Response (relative) (1)	0	0	2	0	2	0	0	1	0	2
Contact Jitter (relative) (3)	4	5	2	3	2	3	4	0	3	2

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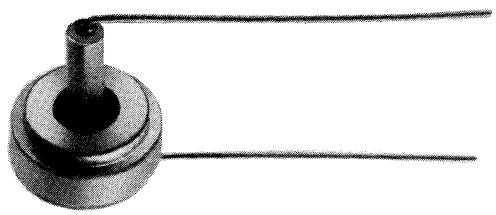
FIFTH DIMENSION INC.

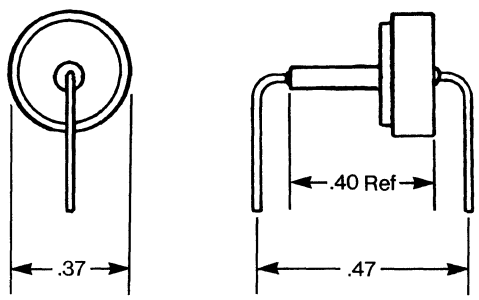
Mercury Impulse Switches

Patented under one or more of the following: 3,831,118, 3,976,960 and 4,683,355

Hi-G Impulse Switches: 200 to 2,000 G's



Part Number MISL-G*-001
*Nominal G Value

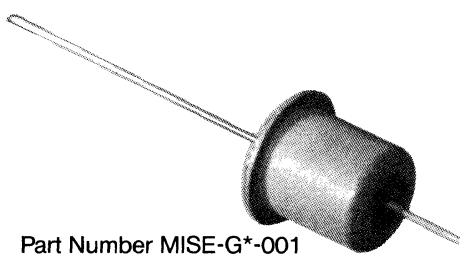


- Mountable in any position — responds to axial loads
- No contact bounce
- Hermetically-sealed welded steel case
- Used for ordnance fuzing applications
- Can be used for repetitive applications

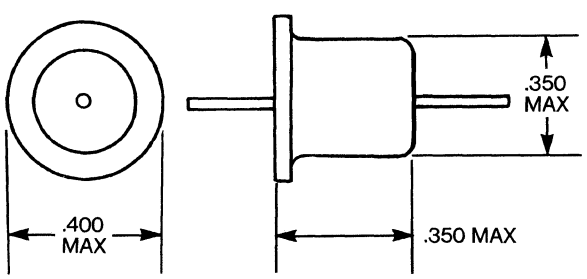
Specifications

Contact Type: Form A (SPST, normally open, non-latching)
Sensitivity (nominal): 200-2,000 G*
Tolerance (standard): G max.: G min.=3:1
Operate Time (G level dependent): 0.1 milliseconds typical
Release Time (following G decay): proportional to the integral of Gdt
Maximum Shock: as high as 10,000 G
Contact Bounce: None
Typical Contact Resistance (ohms): 0.15
Rated Load: 2.0 amp @ 5 VDC to 0.1 amp @ 200 VDC
Insulation Resistance @ 500 VDC: 1,000 megohms
Breakdown Voltage (VDC): 1,000
Operating Temperature Range (°C): −35 to +125
Storage Temperature (°C): −65 to +125

Lo-G Impact Switches: 1.5 to 10 G



Part Number MISE-G*-001
*Nominal G Value



- Mountable in any position — responds to axial loads
- No contact bounce
- No mechanical springs — liquid-phase mercury design
- Hermetically-sealed welded steel case
- High repeatability

Specifications

Contact Type:
Form A (SPST, normally open, non-latching)
Sensitivity: 1.5 to 10 G*
Contact Resistance, max. (ohms): 10
Rated Load: 0.1 amp @ 10 VDC to 0.01 amp @ 200 VDC
Insulation Resistance @ 500 VDC: 1,000 megohms
Breakdown Voltage (VDC): 1,000
Operating Temperature Range (°C): −35 to +85
Storage Temperature Range (°C): −65 to +125

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GORDOS

MERCURY TILT SWITCHES

MERCURY SWITCH CHARACTERISTICS

FOR MANY APPLICATIONS preference is given to a mercury switch over comparable mechanical switches for specific reasons. Contacts are sealed in protected atmosphere and can be observed; no contact bounce; high amperage can be switched with low operating force; convenient overtravel, horizontal reference. Mercury switches are quiet operating, reliable and often lower in cost.

CONSTRUCTION

Electrodes are hermetically sealed in a glass envelope containing high purity mercury. When switch is tilted, only the mercury moves, making or breaking the circuit.

DIFFERENTIAL ANGLE

Differential angle in an SPST switch is the angle through which the switch must be tilted to cause the mercury to move from the just-make position to the just-break position.

INSTALLATION

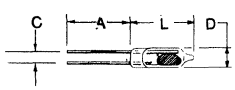
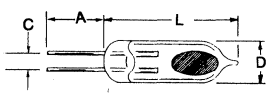
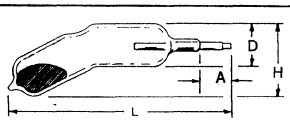
The most common installation method for mercury switches is a simple spring clip, either riveted, welded or attached with screws to the mounting surface. The recommended mounting clip for each switch is listed in the specification charts and must be ordered separately.

TEMPERATURE

Switch operating temperature is limited by mercury's freezing point of −38°C. The upper temperature limit depends primarily on the characteristics of the lead wire or insulating materials, generally approaching +300°F (+149°C).

LEAD TERMINATION

With the exception of the HG 457 LO, leads are dumet and can be soldered or welded. To order solder-dipped leads, add the suffix "S" to the part number. The HG 457 LO has tungsten leads.

SELECTION GUIDE Outline Description		Switch Part Number	VAC Resistive Switching Current Ratings			Differential Angle Degrees		Outline Dimensions Inches					Type of Contact *	Standard Mounting Clip Part No.
			30	115	220	Max.	Min.	D	L	H	A	C		
	Low Angle	HG 213 LO	.3	.1	.05	5°	(Typ.) 1°	.175	.88	—	.88	.075	MDM	M-539
	Platinum & Platinum Tipped Electrodes	HG 225 LO	.5	.3	.10	10°	—	.175	.88	—	.88	.075	MWM	M-539
	Precision Switch Subminiature	HG 520 LO	.25	.1	.05	10°	—	.155	.50	—	.94	.06	MDM	M-539
	Low Angle Standard Switch	HG 251 LO	3	1	.5	2°	—	.325	1.00	—	.88	.125	MDM	M-514
	Standard Switch	HG 252 LO	4	2	1	14°	—	.325	1.00	—	.88	.125	MWM	M-514
	High Load Standard Switch	HG 455 LO	15	10	5	5°	—	.435	1.69	—	.25	.150	MDM	M-56
	High Differential Angle	HG 457 LO	20	10	5	32.5°	27.5°	.446	2.25	.875	.25	.150	MDM	M-56

Products and specifications subject to change without notice.

***Mercury to Wetted Metal (MWM)**—The contact surface of the electrode is coated with a permanent adherent film of mercury to provide a low, stable resistance for low energy circuits and improve the current-carrying capacity for higher-load applications. The wetted contact provides a snap-action which reduces arcing, stabilizes the differential angle, and offers excellent contact resistance.

***Mercury to Dry Metal (MDM)** — The mercury pool makes direct contact with the electrode base metal or welded-on tip. This contact design, the most common in mercury switches, is incorporated in switches with moderate-to-small current ratings. It is not recommended for low energy circuits.

Gordos manufactures a wide variety of Mercury Tilt Switches.

Consult factory for a configuration to meet your particular requirements.

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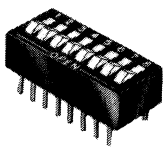
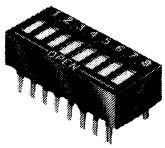
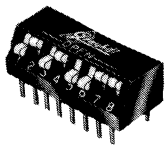
SPST DIP Switches

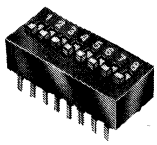
SINGLE POLE/SINGLE THROW SLIDE AND ROCKER DIP SWITCHES

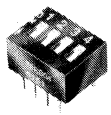
- High Pressure, Reliable Contact
- Shock and Vibration Immunity
- Sealed Bases as Standard
- Top Seal Option at Minimal Price


Raised Type


Recessed Type


PIANO-DIP®

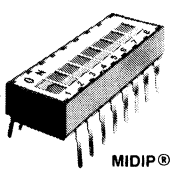

Raised Type


Recessed Type

ROCKER DIP SWITCHES—SERIES 76

Rated to make and break 50 mA, 30 Vdc for 35,000 operations per position, and 125 mA, 30 Vdc for 25,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380″; height is .315″ for raised rocker style, .267″ for recessed style, and .301″ for the PIANO-DIP® switch.

MACHINE INSERTABLE, MIDIP® SWITCH—SERIES 90


MIDIP®

Compatible with leading TO-116 IC insertion equipment. Rated to make and break 100 mA, 30 Vdc for 2,000 operations per position. Base contacts are brass, gold plated 10 microinches over nickel. Terminals are molded (sealed) into base. Top seal is thermoplastic. Width is .280″; height is .160″.

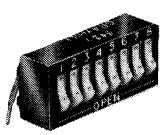
SLIDE DIP SWITCHES—SERIES 78

Rated to make and break 50 mA, 30 Vdc and 125 mA, 30 Vdc for 10,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. Width is .380″; height is .315″ for raised slides and .265″ for recessed slides.

SILVER CONTACT OPTION— 78SS: Economical platings provide a switch which is rated to make and break 50 mA, 30 Vdc for 7,500 operations per position. Shorting member, base contacts and terminals are copper alloy, silver plated 30 microinches over nickel. Width is .380″; height is .315″.

SERIES 76 AND 78 RIGHT ANGLE STYLES

All standard 76 and 78 switches except the PIANO-DIP® switches are available with terminals for right angle mounting. Contact GRAYHILL for more information.



ADDITIONAL SPECIFICATIONS—For specifications not listed on this page, see GENERAL SPECIFICATIONS on next page.

ORDERING INFORMATION

Standard Switches

Description	No. Of Positions	Length	Part No. Raised Actuator	Part No. Recessed Actuator
Rocker Actuated Switches	2	0.280	76SB02	76RSB02
	3	0.380	76SB03	76RSB03
	4	0.480	76SB04	76RSB04
	5	0.580	76SB05	76RSB05
	6	0.680	76SB07	76RSB06
	7	0.780	76SB07	76RSB07
	8	0.880	76SB08	76RSB08
	9	0.980	76SB09	76RSB09
	10	1.080	76SB10	76RSB10
	12	1.280	76SB12	76RSB12
Slide Actuated Switches	2	0.280	78B02	78RB02
	3	0.380	78B03	78RB03
	4	0.480	78B04	78RB04
	5	0.580	78B05	78RB05
	6	0.680	78B06	78RB06
	7	0.780	78B07	78RB07
	8	0.880	78B08	78RB08
	9	0.980	78B09	78RB09
	10	1.080	78B10	78RB10
PIANO-DIP® Side Actuated Switches	4	0.480	76PSB04	—
	5	0.580	76PSB05	—
	6	0.680	76PSB06	—
	7	0.780	76PSB07	—
	8	0.880	76PSB08	—
	9	0.980	76PSB09	—
	10	1.080	76PSB10	—
Slides With Silver	4	0.480	78SS04	—
	8	0.880	78SS08	—
MIDIP® Machine Insertable Switches	4	0.470	—	90B04
	5	0.570	—	90B05
	6	0.670	—	90B06
	7	0.770	—	90B07
	8	0.870	—	90B08
	9	0.970	—	90B09
	10	1.070	—	90B10

Military Qualified Switches

Description	No. Of Positions	Length	Grayhill Number	Military Number
Military Qualified Raised Rocker Actuated Switches	2	0.280	76MSB02	M83504/01-022
	3	0.380	76MSB03	M83504/01-023
	4	0.480	76MSB04	M83504/01-024
	5	0.580	76MSB05	M83504/01-025
	6	0.680	76MSB06	M83504/01-026
	7	0.780	76MSB07	M83504/01-027
	8	0.880	76MSB08	M83504/01-028
	9	0.980	76MSB09	M83504/01-029
	10	1.080	76MSB10	M83504/01-030
	12	1.280	76MSB12	M83504/12-032
Military Qualified Recessed Rocker Actuated Switches	2	.0280	76MRSB02	M83504/02-022
	3	0.380	76MRSB03	M83504/02-023
	4	0.480	76MRSB04	M83504/02-024
	5	0.580	76MRSB05	M83504/02-025
	6	0.680	76MRSB06	M83504/02-026
	7	0.780	76MRSB07	M83504/02-027
	8	0.880	76MRSB08	M83504/02-028
	9	0.980	76MRSB09	M83504/02-029
	10	1.080	76MRSB10	M83504/02-030
	12	1.280	76MRSB12	M83504/02-032
Military Qualified Raised Slide Switches	2	0.280	78M02	M83504/04-022
	3	0.380	78M03	M83504/04-023
	4	0.480	78M04	M83504/04-024
	5	0.580	78M05	M83504/04-025
	6	0.680	78M06	M83504/04-026
	7	0.780	78M08	M83504/04-027
	8	0.880	78M08	M83504/04-028
	9	0.980	78M09	M83504/04-029
	10	1.080	78M10	M83504/04-030

To order top tape sealed, standard or military switch, add suffix S to GRAYHILL part number (or T to Military Number).

For prices and discounts, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

Available From Your Local GRAYHILL Distributor

Special Circuit DIP Switches

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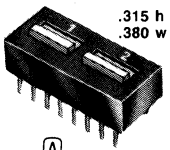
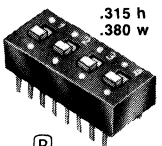
SERIES 78 SLIDE SWITCHES

- 2 Pole, 3 Pole, and 4 Pole/ST
- SPDT & DPDT — Separate Circuits



Ⓐ 2PST, 3PST 4PST



Ⓑ SPDT & DPDT

GENERAL SPECIFICATIONS

(Applicable to this page and previous one.)

Failure criteria are as follows: contact resistance is 100 milliohms; insulation resistance is 1,000 megohms; and dielectric strength is 500 Vac. Environmental specifications are tested to MIL-STD-202F per MIL-S-83504.

Switches passed the following tests: vibration (10-2,000 Hz at 15G); shock (50G, 11 milliseconds half sine); moisture resistance (240 hours with temperature cycling and polarization); thermal shock; and thermal aging (1,000 hours).

Machine soldering requires switches be top sealed. Sealed recessed rocker switches were successfully tested per EIA Standard RS-448-2 for machine soldering. Similar performance can be expected from sealed switches wtih other means of actuation. Tests include the following: fluxing with flux touching switch body; immersion (therefore suitable for spray and vapor/spray cleaning); and the 2, 4, and 6 second soldering time. Acceptable cleaning solutions are 1-1-1 trichlorethane, Freon (TF, TE, or TMS). Acetone, methylene chloride, and Freon TMC are not recommended.

Housings and actuators are polyester: UL94V-O rating. Potting (except Series 90) is epoxy. Top seal (except Series 90) is polyester film. Terminals (except Series 78SS) are brass, solder plated 100 microinches minimum over copper/nickel barrier. Shorting member (except Series 78SS) is brass, gold plated 10 microinches minimum over nickel plate. See individual series for materials not shown here.

ORDERING INFORMATION

Multiple Pole/Single Throw Slide Actuated Switches—Fig. A

Circuitry	No. of Positions	Length	Part Number
2PST	1	0.280	78F01
	2	0.480	78F02
	3	0.680	78F03
	4	0.880	78F04
	5	1.080	78F05
3PST	1	0.380	78G01
	2	0.680	78G02
	3	0.980	78G03
4PST	1	0.480	78H01
	2	0.880	78H02

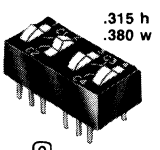
Double Throw (and Separate Circuit) Slide Actuated Switches—Fig. b

SPDT	1	0.280	78J01
	2	0.480	78J02
	3	0.680	78J03
	4	0.880	78J04
	5	1.080	78J05
DPDT	1	0.480	78K01
	2	0.880	78K02

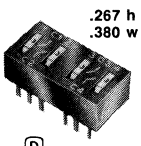
To order top sealed switches, Figures A and B, add the suffix S to the part number in the chart.

SERIES 76 ROCKER AND TOGGLE SWITCHES

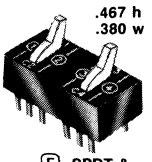
- 3 Actuation Choices
- SPDT & DPDT — With Commons



Ⓒ SPDT & DPDT



Ⓓ SPDT & DPDT



Ⓔ SPDT & DPDT

2 POLE, 3 POLE, AND 4 POLE, SINGLE THROW SLIDE SWITCHES (FIG. A)

Rated for 10,000 operations to make and break the following loads: 1 mA, 5 Vdc; or 50 to 150 mA, 30 Vdc. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate.

SPDT AND DPDT SLIDE SWITCHES WITH SEPARATE CIRCUITS (FIG. B)

Rating and materials are the same as the switches in Figure A. In Single Pole/Double Throw switches, each slide operates two adjacent separate circuits, opening one of them, while closing the other. (In Double Pole/Double Throw switches, 1 slide switches 4 circuits at once, opening circuits 1 and 3, while closing 2 and 4, etc.). This circuitry, used in telephone switching systems, makes these switches form, fit, and function equivalents. For true SPDT (DPDT) circuitry, adjacent terminal pairs may be tied with a printed circuit. Dot on the cover indicates the closed position of individual terminal pairs.

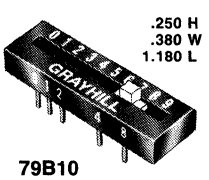
SPDT AND DPDT ROCKER AND TOGGLE SWITCHES WITH COMMON POLES (FIG. C, D, E)

Rated to make and break 50 mA, 30 Vdc for 35,000 operations, and 125 mA. 30 Vdc for 25,000 operations. Base contacts are copper alloy, gold plated 10 microinches minimum over nickel plate. SPDT (DPDT) circuits are 3 (6) terminal circuits for true SPDT (DPDT) switching and compact spacing. Common pole terminals are marked with a C, and first and second throws are marked as 1 and 2.

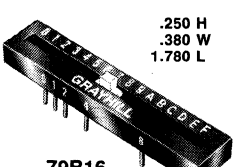
Double Throw (with Commons) Rocker and Toggle Actuated Switches—Fig. C, D, E

Circuitry	No. Of Positions	Length	Part No. Raised Rocker	Part No. Recessed Rocker	Part Number TOGGLE-DIP
SPDT DIP-C	2	0.380	76SC02	76RSC02	76STC02
	3	0.580	76SC03	76RSC03	
	4	0.780	76SC04	76RSC04	76STC04
DPDT DOUBLE-DIP	1	0.380	76SD01	76RSD01	76STD01
	2	0.780	76SD02	76RSD02	76STD02

To order top sealed switch (not available on TOGGLE-DIP), add the suffix S to the part number.



79B10
Binary Coded



79B16
Hexadecimal

BINARY CODED OUTPUT LINEAR ACTION DIP SWITCHES—SERIES 79

Switches have a zero output. They are rated to make and break 10 mA 50 Vdc, or 50 mA 30 Vdc, or 125 mA 6 Vdc for 2,000 cycles of twice through all positions. Switches have several bussed terminals on one side, any one of which may be used for the common pole. Consult a Grayhill catalog for location of pins. For top seal versions, add the suffix "S" to the part numbers shown above.

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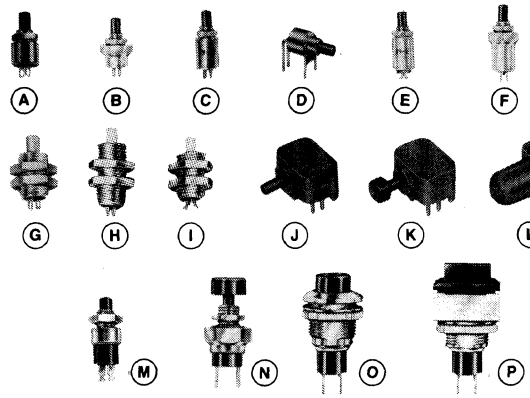
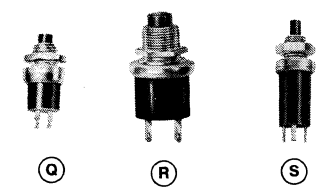
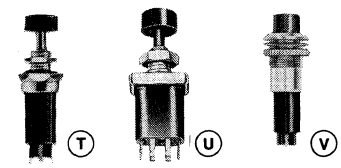
SMALL LOW CURRENT MOMENTARY SWITCHES



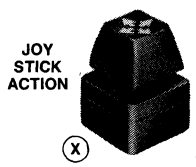
BUTT CONTACTS

50% ACTUAL SIZE





WIPING CONTACTS



SPST = Single Pole/Single Throw, Momentary
SPDT = Single Pole/Double Throw, Momentary
DPDT = Double Pole/Double Throw, Non-shorting, Momentary
NO or NC = Normally Open or Normally Closed

MINIATURE, BUTT CONTACT SWITCHES—FIG. A TO L

Gold contacts provide low level switching with maximum life in minimum space. PC, sealed, overtravel, right angle, and limit switch. SPST NO or NC, and SPDT types.

1 AMP BUTT CONTACT SWITCHES—FIG. M TO P

Small, long wearing switches with silver contacts. SPST NO in standard, UL recognized, sealed, and bezel types; SPST NC in standard and UL types.

1/2 & 1 AMP WIPING CONTACT SWITCHES—FIG. Q, R

Self cleaning contacts for use in critical contact resistance circuits. SPST NO or NC, standard and UL recognized types.

1/4 AMP WIPING CONTACT SWITCHES— FIG. T, U, V

Long wipe, double throw switches for low level switching. SPDT or DPDT, standard, sealed, or bezel types.

10 AMP SNAP ACTION SWITCHES—FIG. W

Rapid make and break for higher current switching; audible click. SPST NO or NC, and SPDT types.

4-WAY SWITCH, JOYSTICK LIKE ACTION

Moves cursor or icon on a display; directional arrows on keycap SP4T with center common.

ORDERING INFORMATION

Circuitry & Description	Figure	Part Numbers: Red Button Or Natural	Part Numbers: Black Button	Make & Break Current*	Life Operations	Behind Panel	Max. Width
NO	A	39-1	39-3	500 mA	1,000,000	.315	.253
NO, PC	A	39-401 RED	39-401 BLK	150 mA***	1,000,000	.215	.253
NO, Sealed	B	39-351 RED	39-351 BLK	500 mA	250,000	.350	.361
NO, Overtravel	C	39-12	39-24	500 mA	100,000	.455	.253
NO, PC, Right Angle	D	39-501 RED	39-501 BLK	150 mA***	1,000,000	.300	.253
NC	E	39-2	39-6	250 mA	250,000	.490	.253
NC, Sealed	F	39-352 RED	39-352 BLK	250 mA	100,000	.529	.361
NO, Limit	G	39-101 (Natural)	—	500 mA	500,000	.650	.505
NO, Overtravel, Sealed	H	39-701 (Natural)	—	150 mA**	100,000	.800	.505
NC, Limit, Sealed	I	39-702 (Natural)	—	250 mA	100,000	.560	.505
SPDT, PC, Right Angle	J	39-251 RED	39-251 BLK	250 mA	500,000	.400	.500
SPDT, PC, RA, Sealed	J,L	39-250 RED	39-250 BLK	250 mA	500,000	.400	.500
SPDT, PC, RA, Wide Button	K	39-261 RED	39-261 BLK	250 mA	500,000	.400	.500
SPDT, PC, RA, Wide, Sealed	K,L	39-260 RED	39-260 BLK	250 mA	500,000	.400	.500
NO	M	30-1	30-3	1 Amp	1,000,000	.592	.375
NO, UL Recognized	M	30-1UL	30-3UL	5 Amps	6,000	.592	.375
NO, Sealed	N	30-251 RED	30-251 BLK	1 Amp	100,000	.632	.505
NO, Overtravel	M	30-15	30-37	1 Amp	500,000	.677	.375
NO, Round Bezel	O	30-05-01-502-0303	30-05-01-502-0707	1 Amp	1,000,000	.930	.640
NO, Square Bezel	P	30-01-01-500-0303	30-01-01-500-0707	1 Amp	1,000,000	1.110	.640
NC	M	30-2	30-6	1 Amp	1,000,000	.605	.375
NC, UL Recognized	M	30-2UL	30-6UL	5 Amps	6,000	.605	.375
NO	Q	23-1	23-4	250 mA	100,000	.663	.468
NO	R	4001	10-9	1 Amp	100,000	.965	.800
NO, UL Recognized	R	4001UL	10-9UL	3 Amps	6,000	.965	.800
NC	R	4002	10-10	1 Amp	100,000	.965	.800
NC, UL Recognized	R	4002UL	10-10UL	3 Amps	6,000	.965	.800
SPDT	S	46-101 RED	46-101 BLK	250 mA	250,000	.890	.437
SPDT, Sealed	T	46-150 RED	46-150 BLK	250 mA	100,000	.957	.437
SPDT, Round Bezel	V	46-05-05-502-0303	46-05-05-502-0707	250 mA	250,000	1.179	.640
DPDT	U	46-200 RED	46-200 BLK	250 mA	250,000	.921	.625
DPDT, Sealed	U	46-270 RED	46-270 BLK	250 mA	100,000	.957	.650
NO	W	2201	7-7	10 Amps	25,000	1.239	.880
NC	W	2202	7-8	10 Amps	25,000	1.239	.880
SPDT	W	7-26 RED	7-26 BLK	10 Amps	25,000	1.239	.880
4-Way, SP4T	W	—	04A-K01	250 mA	500,000	1.315	.845

*At 115 Vac resistive except as noted. **At 5 Vdc. ***At 28 Vdc.

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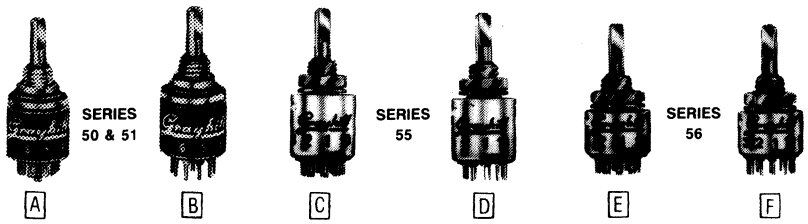
Rotary Switches

SINGLE DECK ROTARY SWITCHES

- 1/2 Inch Diameter, 200 mA Rating
- 1 to 2 Poles; 22½°, 30°, & 36° Throws
- PC, Military, and Adjustable Styles

2/3 ACTUAL SIZE



STANDARD AND MILITARY QUALIFIED SWITCHES
SERIES 50 AND 51 SWITCHES — FIGS. A AND B

SERIES 50—36° (10 position), 0.5 inch diameter. Length behind panel for solder lug is 0.617. Height above board for PC mount is 0.667. Circle of terminal centers is 0.320. Rated to make and break 200 mA for 10,000 cycles (360° turn and return). Available in all listed styles except D, DP, SD, and SDP. Adjustable stops have removable stop pins. Military styles are qualified to MIL-S-3786/20.

SERIES 51 - 30° (12 position) and 22½° (16 position), 0.562 inch diameter. Circle of terminal centers is 0.382 in 30° and 0.500 in 22½°. All other dimensions and rating same as Series 50. Available in all listed styles except D, DP, SD, and SDP. Military styles are qualified to MIL-S-3786/35.

ECONOMICAL DESIGN ROTARY SWITCHES
SERIES 55 — FIGS. C AND D, SERIES 56 — FIGS. E AND F

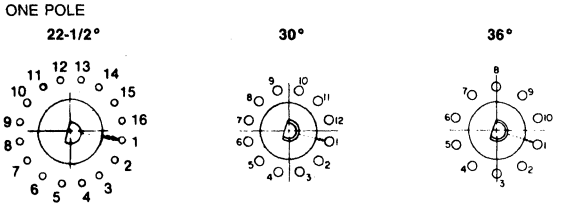
SERIES 55 — Economical version of Series 50 and 51. 36° (10 position) and 30° (12 position), 0.5 inch diameter. Length behind panel for solder lug is 0.635. Height above board for PC mount is 0.532. Circle of terminal centers are 0.340 (36°) and 0.366 (30°). Ratings same as Series 50. Available in all listed styles except military types.

SERIES 56 — Short behind panel. 36° (10 position) and 30° (12 position), 0.5 inch diameter. Length behind panel for solder lug is 0.480. Height above board for PC mount is 0.377. Circle of terminal centers same as Series 55. Ratings same as Series 50. Available in all listed styles except military types. Solder lug terminals (all styles without P).

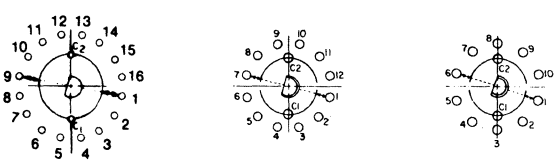
CIRCUIT DIAGRAM

Switch is viewed from shaft end and shown in position number one. For circle of terminal centers, see above. For center to center distance of common terminals, see the series and dimension below the 2-pole diagram.

ONE POLE



TWO POLE



51—.156 | 51—.156, 55/56—.190 | 50—.125, 55/56—.190

CHOICES

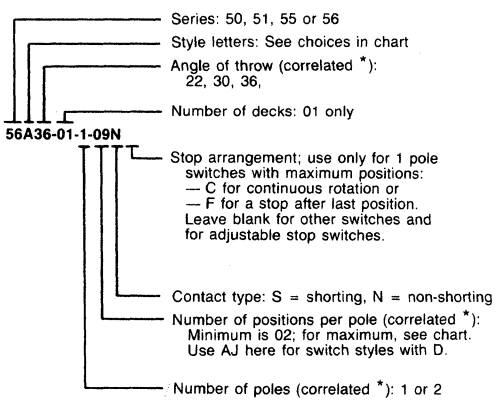
Series	Styles	Angle Of Throw	Number Of Poles	Positions Per Pole, Min.-Max.
51	A, S, P, & SP	22 1/2°	1	02 to 16
			2	02 to 08
	A, S, C, M, P, SP, CP, MP, CD, MD, CDP, & MDP	30°	1	02 to 12
			2	02 to 06
55/56	A, S, P, SP, D, SD, DP, & SDP	36°	1	02 to 12
			2	02 to 06
		30°	1	02 to 10
			2	02 to 05
50	A, S, C, M, P, SP, CP*, MP*, CD*, MD*, CDP*, & MDP*	36°	1	02 to 10
			2	02 to 05

*These styles in Series 50 (only) are not military qualified, but they are made like the military qualified switches.

STYLES

Solder Lug Terminals	PC Terminals
A = Basic Style	P = Basic Style
D = Plus Adjustable Stops	DP = Plus Adj. Stop
S = Shaft/Panel Seal	SP = Shaft/Panel Seal
SD = Seals, Adj. Stops	SDP = Seals, Adj. Stop
C = Basic Mil. Qual.	CP* = Basic Mil. Qual.
CD* = Mil. Qual., Adj. Stop	CDP* = Mil. Qual., Adj. Stop
M = Mil. Qual., Seals	MP* = Mil. Qual. Seals
MD* = Mil., Seal, Adj. Stop	MDP* = Mil., Seals, Adj. Stop

PART NUMBER FORMATION



*Parts of the number are correlated to others and must agree. For example, a 30°, 2 pole switch is limited to 06 positions per pole.

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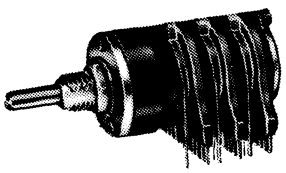
Rotary Switches

1/4 AMP ECONOMICAL ENCLOSED MULTIDECK SWITCHES — SERIES 71



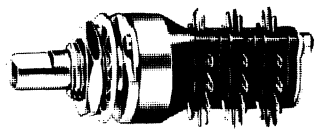
Style AF

SHOWN ON THIS PAGE

- 30° or 36° 1-3 Decks; 1 & 2 Poles
- Adjustable & MIL-S-3786 Styles
- 1/8″ or 1/4″ Shift Diameter
- Solder Lug or PC Terminal

ALSO AVAILABLE

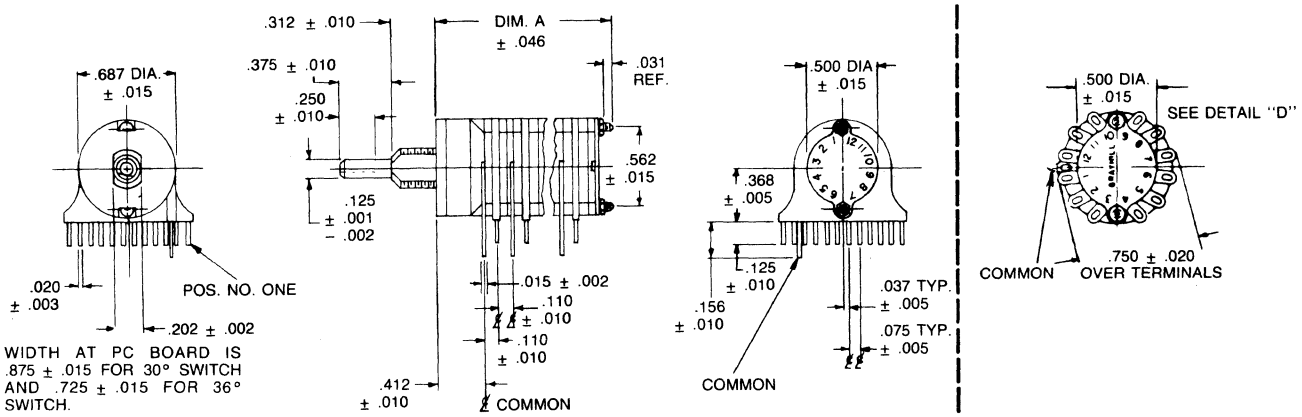
- 4 to 12 Decks
- 3 to 6 Poles Per Deck
- Concentric Shaft Switches



Style B

DIMENSIONS

71AF30 shown here; see also below



STANDARD STYLES

Style A shaft is 1/8″ in diameter, with a 1/4″ diameter bushing; style B shaft is 1/4″ in diameter with a 3/8″ diameter bushing. Either style shaft may be ordered with either 30° or 36° angle of throw, with either solder lug or printed circuit terminals.

SHAFT AND PANEL SEALED STYLES

Style S shaft is sealed by an "O" ring inside the bushing; the panel, by a ring at the base of the bushing. Seals do not alter dimensions. Not available with adjustable stops.

ADJUSTABLE STOP STYLES

Adjustable stop switches are standard switches with removable stop pins which the user can relocate as desired. They are available in either 30° or 36° angle of throw, with either shaft diameter, and with either solder lug or PC terminals.

MILITARY QUALIFIED STYLES

Style M switches are qualified to MIL-S-3786/39 and may be ordered by either the GRAYHILL part number or the M number. Military switches are available in 30° or 36° angle of throw, with either solder lug, or printed circuit terminals, in either shaft diameter. PC switches of 3 decks have a spacer deck after the second deck (see Dim. A in chart).

SPECIFICATIONS

RATING: Switches make and break 400 mA 30 Vdc (or 115 Vac), resistive, for 10,000 cycles (or 200 mA for 25,000 cycles); and 250 mA 30 Vdc, inductive (250 millihenries) for 10,000 cycles or 100 mA for 25,000 cycles. A cycle is a 360° rotation and a 360° return.

For additional specifications, materials, characteristics, military qualification information, circuit diagrams, etc. consult the GRAYHILL catalog.

ACCESSORIES

Accessory non-turn washers may be used when only round holes can be used to mount switches. Washer for style A switch is part number 50J1066; washer for style B is 12C1087-1.

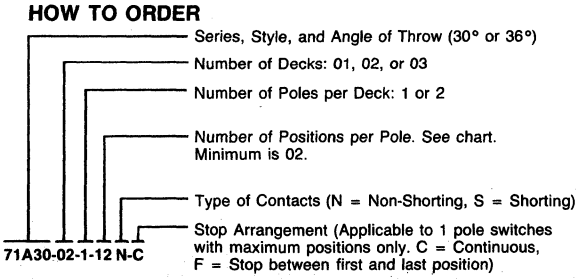
ORDERING INFORMATION

Style Choices By Shaft Size 1/8 Dia.	1/4 Dia.	No. Of Decks	No. Of Poles/ Deck	Positions Per Pole, Min.-Max. 30°	36°
A, AF, AS, ASF, AD, ADF, MA, MF, MAS, MASF	B, BF, BS, ASF, BD, BDF, MB, MBF, MBS, MBSF	01	1	02-12	02-10
			2	02-06	02-05
		02	1	02-12	02-10
			2	02-06	02-05
		03	1	02-12	02-10
			2	02-06	02-05

(Solder Lug Terminals in all styles without F.)

A = 1/8″ diameter shaft
B = 1/4″ diameter shaft
F = PC mount
D = adjustable stop
M = military qualified
S = shaft and panel seal

HOW TO ORDER



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Rotary Switches

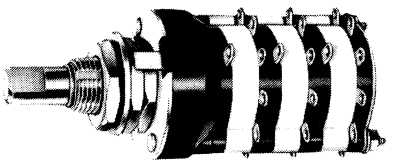
1 AMP MULTIDECK ROTARY SWITCHES — SERIES 42 AND 44

SHOWN HERE

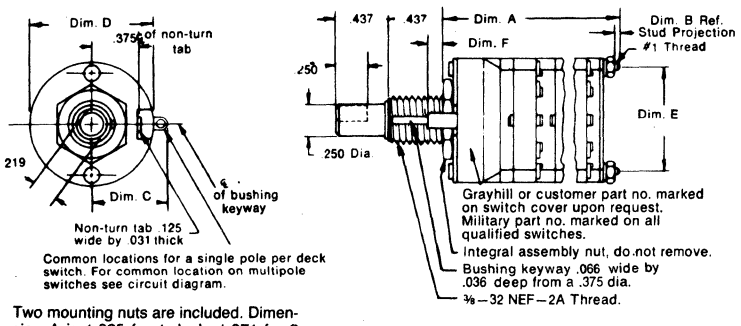
- 30° or 36° Throws
- 1-3 Decks; 1 & 2 Poles
- Solder Lug Style, Fixed Or Adjustable Stops

ALSO AVAILABLE *

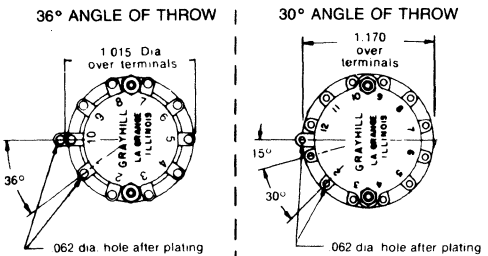
- 45°, 60°, and 90° Throws
- To 12 Decks; to 6 Poles
- PC Mount, Military, Sealed, Concentric Shaft, Add-A-Pot, and UL Recognized Styles



DIMENSIONS



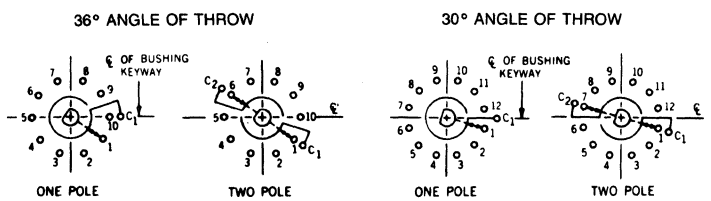
Two mounting nuts are included. Dimension A is 1.025 for 1 deck, 1.371 for 2 decks, and 1.717 for 3 decks. Dimension B is .062 for 1 to 5 decks.



Dimensions	C	D	E	F
SERIES 42	.562	1,000	.830	.093
SERIES 44	.642	1,162	1.000	.121

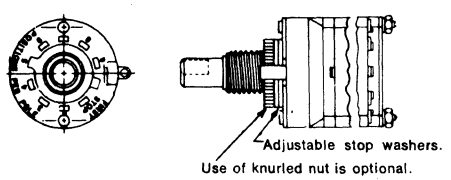
CIRCUIT DIAGRAMS

Shaft flat is opposite contact for first pole.



ADJUSTABLE STOPS

Adjustable stop switches permit the user to externally set the switch stops which limit the rotation, by removing and relocating the stop washers. The panel or a knurled nut holds the washers in place. All other parts are the same as shown above.



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SPECIFICATION

Switches are rated to carry 10A, and to make and break the designated loads for 25,000 cycles (360° cw and 360° ccw) of operation. Resistive loads are 1A, 115 Vac: 1A, 6-28 Vdc; and 100 mA, 115 Vdc. Inductive loads are 250 mA, 115 Vac; 100 mA, 6-28 Vdc, and 20 mA, 115 Vdc.

Contact resistance is 200 milliohms maximum after life. Insulation resistance is 50,000 megohms minimum initially. Voltage breakdown is 2,000 Vac, initially and 500 Vac minimum after environmental tests. Stop-strength is 15 pound-inches minimum for fixed stop switches; 12 pound-inches for adjustable stop. Shorting or non-shorting, wiping contacts have over 150 grams of contact force.

ALSO AVAILABLE

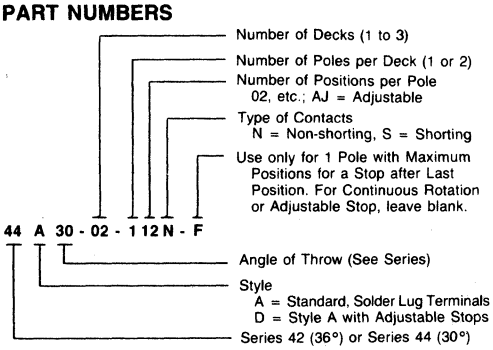
For other angles of throw; 3 to 6 poles per deck; concentric shaft or PC styles, consult GRAYHILL catalog for complete engineering information and drawings, or contact your local sales office.

SELECTION AND ORDERING INFORMATION

Series Angle Of Throw	Styles	No. Of Decks	Poles Per Deck	No. Of Positions Per Pole
42 36°	A = Standard S = Standard, Shaft/Panel Seal H = Military Qualified 125°C HS = Military Qualified, S/P Seal M = Military Qualified 85° UA = UL Recognized US = UL Recognized, S/P Seal D = Adjustable Stops UD = Adj. Stops, UL Recognized	01-12	1	02-10
			2	02-05
44 30°			1	02-12
			2	02-06

Adjustable stop switches and some fixed stop switches are available from your local GRAYHILL Distributor.

PART NUMBERS



For prices and discounts, contact your local Sales Office, an authorized Distributor, or GRAYHILL.

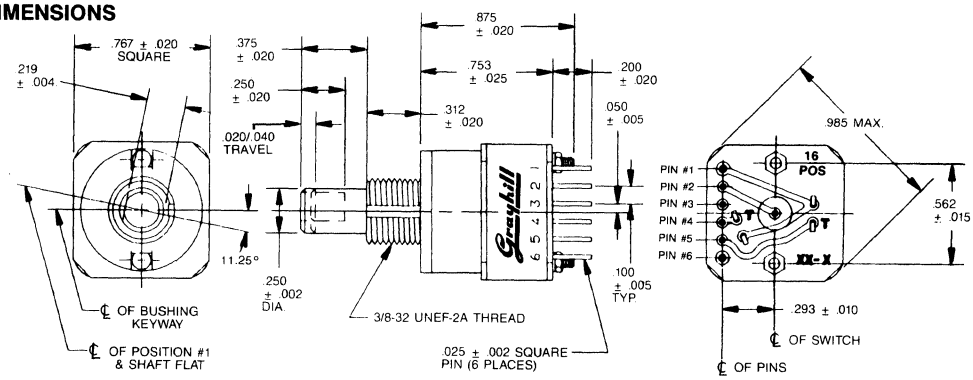
Grayhill INC. 561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (312) 354-1055

Rotary Switches

OPTICALLY COUPLED ROTARY ENCODER SWITCH—SERIES 61

- Economical Touchscreen Alternative
- 1-Hand Control of Cursor and Entry

DIMENSIONS



Q2B CODE	OUTPUTS A	OUTPUTS B
1		
2	•	
3	•	•
4		•
5		
6	•	
7	•	•
8		•
9		
10	•	
11	•	•
12		•
13		
14	•	
15	•	•
16		•

SWITCH POSITION

2BC CODE	OUTPUTS A	OUTPUTS B
1		
2	•	
3		•
4		
5	•	
6		•
7		
8	•	
9		•
10		
11	•	
12		•
13		
14	•	
15		•
16		

SWITCH POSITION

GENERAL SPECIFICATIONS

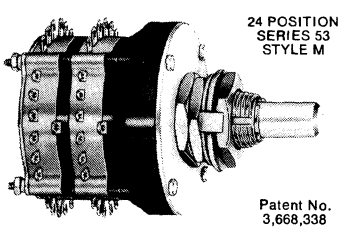
Available in Quadrature 2 Bit Code (Q2B) or 2 Bit Counting Code (2BC) with optional pushbutton entry switch. Encoder is rated at more than 1 million cycles at 4-6 Vdc, 30 mA maximum. Logic low is .5V maximum; logic high is 3.8V minimum. Terminals: 1 = Ground, 4 = Output B, 5 = Output A, 6 = 5V Supply, 2 and 3 = Optional switch. External 4.7K resistors are needed between terminals 4 & 6 and 5 & 6.

ORDERING INFORMATION

Description	Code	Part No.
16 POSITION WITHOUT PUSHBUTTON	Q2B	61B22-01-01
16 POSITION WITH PUSHBUTTON	Q2B	61B22-01-02
24 POSITION WITHOUT PUSHBUTTON	Q2B	61B15-01-01
24 POSITION WITH PUSHBUTTON	Q2B	61B15-01-02
24 POSITION WITHOUT PUSHBUTTON	2BC	61B15-01-01
24 POSITION WITH PUSHBUTTON	2BC	61B15-01-02

For prices contact a local Distributor, or Grayhill.

16, 20, AND 24 POSITION 1/2 AMP SWITCHES

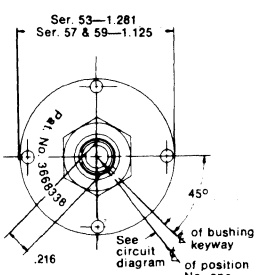


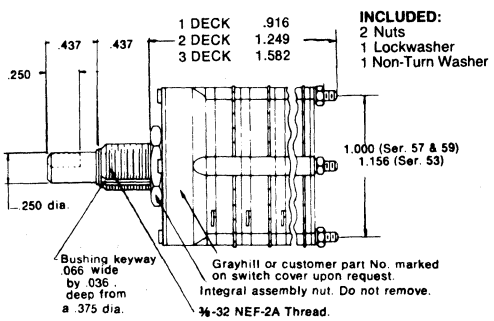
24 POSITION
SERIES 53
STYLE M

Patent No. 3,668,338

- More Circuits in Less Space
- Logic Level Switching

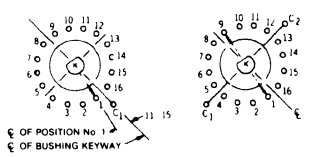
DIMENSIONS



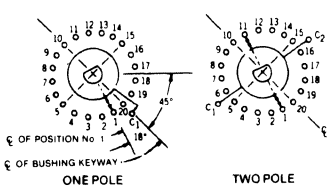


INCLUDED:
2 Nuts
1 Lockwasher
1 Non-Turn Washer

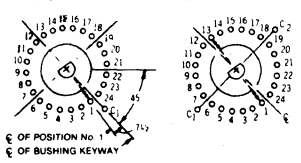
SERIES 57 — 22½° THROW



SERIES 59 — 18° THROW



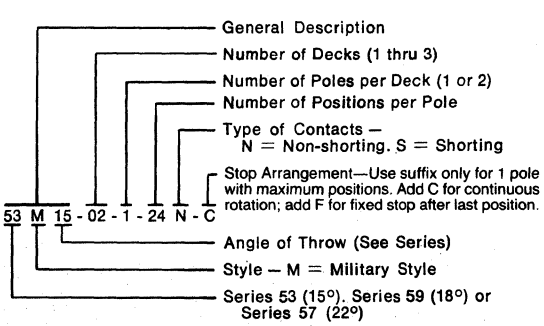
SERIES 53 — 15° THROW



SPECIFICATIONS

Voltage: 115 Vac or 30 Vdc, resistive; 30 Vdc, inductive. Life: 10,000 cycles (360°cw + 360° cow) at 500 mA, resistive or 30,000 at 200 mA; measured at standard conditions.

ORDERING INFORMATION



Poles/Deck and Positions/Pole

Series No.	1 Pole	2 Pole
53	2-24	2-12
59	2-20	2-10
57	2-16	2-8

For 3-12 poles, 4-12 decks, sealed, or military styles, contact GRAYHILL.

For prices and discounts, contact a local Sales Office, an authorized Distributor, or Grayhill.

Available From Your Local GRAYHILL Distributor

GRIMES MAKES GENUINE AMERICAN-MADE SWITCHES FOR JUST ~~95¢~~ 19¢* no matter how many you buy... NO ONE ELSE DOES.

Grimes makes low-profile keyboard switches with just 5 moving parts for greater reliability. And Grimes gives you features like our unique bottom bearing to reduce binding and our built-in jumper to eliminate the need and expense of jumper wires or double-sided circuit boards.

*Some comparable switches are sold for up to 95¢ each in small quantities, reducing in price to 25¢ each on orders of 100,000 or more. Our switches are 19¢ regardless of quantity.

SPECIFICATIONS SPST LOW PROFILE SWITCH WITH TACTILE FEEL.

Switch Contacts

Contact Arrangement	Single pole, single position, non-lock release with built in jumpers. Closed Contact Resistance Less than 4 ohms measured at 1 mA, 5VDC.
Contact Material	Gold plated at contact points.
Open Contact Resistance	Greater than 50M ohms measured at less than 5VDC.
Contact Bounce Time	Less than 5mSEC, make or break with normal finger activation (1mSEC typical.)
Dielectric Strength	Will withstand 110 VAC for 1 minute. without breakdown or other defects.
Total Switch Travel	Greater than .115 inch, less than .130 inch.
Contact Terminals	Four (4) solder pin terminals per switch contact form internal jumpers. Terminals are of phosphor bronze alloy solder plated. Terminals will withstand two completely reversed 90 degree bends before breakage.
Switch Mounting	Switch is self retaining by snap action of two of the four contact posts in a .062 thick PCB, before soldering. Switch withstands flow soldering at 500 degrees F without masking. Locating posts provide positive rotational positioning when soldering the four terminals to the PC board.
Maximum Switched Voltage	50 VDC.
Maximum Switched Current	10 mA
Maximum Switched Power	50 mW resistive

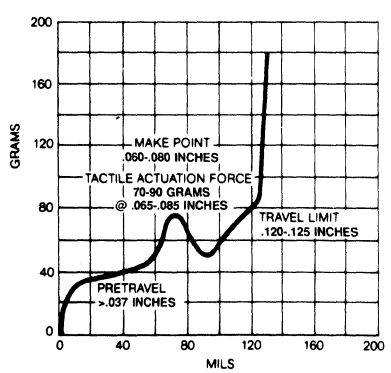
Mechanical Specifications

Actuation/Travel Force	See graph below.
Preload	Greater than 22 grams, less than 42 grams.
Pretravel	Greater than .055 inch.
Actuation Force	Greater than 70 grams, less than 90 grams.
Actuation Travel	Greater than .060 inch, less than .080 inch.
Contact Closure	Contact closure will be effected after no more than .095 inch stem travel.
Switch Life	The switch will perform satisfactorily per this electrical specification after 10×10^6 actuations while switching 1 mA.

Environmental Specifications

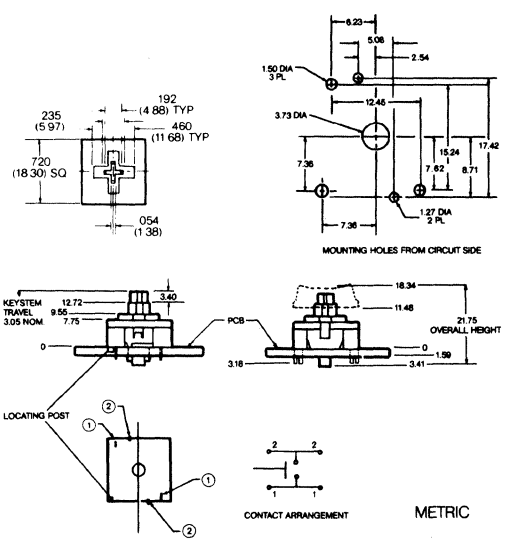
Operating Temperature Range	Greater than 0 degree C (32 degree F) less than 55 degrees C (131 degrees F).
Storage Temperature Range	Greater than −40 degrees C (−40 degrees F) less than 70 degrees C (158 degrees F)
Specification Verification Temperature Range	Greater than 15 degrees C (59 degrees F), less than 30 degrees (89 degrees F)
Humidity	Greater than 20% RH, less than 90% RH (non-condensing)
Shock	No defects in appearance or performance following a 30g shock per Mil-STD-202E, method 213 B. Test condition K (30g. 11ms 1/2 sine, 3 axis).
Vibration	No defects in appearance or performance following a random vibration test conducted per Mil-STD-202E method 214 test condition A (5.23g, 15 min, 3 axis).
Thermal Cycle	No defects in appearance following 8 thermal cycles between −40 degrees C and 65 degrees C per attached cycle graph.
Ozone	No defects in appearance or performance following a 250 hour exposure to 2.5 PPM ozone at 95% RH.
Hydrogen Sulfide	No defects in appearance or performance following 250 hour exposure to 25 PPM H_2S. The first two hundred hours at 95% RH and the final 50 at not greater than 50% HR.

Force vs. switch stem travel curve



FREE SAMPLES AVAILABLE.

General layout and dimensions.



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GRIMES

THE AMERICAN SWITCH

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REED SWITCHES

HAMLIN

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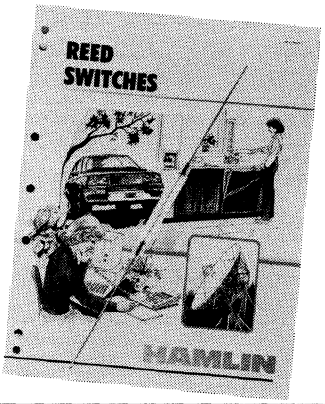
Dry and mercury wetted magnetic reed switches are precision created for reliable operation under the most critical conditions. These switches are hermetically sealed for safe dependable use in any atmosphere and are unaffected by high or low temperatures or pressure.

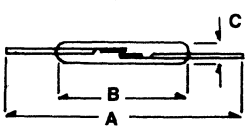
For detailed product information send for the Hamlin Reed Switch Catalog. The catalog provides complete information regarding specifications, dimensions, theory of operation, magnetic actuators, and reed switch application data.



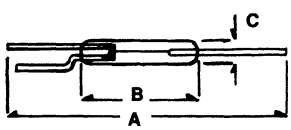
SWITCH MODEL NUMBER	FORM	DIM.* CODE	MAX. DC RATING	MAX. SWITCH AMPS.	MAX. DC VOLTS	A.T. PULL-IN RANGE	SPECIAL FEATURES	SWITCH LIST PRICE		ACTUATOR MAGNET	MAGNET LIST PRICE
MINIATURE MAGNETIC REED SWITCHES											
MINI-2S-115	A	1	3W	0.250	150	7-22	Miniature Size	1.39		H-31	.80
MDRR-6-185	A	2	10W	0.500	300	12-42	High Voltage Hold-off	1.01		H-33	1.24
MDRR-4-185	A	2	10W	0.500	200	12-37	Small Size	.95		H-33	1.24
MDSR-4-185	A	3	10W	0.500	200	12-37	.090" Dia.	.95		H-33	1.24
MLSR-4-185	A	2	20W	1.000	200	17-47	High Inrush	1.32		H-33	1.24
MLRR-2-185	A	4	20W	1.000	200	17-47	High Inrush	1.32		H-33	1.24
MARR-2-185	A	4	10W	0.750	200	12-52	Hi-Rel	.95		H-33	1.24
MARR-8-185	A	4	10W	0.500	300	22-62	High Voltage	1.07		H-33	1.24
MARR-5-196	A	4	10W	0.500	1000	22-52	Breakdown 1500 Volts	3.60		H-33	1.24
MRT-2-276	A	5	50W	1.500	180	37-62	High Current	2.14		H-33	1.24
MRG-DT-175	C	9	3W	0.250	175	15-40	Mod. Current & Voltage	3.47		H-33	1.24
MDRR-DT-175	C	8	3W	0.250	175	15-40	Small Size	3.15		H-33	1.24
STANDARD SIZE MAGNETIC REED SWITCHES											
DRR-DTH-445	C	10	30W	0.500	250	40-100	High Breakdown	5.74		H-32	2.76
DRT-DTH-445	C	10	50W	1.5	500	40-100	Inductive Loads	7.34		H-34	3.48
HIGH CURRENT MAGNETIC REED SWITCHES											
DRR-129-425	A	11	100W	3	400	52-102	High Current	3.59		H-34	3.48
MERCURY WETTED MAGNETIC REED SWITCHES											
MDC-1-387	A	6	50W	2	500	35-65	Mercury Wet	5.36		H-33	1.24
MDC-3-328	A	7	50W	2	500	35-65	Mercury Wet	6.93		H-33	1.24

SWITCH DIMENSIONS

FORM A



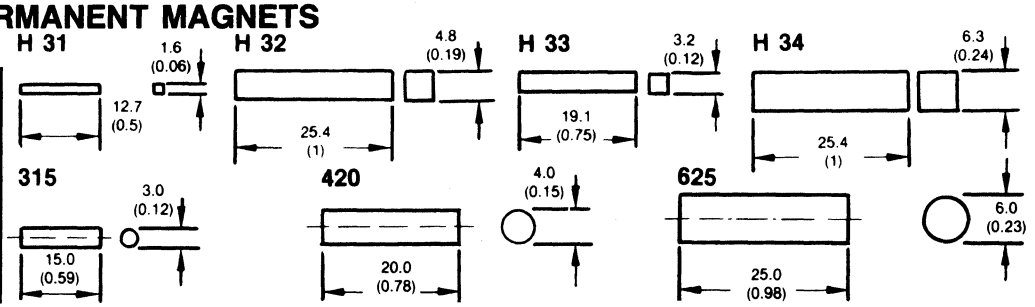
FORM C

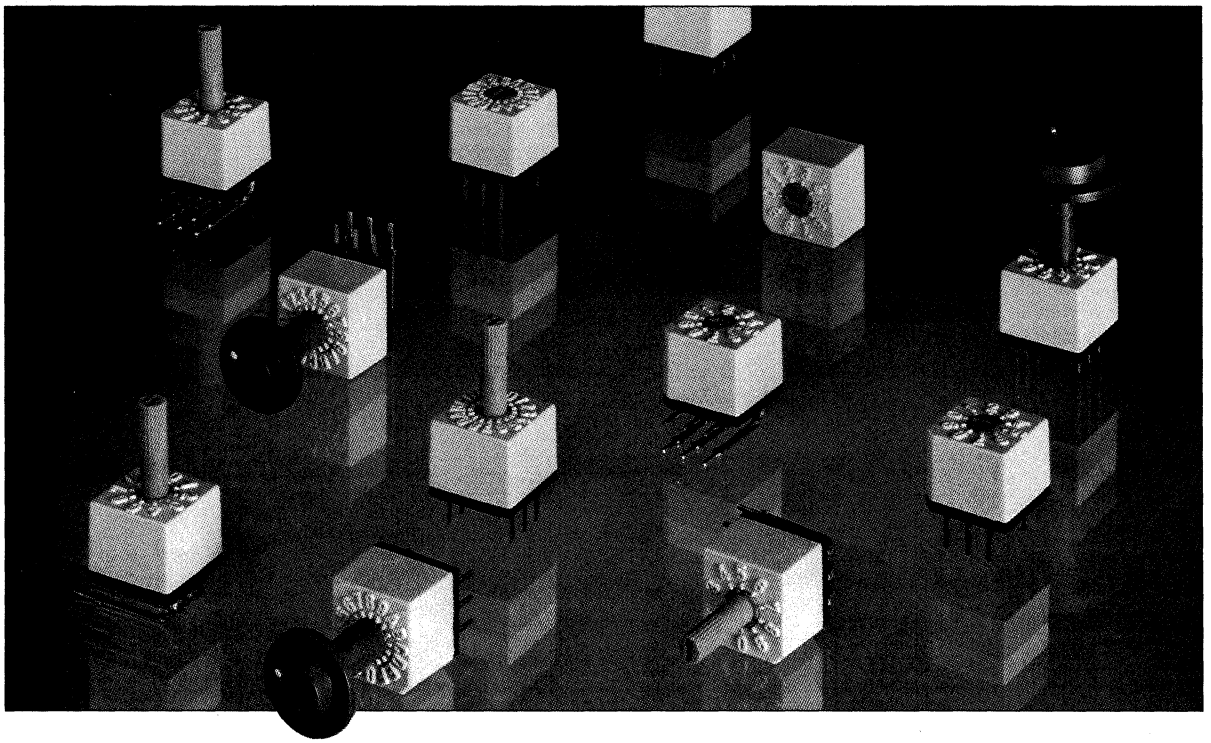


* DIMENSION CODE		1	2	3	4	5	6	7	8	9	10	11
A OVERALL LENGTH NOMINAL	INCH	1.235	1.590	1.590	2.230	2.230	2.250	1.580	2.066	2.125	3.375	3.250
	MM	31.36	40.38	40.38	56.64	56.64	57.15	40.13	52.47	53.97	85.72	82.55
B GLASS LENGTH MAX.	INCH	0.500	0.600	0.600	0.800	0.800	0.610	0.550	0.580	0.610	1.562	2.000
	MM	12.70	15.24	15.24	20.32	20.32	15.49	13.97	14.73	15.49	39.67	50.80
C GLASS DIAMETER MAX.	INCH	0.070	0.105	0.090	0.105	0.130	0.130	0.100	0.105	0.130	0.218	0.207
	MM	1.78	2.660	2.280	2.660	3.300	3.300	2.540	2.660	3.300	5.54	5.250

ALNICO V PERMANENT MAGNETS

MAGNET TYPE	PRICE 1-24
H–31	.80
H–32	2.76
H–33	1.24
H–34	3.48
315	.92
420	1.33
625	1.90





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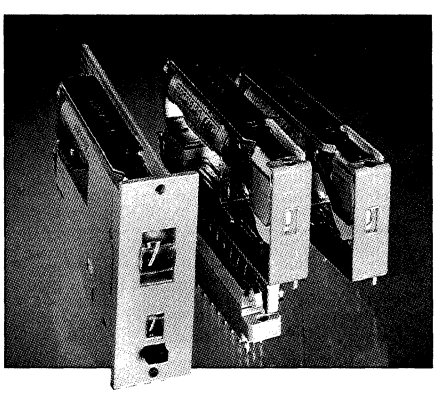
Everybody talks about quality, Hartmann does something about it.

That's because we have total control over design and production of our PCB code switches and pulse counters. We do it all in-house: design, materials selection, plastics molding, metals stamping, plating, final product assembly, testing. So we control quality every step of the process. And that results in reliable products at attractive prices.

With 27 years' experience worldwide, we offer a full line of BCD, BCD complement, and hexadecimal code switches and decadic pulse counters.



We can help you control the efficiency and quality of your production. With programs like just-in-time delivery, custom products, and special designs for your proprietary needs.

When you're ready to do more than talk about quality, talk to Hartmann, 10097 Tyler Place, Ijamsville, MD 21754, **(301) 831-1055.**

Hartmann

HASCO COMPONENTS INC. / REED SWITCHES

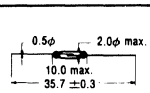
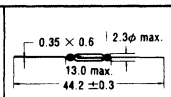
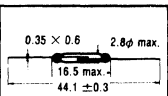
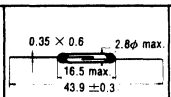
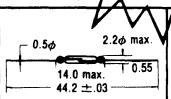
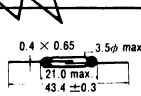
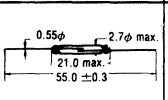
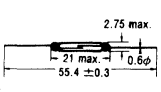
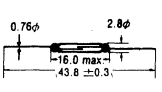
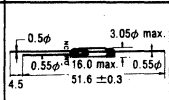
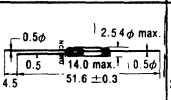
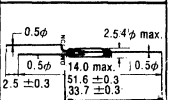
SINCE 1976

OKI electric industry company, ltd.

SAMPLES SENT SAME DAY!

Specifications

POLYMER FREE CONTACTS

							
		ORD-211	**ORD-221**	**ORD-225**	**ORD-226**	**ORD-228**	**ORD-234**
Electrical Characteristics	Contact	1A	1A (offset)	1A	1A RLS/OP >0.8	1A	1A
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	150 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	150 min.	200 min.	250 min.	150 min.	200 min.	300 min.
	Insulation resistance [Ω]	10^9 min.	10^9 min.	10^{10} min.	10^9 min.	10^9 min.	10^{10} min.
	Electrostatic cap. [PF]	0.2 max.	0.3 max.	0.3 max.	0.3 max.	0.3 max.	0.5 max.
	Contact capacity [VA]	1.0	10	10	10	10	10
	Max. conductive curr. [A]	0.3	1.0	1.0	0.5	1.0	2.0
	Max. voltage [V]	24	100	100	100	100	200
Oper. Characteristics	Operate time [ms]	0.3 max.	0.3 max.	0.4 max.	0.3 max.	0.3 max.	0.5 max.
	Bounce time [ms]	0.3 max.	0.3 max.	0.4 max.	1.0 max.	0.3 max.	0.5 max.
	Release time [ms]	0.05 max.	0.05 max.	0.05 max.	0.1 max.	0.05 max.	0.05 max.
	Resonant frequency [Hz]	8600 ±500	2750 ±250	3700 ±300	4200 ±200	5300 ±300	2200 ±300
	Max operating freq. [Hz]	500	500	500	500	500	500
Standard Coil	Coil resistance [Ω]	600	450	450	450	450	500
	No. of turns [T]	5000	5000	5000	5000	5000	5000
	Dimensions [mm]	2.0 x 10	2.9 x 15	2.9 x 15	2.9 x 15	2.9 x 15	3.6 x 20
	Type No.	8	6	6	6	6	3
Features (Contact material)		Ultra-miniature Rh	Miniature offset (Rh)	General purpose miniature (Rh)	Drop-out Pull-in >0.8 (Rh)	General purpose miniature (Rh)	Long life (Rh)
							
		ORD-229	**ORD-2210**	**ORD-2211**	**ORT-233**	**ORT-551**	**ORT-551-1**
Electrical Characteristics	Contact	1A	1A	1A	1C	1C	1C
	Contact resist. (Initial) [mΩ]	150 max.	150 max.	100 max.	150 max.	150 max.	150 max.
	Breakdown voltage [DCV]	700 min.	300 min.	200 min.	200 min.	200 min.	200 min.
	Insulation resistance [Ω]	10^{10} min.	10^{10} min.	10^9	10^9 min.	10^9 min.	10^9 min.
	Electrostatic cap. [PF]	0.2 max.	0.5 max.	0.3 max.	1.5 max.		
	Contact capacity [VA]	20	70	30W max.	3	3	3
	Max. conductive curr. [A]	2.0	2.5	0.5; in-rush 3	0.5	0.5	0.5
	Max. voltage [V]	250	100	100	30	30	30
Operating Characteristics	Operate time [ms]	0.5 max.	0.5 max.	0.6 max.	1.0 max.	1.0 max.	1.0 max.
	Bounce time [ms]	0.5 max.	0.5 max.	0.4 max.	(NC) 1.0 max. (NO) 1.5 max.	(NC) 1.5 max. (NO) 1.0 max.	(NC) 1.5 max. (NO) 1.0 max.
	Release time [ms]	0.1 max.	0.1 max.	0.05 max.	0.5 max.	0.5 max.	0.5 max.
	Resonant frequency [Hz]	2200 ±300	2350 ±250	4600 ±500	6000 ±4000		
	Max. operating freq. [Hz]	500	500	500	200		
Standard Coil	Coil resistance [Ω]	500	500	450	570		
	No. of turns [T]	5000	5000	5000	5000		
	Dimensions [mm]	2.8 x 18	3.6 x 20	2.9 x 15	3.6 x 10		
	Type No.	7	3	6	10		
Features (Contact material)		High breakdown voltage (Rh)	High power (Rh)	High inrush	Miniature transfer (Rh)	Ultra Miniature transfer (Rh)	Ultra Miniature transfer (Rh)

For a comprehensive engineering Reed Switch Catalog, contact factory. **(Also Available in Ruthenium.)**

High Reliability Supported by Unique Technology.

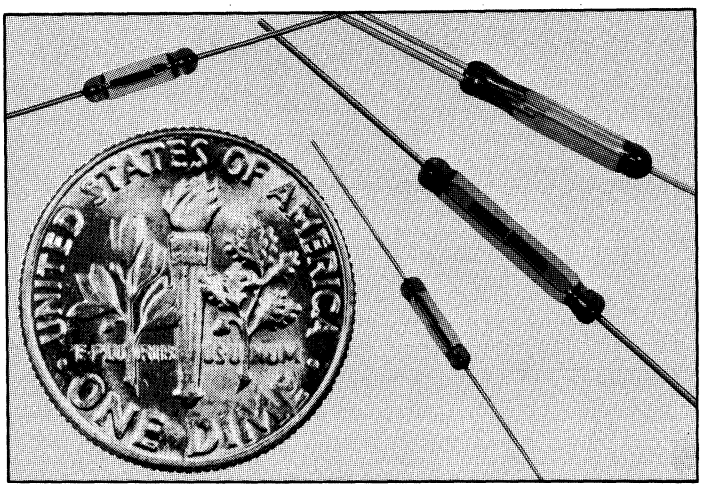
Flux Scanning Method:

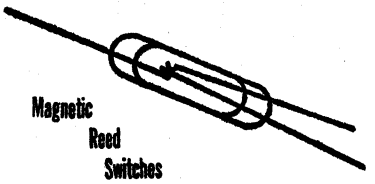
In spite of severe control of the sealing process, there is a slight probability that foreign matter such as magnetic particles may enter the glass. After extensive study in the detection of micro impurities, OKI has adopted the highly reliable flux scanning method. In flux scanning, external magnetism is moved so that foreign matter near the reed is forced to jump to the contact part. The contact resistance then measured is used as the standard for the selection of characteristics. We have thus succeeded in remarkably improving the reliability of reed switches by replacing conventional visual checking with the latest flux scanning method.

EXCLUSIVE AGENT FOR OKI REED SWITCHES IN USA AND CANADA

HASCO COMPONENTS, INC. / 247-40 JERICHO TPKE., BELLEROSE VILLAGE, NY 11001 / (516) 328-9292 TWX: 710-582-5750 FAX: 516-326-9125

HERMETIC SWITCH





REED SWITCHES

FROM THE WORLD'S SMALLEST THROUGH THE INDUSTRY'S MOST POWERFUL

Model	Form	Max D C. Watts	Max D C. Amps	Max D C. Volts	Stock Amp-Turn Pull-In Range	Overall Length Inches	Max Glass Dia. Inches	Max Glass Length Inches	Special Features
MICRO-MINIATURE									
HSR-003	A	.01	.01	10	5-25	1.050	.055	.210	AVAILABLE IN HI-REL AND COMMERCIAL GRADES
HSR-042	A	0.3	.01	100	10-35	1.850	.090	.370	
HSR-370	C	3	.10	28	15-35	1.490	.072	.485	
MINIATURE									
HSR-1015RF	A	10	.5	200	40	2.090	.101	.800	STANDARD OR RADIO FREQUENCY CONTACT PREPARATION
HSR-1017	A	12	.5	200	15-40	2.190	.115	.850	
HSR-520	C	3	.25	100	15-40	2.000	.125	.600	
STANDARD									
HSR-190	A	15	1.0	250	40-80	3.230	.210	2.100	FULL SIZE ECONOMICAL
HSR-780	A	25	1.5	1500	60-100	3.200	.215	2.000	
HSR-630	C	25	1.0	200	40-80	3.390	.210	1.300	
HIGH POWER									
HSR-134	A	100	3.0	100	60-100	3.390	.210	1.300	POWER SWITCHING IN 100 TO 200 WATT RANGE
HSR-V205	A	200	3.0	2500	100-150	3.230	.210	2.100	
HSR-834	C	100	3.0	500	60-100	3.390	.210	1.300	
HIGH VOLTAGE									
HSR-790	A	50	2.5	1000	60-100	3.230	.215	2.000	UP TO 10,000 VDC DIELECTRIC
HSR-V7K	A	50	3.0	5000	60-125	3.230	.210	2.100	
HSR-V10K	A	50	3.0	7500	100-150	3.230	.210	2.100	

ASK FOR CATALOG
ON COMPLETE REED SWITCH PRODUCT LINE
INCLUDING OVER 40 STANDARD MODELS

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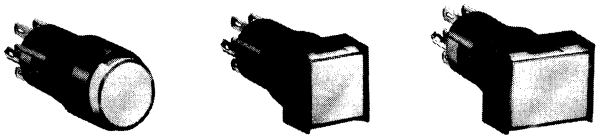
TELEX 796125 / FAX 405-224-9423

idec

LIGHTED & NON-LIGHTED MINIATURE PUSHBUTTONS

IDEC'S A SERIES
MINIATURE PUSHBUTTONS



Round Square Rectangular

FEATURES

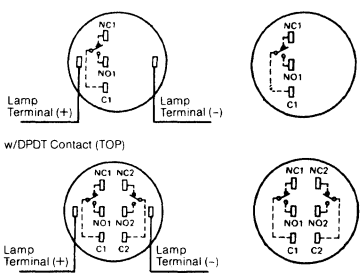
- Compact size—∅.630 inch (∅16mm)
- Super bright LED or incandescent illumination
- Switching from 3 amps maximum down to low-level 1mA AC/DC, 5V
- Enclosed IP40 or oiltight IP65 construction
- SPDT and DPDT form C contact configuration
- Momentary switch action (alternate action available)

SPECIFICATIONS & CONTACT RATINGS

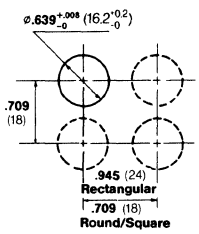
Contact Resistance: 50mΩ maximum (initial value)
Insulation Resistance: 100MΩ minimum (500V DC megger)
Dielectric Strength: 2,000V AC, 1 minute
Service Life (Mechanical): Momentary action type: 1,000,000 operations min.
Degrees of Protection: IP40: Enclosed type
IP65: Waterproof/Oiltight type

Contact Configuration: SPDT, DPDT
Contact Ratings: 3 amp, 250V AC/DC maximum
1mA, AC/DC 5V, minimum
Contact Material: Gold-clad silver

TERMINAL ARRANGEMENT

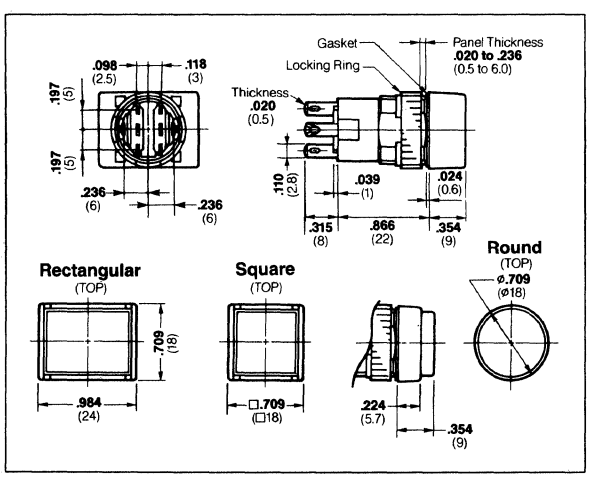


PANEL CUT-OUT



DIMENSIONS

Dimensions in **inches** (mm)



TYPE LIST

ILLUMINATED – LED TYPE (MOMENTARY ACTION)

Shape	Operating Voltage	Contact	Type No.	
			Enclosed Type (IP40)	Oiltight Type (IP65)
Round	6V DC ± 5%	SPDT	AL6M-M12-*	AL6M-M12P-*
		DPDT	AL6M-M22-*	AL6M-M22P-*
	12V DC ± 10%	SPDT	AL6M-M13-*	AL6M-M13P-*
		DPDT	AL6M-M23-*	AL6M-M23P-*
	24V DC ± 10%	SPDT	AL6M-M14-*	AL6M-M14P-*
		DPDT	AL6M-M24-*	AL6M-M24P-*
Square	6V DC ± 5%	SPDT	AL6Q-M12-*	AL6Q-M12P-*
		DPDT	AL6Q-M22-*	AL6Q-M22P-*
	12V DC ± 10%	SPDT	AL6Q-M13-*	AL6Q-M13P-*
		DPDT	AL6Q-M23-*	AL6Q-M23P-*
	24V DC ± 10%	SPDT	AL6Q-M14-*	AL6Q-M14P-*
		DPDT	AL6Q-M24-*	AL6Q-M24P-*
Rectangular	6V DC ± 5%	SPDT	AL6H-M12-*	AL6H-M12P-*
		DPDT	AL6H-M22-*	AL6H-M22P-*
	12V DC ± 10%	SPDT	AL6H-M13-*	AL6H-M13P-*
		DPDT	AL6H-M23-*	AL6H-M23P-*
	24V DC ± 10%	SPDT	AL6H-M14-*	AL6H-M14P-*
		DPDT	AL6H-M24-*	AL6H-M24P-*

LED Lamp Voltage/ Current Ratings:
6VDC: 6VDC/20mA
12VDC: 12VDC/13mA
24VDC: 24VDC/10mA

Ordering Notes:
*Specify lens color code:
R—Red A—Amber W—White
G—Green Y—Yellow

ILLUMINATED – INCANDESCENT TYPE (MOMENTARY ACTION)

Shape	Operating Voltage	Contact	Type No.	
			Enclosed Type (IP40)	Oiltight Type (IP65)
Round	5V AC/DC ± 5%	SPDT	AL6M-M15-*	AL6M-M15P-*
		DPDT	AL6M-M25-*	AL6M-M25P-*
	12V AC/DC ± 10%	SPDT	AL6M-M16-*	AL6M-M16P-*
		DPDT	AL6M-M26-*	AL6M-M26P-*
	24V AC/DC ± 10%	SPDT	AL6M-M17-*	AL6M-M17P-*
		DPDT	AL6M-M27-*	AL6M-M27P-*
Square	5V AC/DC ± 5%	SPDT	AL6Q-M15-*	AL6Q-M15P-*
		DPDT	AL6Q-M25-*	AL6Q-M25P-*
	12V AC/DC ± 10%	SPDT	AL6Q-M16-*	AL6Q-M16P-*
		DPDT	AL6Q-M26-*	AL6Q-M26P-*
	24V AC/DC ± 10%	SPDT	AL6Q-M17-*	AL6Q-M17P-*
		DPDT	AL6Q-M27-*	AL6Q-M27P-*
Rectangular	5V AC/DC ± 5%	SPDT	AL6H-M15-*	AL6H-M15P-*
		DPDT	AL6H-M25-*	AL6H-M25P-*
	12V AC/DC ± 10%	SPDT	AL6H-M16-*	AL6H-M16P-*
		DPDT	AL6H-M26-*	AL6H-M26P-*
	24V AC/DC ± 10%	SPDT	AL6H-M17-*	AL6H-M17P-*
		DPDT	AL6H-M27-*	AL6H-M27P-*

Incandescent Lamp Voltage/Current Ratings:
5V AC/DC: 6V(AC/DC)/70mA
12V AC/DC: 12V(AC/DC)/37mA
24V AC/DC: 24V(AC/DC)/24mA

Ordering Notes:
*Specify lens color code:
R—Red A—Amber W—White
G—Green S—Blue

NON-ILLUMINATED (MOMENTARY ACTION)

Shape	Contact	Type No.	
		Enclosed Type (IP40)	Oiltight Type (IP65)
Round	SPDT	AB6M-M1-*	AB6M-M1P-*
	DPDT	AB6M-M2-*	AB6M-M2P-*
Square	SPDT	AB6Q-M1-*	AB6Q-M1P-*
	DPDT	AB6Q-M2-*	AB6Q-M2P-*
Rectangular	SPDT	AB6H-M1-*	AB6H-M1P-*
	DPDT	AB6H-M2-*	AB6H-M2P-*

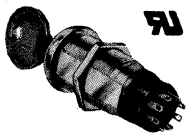
Ordering Notes:
*Specify button color code: B—Black G—Green S—Blue
R—Red W—White Y—Yellow

LED PILOT LIGHTS—SEE SECTION 2450

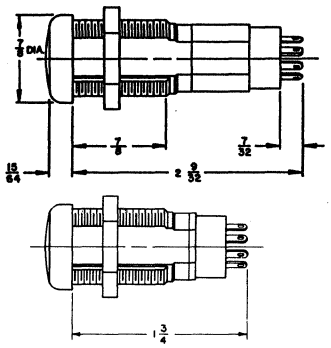
SWITCHLOCKS

Illinois Lock Company *A Division of The Eastern Co.*

LQ7



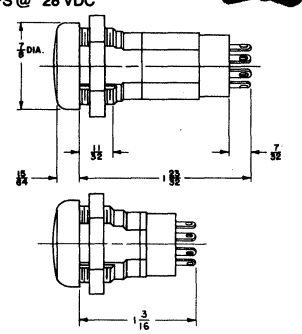
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ9

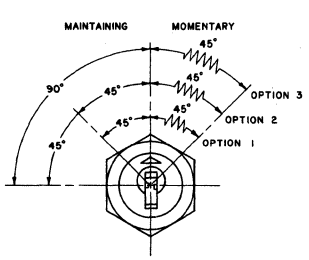
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

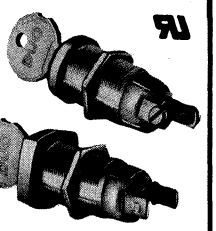
LQ14

ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

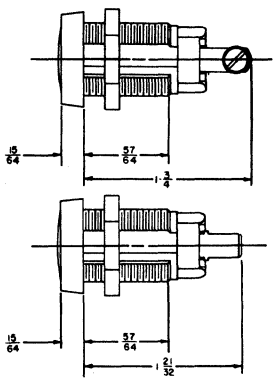


FOR LOCK DIM'S, REFER TO LQ7.

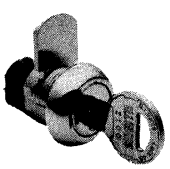
LQ1



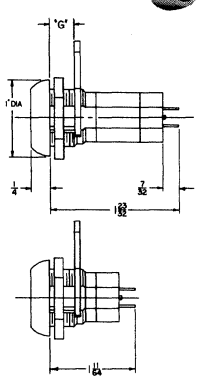
ELECTRICAL RATINGS
5 AMPS @ 115 VAC
5 AMPS @ 24 VAC



LQ20



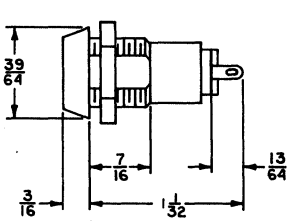
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



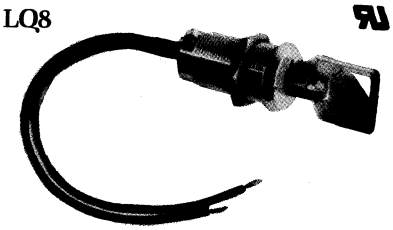
STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

S109

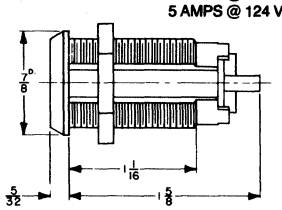
ELECTRICAL RATINGS
0.50 AMP @ 110 VAC
0.50 AMP @ 110 VDC



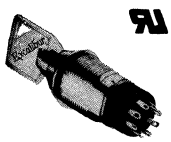
LQ8



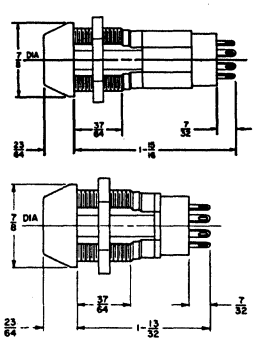
ELECTRICAL RATINGS
5 AMPS @ 120 VAC
5 AMPS @ 124 VDC



LQ13

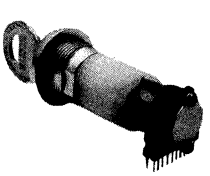


ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

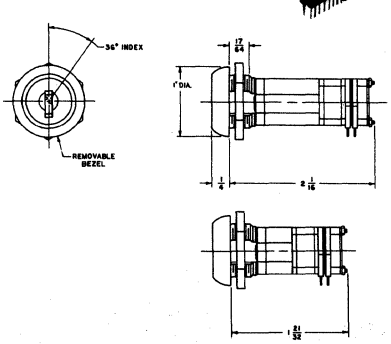


STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ22



150 MA. @
28 VDC RESISTIVE
100 MA. @
115 VAC RESISTIVE



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SWITCHLOCKS

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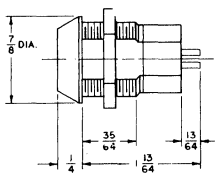
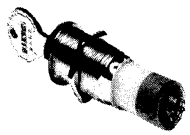
S204

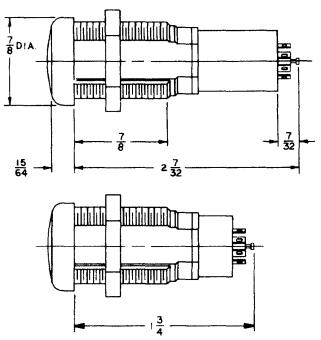
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC



LQ7CC



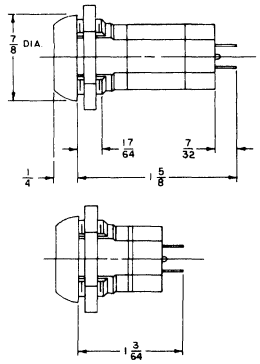
ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC



STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

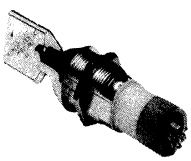
LQ17ZZ

ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

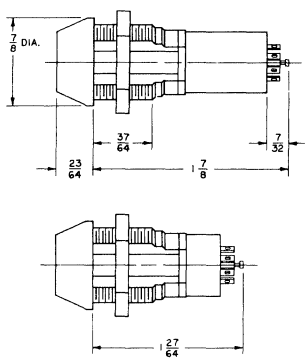


STANDARD & 20KVDC ANTI-STATIC
PROTECTION ROTARY SLIDE SWITCHES

LQ13CC



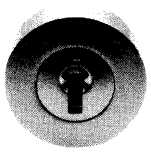
ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC

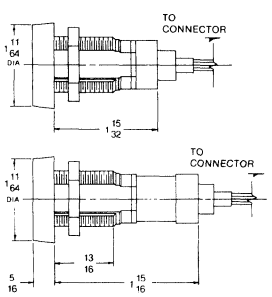


STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ21

ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC
OR
ELECTRICAL RATINGS
4 AMPS @ 125 VAC
2 AMPS @ 250 VAC
4 AMPS @ 28 VDC

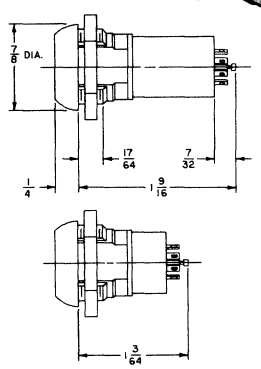




STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ17CC

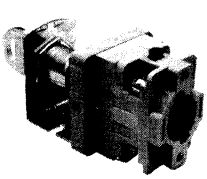
ELECTRICAL RATINGS
200 M.A. @ 28 VDC
150 M.A. @ 115 VAC

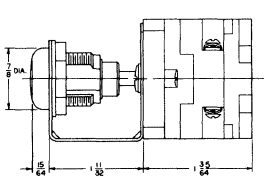


STANDARD & 20KVDC ANTI-STATIC
PROTECTION CENTER COMMON SWITCHES

LQ18

ELECTRICAL RATINGS
20 AMPS @ 600 VAC





UL & CSA LISTED CAM SWITCH

LQ14CC

ELECTRICAL RATINGS
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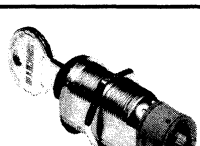
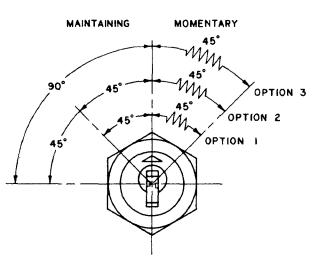
150 M.A. @ 115 VAC



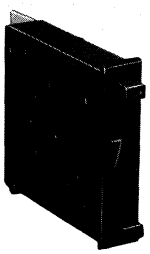


FOR LOCK DIM'S, REFER TO LQ7CC

World's largest selection **of switchlocks for standard and OEM applications. Varying levels of security. Maintaining and momentary indexing, lengths starting at less than 1″, milliamps to 20 AMPS, single and multiple poles, shorting and nonshorting contacts, static protection to 20 KVDC, quick connect, solderlug and PC terminals, L.E.D. indicator lights, custom wire harnessing, combination cam/switch lock.**

303 WEST HINTZ ROAD WHEELING, IL 60090 PHONE (312) 537-1800 TWX 910-651-0221 FACSIMILIE (312) 537-1881

THUMBWHEEL SWITCHES

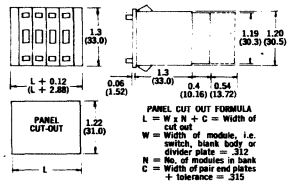


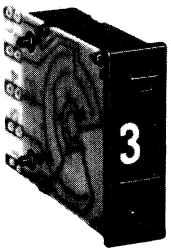
MODEL II IMLEC INDEXER PUSHBUTTON FRONT MOUNT

The Imlec Indexer is a bi-directional push indexing front mount switch, 5/16" in width. Identical in size to our popular MF switches. With snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

These 10 or 16-position switches are available in all popular codes.

DIMENSIONS IN INCHES (IN MILLIMETERS)



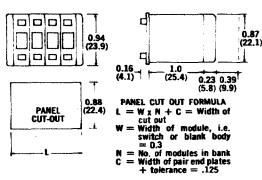


MODEL MI MINI INDEXER PUSHBUTTON FRONT MOUNT

The Mini Indexer is a bi-directional push indexing front mount switch. 0.30" in width. Similar to our Imlec Indexer but smaller in size. Features snap together banking and snap-in panel mounting. Pushbuttons above and below the legend allow the user to add or subtract from the count.

Available in most popular 10-position codes.

DIMENSIONS IN INCHES (IN MILLIMETERS)

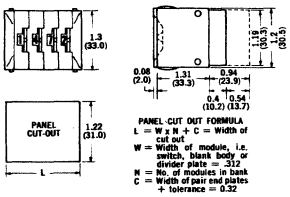


MODEL MF MINIATURE FRONT MOUNT

The MF is our most popular, low cost, 5/16" wide Thumbwheel Switch. Slim, attractive, snap-in panel mounting requires no panel mounting hardware.

Available in all popular 10 and 16-position codes. Matte black finish on high impact moldings, with white legend on black wheel standard.

DIMENSIONS IN INCHES (IN MILLIMETERS)

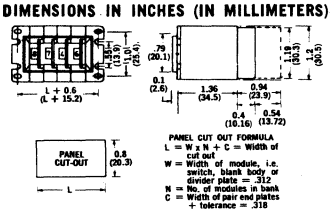


MODEL TR THIN REAR MOUNT

For applications that require a lot of switch in a small space, these 5/16" wide TR switches are ideal. Rear mount counterpart to our popular MF front mount switches.

Available in most 10-position codes including Decimal, BCD, BCD plus Complement and Complement only.

DIMENSIONS IN INCHES (IN MILLIMETERS)

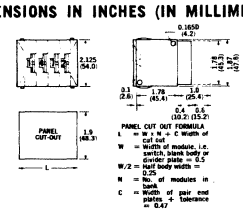


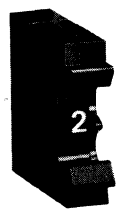
MODEL IF INTERMEDIATE FRONT MOUNT

A rugged front mount switch with large digits, 1/2" wide module. Snap-in front mounting hardware. Available in most popular 10 and 16-position codes.

Matte black finish with white legends on black wheel standard. Gloss fnish, other wheel colors and legends available.

DIMENSIONS IN INCHES (IN MILLIMETERS)



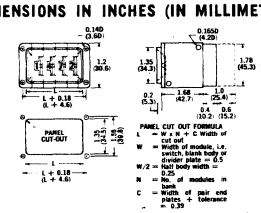


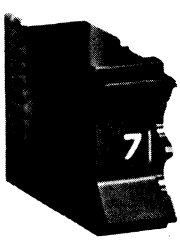
MODEL IR INTERMEDIATE REAR MOUNT

Rugged rear mount counterpart to our IF model, with large readable digits, 1/2" wide module. Available in most popular 10 and 16-position codes.

Matte black finish with white legends on black wheel standard. Gray bodies, gloss finish, other wheel colors and legends available.

DIMENSIONS IN INCHES (IN MILLIMETERS)

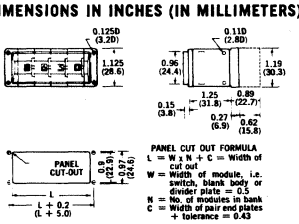




MODEL MR MINIATURE REAR MOUNT

Popular rear mount switch, 1/2" wide module but lower profile than IR model. Available in matte black in most popular 10-position codes including Decimal, BCD, and BCD plus Complements.

DIMENSIONS IN INCHES (IN MILLIMETERS)



Voltage: 200 volts max DC (within power rating) or RMS.

Power: 24 watts max per switch with 12 watts max per energized output.

Insulation Resistance: 1000 megohms between adjacent contacts at 25°C and 20% relative humidity.

Contact Resistance: 0.1 ohms initial and 0.2 ohms after life test at 25°C.

Dielectric Strength: 500 VAC.

Moldings: High impact acetate body in matte black, gloss black or gray finish; wheels are polycarbonate in black with white legends standard, white with black legends for lighted versions, other colors available.

Contact Material: Stator has 0.0001" hard gold over 1 oz. copper on glass fibre as MIL-P-13949GF. Rotor has silver/gold alloy on beryllium copper.

Life: 1,000,000 detents minimum either direction.

Stops: Stops to limit switch to any position.

Panel Thickness: 1/16" to 5/32".

Operating Temperature: −20°C to 70°C. Storage temperature: −40°C to 70°C.

Shock: 100 G's, 6 MS.

Vibration: 15 G's to 70-2000 Hz.

Humidity: 96 HRS, 95% relative.

Options and Accessories Available: Extended Boards for diode suppression; Termination Pins; Stopping; Blank Bodies, Half Bodies; End Plates Divider Plates; Connectors; External LED Lighting; Sealing, etc.

SPECIFICATIONS
ALL MODELS

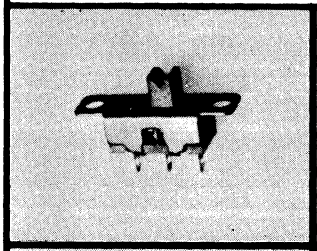
Contact Current: Contacts rated 2 amps @ 115 VAC or 28 VDC non-switching; 0.5 amps @ 28 VAC or DC switching. Minimum recommended switching current 10 microamps @ 20 millivolts.

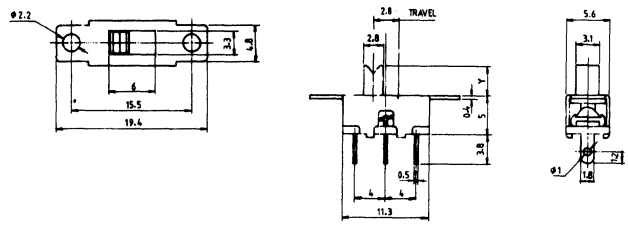
HOW TO ORDER

CODE NO.	DESCRIPTION	II	MI	MF	TR	MR	IF	IR
-12	10 pos. Decimal	II-12	MI-12	MF-12	TR-12	MR-12	IF-12	IR-12
-12A	10 pos. Decimal Ext. Board	II-12A	MI-12A	MF-12A	TR-12A	—	IF-12A	IR-12A
-13	10 pos. Decimal 2 pole	II-13	—	MF-13	TR-13	MR-13	IF-13	IR-13
-18	10 pos. BCD Complement Only	II-18	MI-18	MF-18	TR-18	—	—	—
-18A	10 pos. BCD Complement Only Ext. Board	II-18A	MI-18A	MF-18A	TR-18A	—	—	—
-21	10 pos. BCD	II-21	MI-21	MF-21	TR-21	MR-21	IF-21	IR-21
-21A	10 pos. BCD Ext. Board	II-21A	MI-21A	MF-21A	TR-21A	MR-21A	IF-21A	IR-21A
-22	10 pos. BCD and Complement	II-22	—	MF-22	TR-22	MR-22	IF-22	IR-22
-22A	10 pos. BCD and Complement Ext. Board	II-22A	—	MF-22A	TR-22A	MR-22A	IF-22A	IR-22A
-55	16 pos. Decimal 0-15 or 0-F	II-55	—	MF-55	—	—	IF-55	IR-55
-56	16 pos. BCD 0-15 or 0-F	II-56	—	MF-56	—	—	IF-56	IR-56
-57	16 pos. BCD and Comp. 0-15 or 0-F	II-57	—	MF-57	—	—	IF-57	IR-57
-57A	16 pos. BCD and Comp. 0-15 or 0-F Ext. Board	II-57A	—	MF-57A	—	—	IF-57A	IR-57A
-EP	End Plates, Pair	II-EP	MI-EP	MB-EP	TR-EP	MR-EP	IF-EP	IR-EP
-BB	Blank Body	II-BB	MI-BB	MF-BB	TR-BB	MR-BB	IF-BB	IR-BB
-DP	Divider Plate	—	—	MF-DP	TR-DP	MR-DP	IF-DP	IR-DP
-BBH	Blank Body with Decimal Point	II-BBH	MI-BBH	MF-BBH	TR-BBH	MR-BBH	IF-BBH	IR-BBH
-CN	Connector 10 position only	MCN-10	—	MCN-10	MCN-10	—	ICN-10	ICN-10
-HB	Half Body	—	—	—	—	—	IF-HB	IR-HB
IH	Banking Hardwade (insert no. of modules)	—	—	—	—	IH-( )	IH-( )	IH-( )
MFH	Banking Hardwade (insert no. of modules)	—	—	MFH-( )	MFH-( )	—	—	—

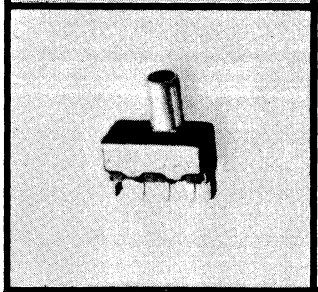
INTERNATIONAL RESOURCE SERVICES

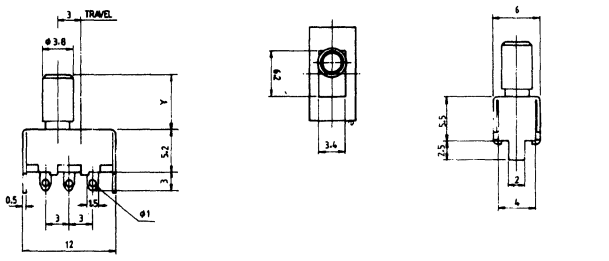
7792 N.W. 72nd AVE. ● MIAMI, FLORIDA 33166 ● TEL: (305) 884-2924



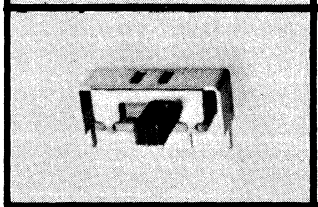


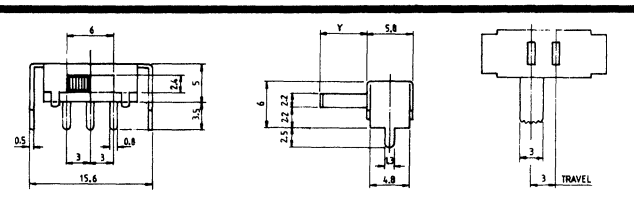
103 SPDT SLIDE SWITCH



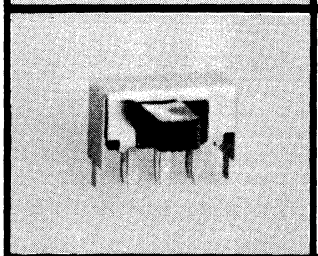


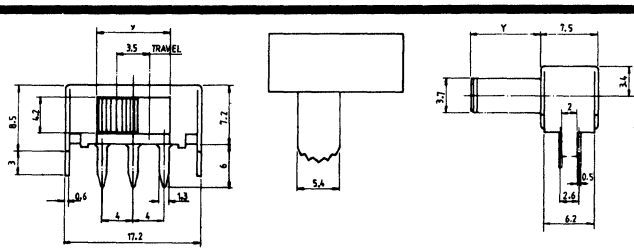
103J SPDT SLIDE SWITCH



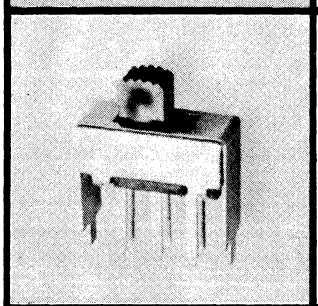


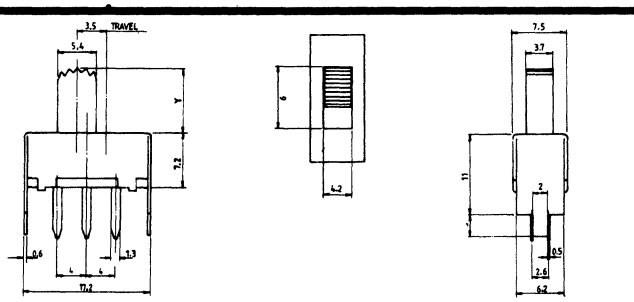
103P SPDT SLIDE SWITCH



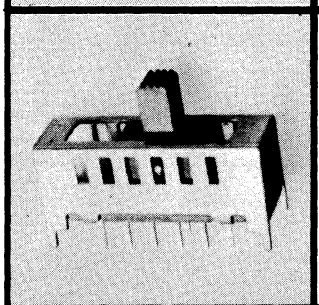


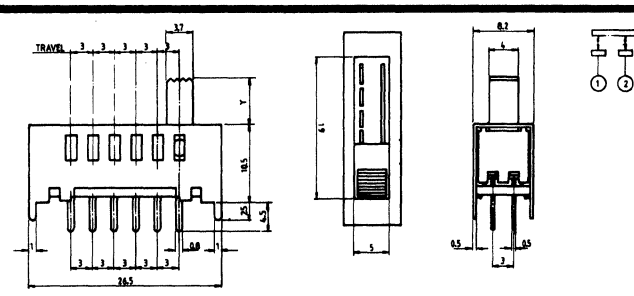
120K DPDT SLIDE SWITCH





120C DPDT SLIDE SWITCH



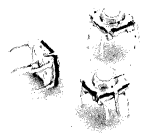


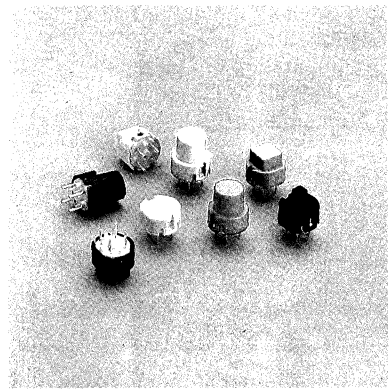
133 SP6T SLIDE SWITCH

Other styles and sizes also available – Please call for samples and detailed specifications.
Problem components? We can supply sourcing from the Far East!
All dimensions shown in millimeters.

Keyswitches

Schadow ITT





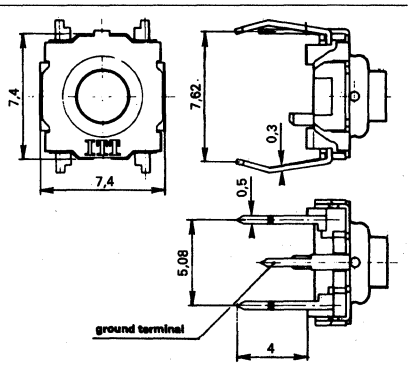
Description
These switches are specially designed for keyboards building. They present a large choice of buttons shapes and colours.

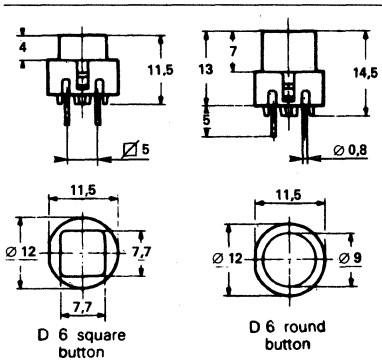
KSA
Short travel (0,3 m/m) miniature fully sealed keyswitch designed for automatic insertion at minimum center to center matrix of 7,62 m/m × 10,16 m/m.

D6
Single pole, momentary action normally open keyswitch. Strapped terminals allows XY coding. Integrated button, good tactile feed back.

Mechanical Data		
Operating force	1,30 N ± 25%	1,3 N
Nominal travel	–	0,8 m/m
Travel max.	0,3 m/m	0,8 m/m
Electrical data		
Contact type	Single pole single throw NO	Single pole single throw NO
Contact material	Ag	Ag
Max. voltage	50 V DC	35 V DC
Max. switching power	1 W	350 mW
Max. switching current	50 mA	10 mA
Contact resistance	50 mΩ	≤ 20 mΩ max
Insulation resistance	$>10^5$ MΩ	100,000 MΩ
Bounce	≦1 ms	5 ms
Life expectancy (operations)	500,000 cycles	500,000 cycles
Climatic data		
Temperature range	− 20 °C + 75 °C	−20 °C +85 °C
Wave or bath soldering	250 °C ± 5 °C/4sec	
Cleaning	Sealed against immersion in solvents	ABS compatible solvents

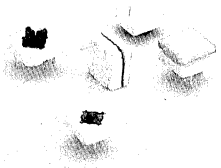
Note: N.O.: normally open

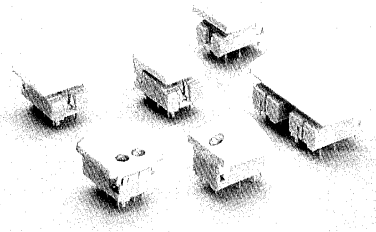


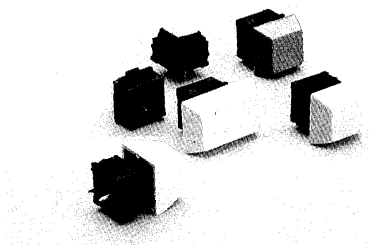


Keyswitches

Schadow ITT







DISC SERIES

MD is a keyswitch module with momentary effect. It can be fitted with a button, thus becoming a complete keyswitch with short and good tactile feeling: the MDP.

MD	MDP
2,4 N	2,4 N
0,6 m/m	0,3 m/m
0,9 m/m	0,5 m/m
Single pole, single throw NO	
Ag*	Au*
100 V DC	100 V DC
6 W	3 W
100 mA	50 mA
<10 mΩ	<15 mΩ
$>10^5$ MΩ	$>10^5$ MΩ
100 μs	100 μs
10^6	5×10^6
–25 °C +70 °C	
235 °C 5sec	
–	

* MD performances, MDP life expectancy 100.000 operations

DIGITAST

Momentary keyswitch with change over contacts, many button shapes including double or triple tabular buttons. In option: 1 or 2 LED buttons*

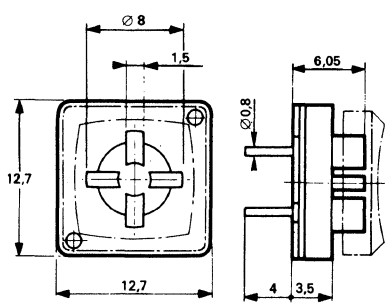
1,5 N	
1,5 m/m	
1,8 m/m	
SPDT	
Au	
24 V	
240 mW	
10 mA	
≦50 mΩ	
1.10^3 MΩ	
1 ms	
5×10^5	
–25 °C to 85 °C	

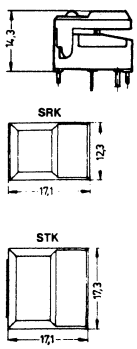
* Note: Push-push version in option

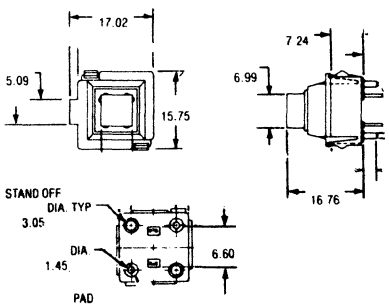
DC 61

Momentary keyswitch for alphanumerical keyboards. Low profil (16,7 m/m). Push-push option and spacebar.

0,7 N	
–	
3,2 m/m	
Single pole single throw NO	
Au	
30 V DC	
1.5 W	
50 mA	
150 mΩ max	
100 mΩ min @ 100 V	
<0,5 ms Nom	
20×10^6	
0 °C to 50 °C	
2s/235°C	







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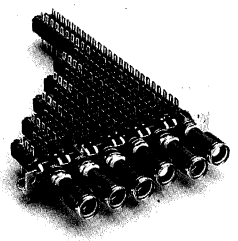
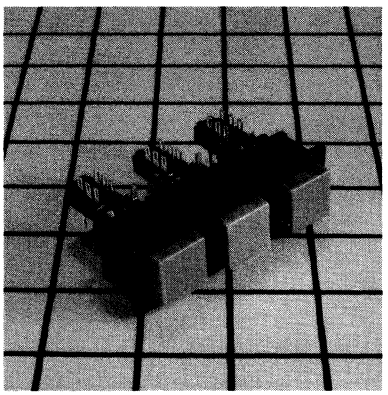
Push button switches

Schadow ITT





Description

ITT push buttons switches family offers the user a wide range of applications by its variety of construction, design and button styles.

F Series

These switches offer wide possibilities:
- up to 10 change overs per module
- frame up to 23 positions with 5 different pitches
- patented mechanical indicator buttons.

ML Series

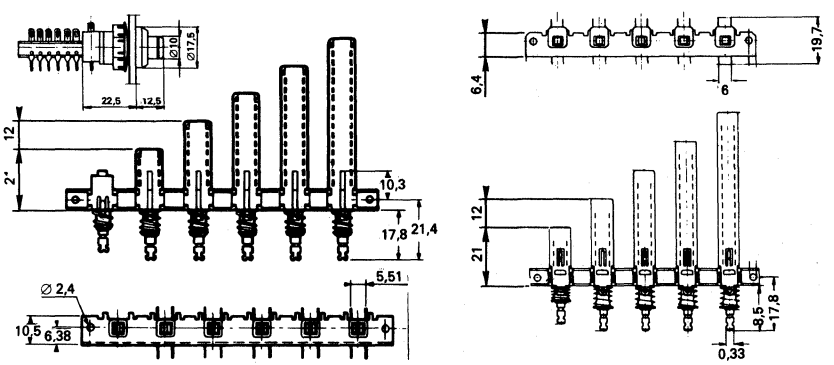
ML Series offers the Design Engineer the latest in High Tech Front panel appearance with a wide variety of switching capabilities. The ML Series buttons can be used with LT, F, F Power and DC50 Series.

Mechanical Data			**FML**
Modules number	1 to 23		1 to 10
Pitch between modules	10–12, 5–15–17, 5–20 m/m		17,5 5 - 25 m/m
Travel max.	4,7 m/m		4.7 m/m
Operating force	7 N for 2 C/O, 15 N 10 C/O		3N for 2 C/O, 4N for 4 C/O
Functions	Interlocking, interdependant		
–	Release key, push-push		
–			

Electrical data			
Number of change overs	2 to 10		2 to 4
Contact materials	Ag	Au	Ag
Switching voltage max.	50 V~	100 V~	125 V AC
Switching current max.	0,5 A	0,04 A	0.45 A
Switching power max.	15 W	300 mW	15 W
Contact resistance	≦10 mΩ	≦20 mΩ	≦ 10 mΩ
Dielectric strenght between contacts and	1500 V		1500 V
between contacts and metallic parts	1500 V		1500 V
Insulation resistance	1×10^9 Ω min		≧ 10^3 Ω
Life expectancy operations	10^5		105

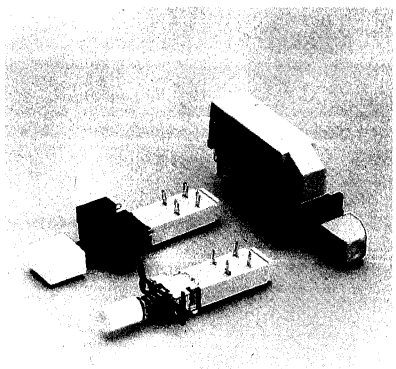
Climatic data	
Temperature range	–20 °C +70 °C
Wave or bath soldering	270 °C/5sec. max.

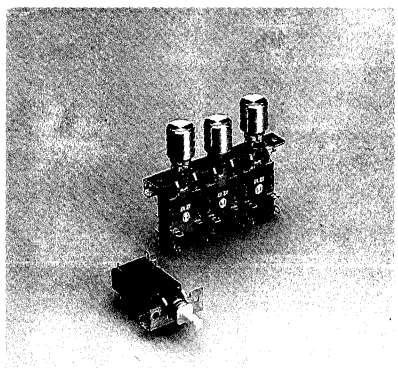
Note: C/O = change over



Power Switches

Schadow ITT





Description

ITT mains switches family can be used individually or together with ITT push buttons. All ITT mains switches responds to international specifications.

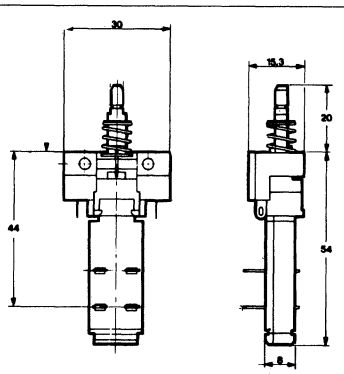
MSA

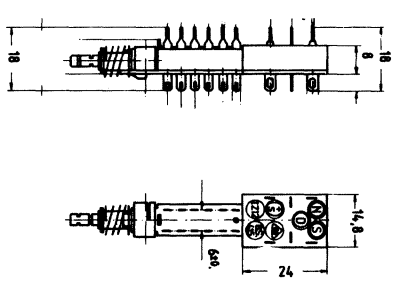
The MSA is a bipolar push button mains switch. It withstands a peak current of 80 A. MSA-ER is the electromagnetic release version. MSA present worldwide approvals.

NE 15

Mains switches compatible with F series ITT push buttons hold several specifications approvals. Double pole double throw or single throw contacts with 2 c/o low currents.

Mechanical data		
Total travel	5,9 m/m	4,7 m/m
Operating force	< 10 N	≦ 7 N
Electrical data		
Switching voltage max.	250 V~	250 V~
Switching current max.	4 A	4 A
Switching power max. (resistive)	1000 W	1000 W
Surge current (peak)	80 A	24 A
Dielectric strength between contacts	1500 Vrms	–
and between contacts/ground	3000 Vrms	–
Insulation resistance between contacts	–	$1 \times 10^{12}\ \Omega$
and between contacts/ground	10^3 MΩ	$1 \times 10^{12}\ \Omega$
Auxiliary contact:		
max. voltage	24 V DC	30 V
Switching current max.	100 mA DC	0,5 A
operating life	25.000	10.000
Options		
	Electromagnetic release, auxiliary momentary contacts	Auxiliary contacts
Climatic data		
Operating temperature	−10 °C +70 °C	−20 °C to + 70 °C





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ITW Switches The line with the "3-Year" Warranty

INDEX BY PREFIX NUMBER

PART NO./SERIES	DESCRIPTION	PAGE NO.
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01-7	One-light bushing mount pushbutton	B•1735
01-9	Pushbutton caps	B•1735
05-1, 2, 4	One-light snap-in pushbutton	B•1739
05-6	One-light snap-in pushbutton	B•1739
05-7	One-light power pushbutton	B•1739
11	Miniature, 10 Amp, double-break	B•1744
14	20 Amp, double-break	B•1743
16	Sub-miniature, 10.1 Amp, double-break	B•1742
18	Series SE 1022 slide voltage selector & power	B•1740
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22	Miniature, 10 Amp, double-break	B•1744
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72	Snap-action switch actuator	B•1744
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16X	Single-pole lighted & non-lighted rocker	B•1741
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APPROVALS Many of ITW switches are available with international approvals and these are indicated with the following symbols:

MIL Spec CEE24

WARRANTY NOTICE

LIMITED WARRANTY: Seller's products are warranted for a period of three (3) years from date of shipment to be free from defects in material and workmanship, provided Buyer, within this warranty period, gives Seller written notice of any claim under this warranty and promptly returns the product prepaid in accordance with Seller's written authorization. Seller will, at its sole election thereafter, refund the purchase price or repair or replace such product found, under the terms of this warranty, to be defective or not within Buyer's specifications. This warranty does not include, nor does Seller assume responsibility for, defects or damage caused by misuse, abuse, alterations, service or repair by others, or failure to properly maintain this product.

THIS WARRANTY IS GIVEN IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. The remedies stated herein are exclusive remedies and Seller shall not be responsible or liable for any indirect, consequential or incidental damages or futher loss of any kind whatsoever.

In no event, shall seller be responsible under this warranty for product failures relating to electrical conductivity, where such failure is for reasons outside seller's control, including failures resulting from improper storage or use.

Seller shall not be responsible for product failures resulting from malfunction of piece part components supplied, designed and/or specified by the buyer. Warranty for components not manufactured by Seller shall only carry the warranty, if any, of that component supplier to the original purchaser.

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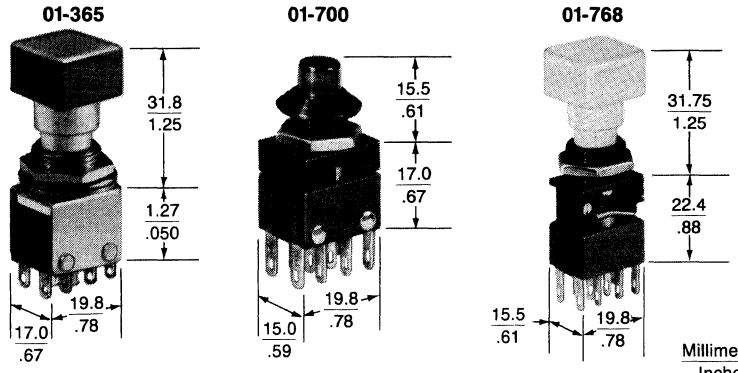
ITW Switches *6615 W. IRVING PARK ROAD • CHICAGO, IL 60634*

Other versions are available. Call (312) 282-4040

TW PUSHBUTTON SWITCHES

SERIES 01



FEATURES

- Momentary or Maintained
- 1 or 2 poles
- Form C or Form Z
- Gold or Silver contacts
- .110 quick connect terminals
- Illumination: LED, T-1¾ flange or screw base incandescent lamp
- Bushing size: 15/32″ or 5/8″
- Ratings: UL–10.1 amps at 125/250 VAC CSA–10.0 amps at 125 VAC
- Series 01-3: Metal bushing and bracket assembly
- Series 01-7: One-piece plastic housing
- Assortment of lens cap styles and colors
- Bezel adapter and dress nuts available
- Versions available to meet the requirements of MIL-S-22885/27

BUTTONS/BEZELS/LAMPS

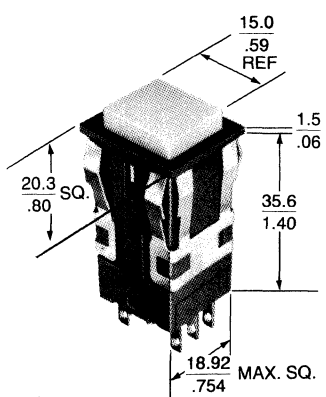
Part Number	Description
01-921312	5/8″ sq/red button
01-921411	3/4″ sq/white button
01-921412	3/4″ sq/red button
01-921413	3/4″ sq/green button
01-941411	3/4″ rd/white button
01-951911	7/8 × 1 1/8/white button
01-951912	7/8 × 1 1/8/red button
70-2150	Bezel adapter
80-040028	Flange base lamp
80-040031	Flange base lamp
80-701319	Flat black bezel
80-701320	Silver bezel

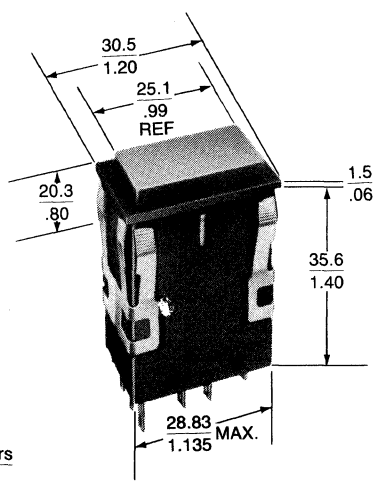
SWITCHES

Part Number	Bushing	Lamp Type	Contacts	Ckty/Action
01-365230	5/8	Flange	Silver	2P Form Z/Main.
01-365630	5/8	Flange	Silver	2P Form/Z Mom.
01-700152	15/32	Red/LED	Silver	1P Form Z/Mom.
01-700155	15/32	Red/LED	Silver	2P Form Z/Main.
01-768210	5/8	Flange	Silver	2P Form C/Main.
01-768610	5/8	Flange	Silver	2P Form C/Mom.

MIL Spec

SERIES 50





FEATURES

- Electromechanical and solid state
- Square, rectangular and indicator only versions
- LED or T-1¾ wedge base incandescent lamp
- Circuitry options: SPDT or DPDT
- Gold or silver contacts
- Momentary or maintained action
- Terminals: .110 quick connect or .025 × .025 PC board
- Panel cutouts: Square–.750″; Rectangular–.750″ × 1.141″
- Ratings: UL Recognized File No. E27957 CSA Certified File No. LR42096
- Three button heights available–.19″, .32″, & .43″ high (above front panel)
- Variety of button caps: transmitted color, insertable legend, dead front, projected color and two-color rectangular buttons are available.
- Variety of button cap colors
- Two-light rectangular switch available
- Optional center and end barriers

BUTTONS

Part No.	Switch Type	Color
50-51C10G	Square	Green
50-51C10K	Square	Black
50-51C10R	Square	Red
50-51F10G	Rectangular	Green
50-51F10R	Rectangular	Red

SWITCHES

Part No.	Lamp Type	Style	Terminal	Circuitry/Action
50-21BBA2AA	None	Square	.110 QC	SPDT Silver/Momentary
50-21CBA2AD	Incandescent	Square	.110 QC	DPDT Silver/Maintained
50-21CBA2BA	Incandescent	Square	.110 QC	SPDT Gold/Momentary
50-21FBA2AA	Incandescent	Rectangular	.110 QC	SPDT Silver/Momentary

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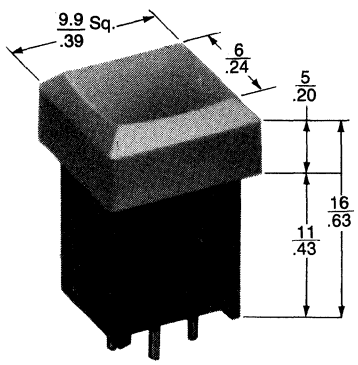
ITW PUSHBUTTON SWITCHES

SERIES 60 DATASWITCH



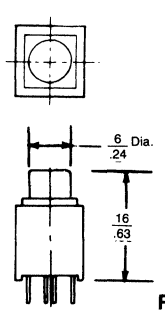
FEATURES:

- Circuitry: SPST-NO momentary
- PCB terminals
- Switch is .39" square
- Square and rectangular buttons; variety of colors
- Designed for flow soldering and automatic cleaning. Solvents must be compatible with 'ABS' and glass-loaded 'Noryl'.
- Legends can be engraved or printed onto switch tops
- Contact Rating: 20 ma-35 VDC

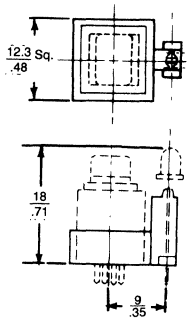
SWITCHES/LED SUPPORT/BUTTONS

Part No.	Description	Color
60-1000	Switch/rectangular button	—
60-2000	Switch/round button	—
60-3000	LED support	—
60-4001	Button/square*	Black
60-4002	Button/square*	Red
60-4003	Button/square*	Green
60-4004	Button/square*	Light Grey
60-4006	Button/square*	Blue
60-4011	Button/rectangular*	Black
60-4012	Button/rectangular*	Red
60-4014	Button/rectangular*	Light Grey

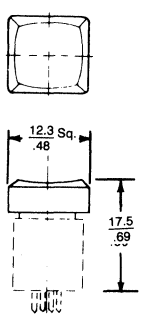
*Button caps fit on 60-1000 switch



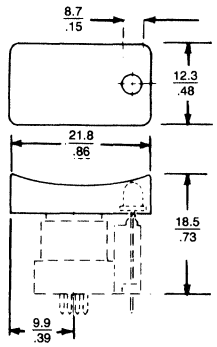
SWITCH WITH ROUND BUTTON



LED SUPPORT



SQUARE CAP



RECTANGULAR CAP

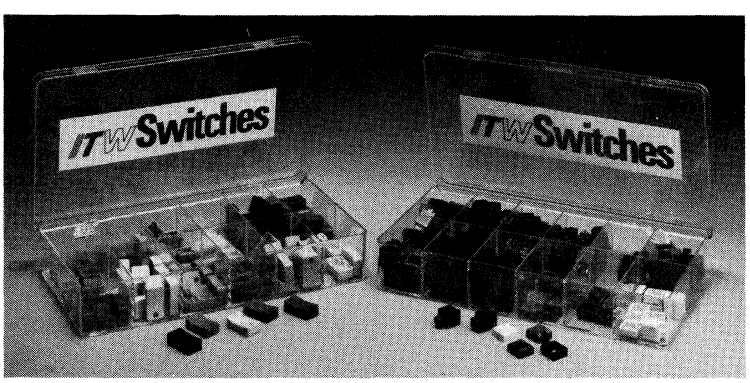
Millimeters
Inches

SERIES 60 PUSHBUTTON KIT

The ITW Switches Series 60 Pushbutton Kit is now available. This kit includes 66 switches (2 styles), 144 caps (all colors and sizes) and 60 LED supports which lets you build all possible Series 60 combinations.

No tools needed—all parts snap together quickly!

To order: 60-KIT



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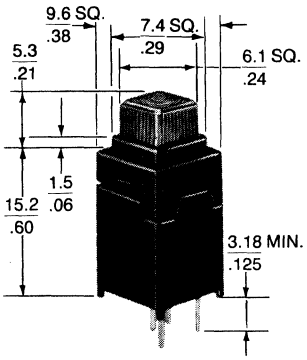
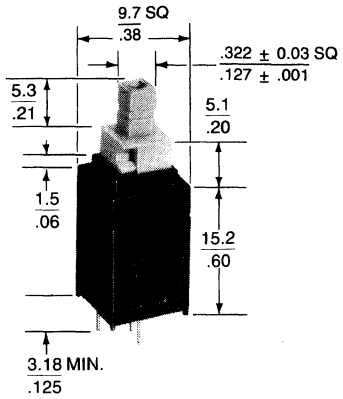
ITW PUSHBUTTON SWITCHES

SERIES 39 LED MINIATURE

STANDARD SWITCH



KEYCAP SWITCH



Millimeters
Inches

FEATURES:

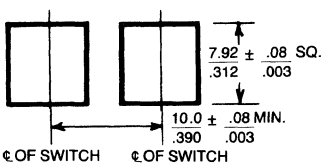
- Circuitry: SPST-NO-DB
- Momentary or maintained
- Bifurcated silver plated contacts
- Available in LED, lighted, non-lighted and indicator only versions
- Button styles: Standard–lighted & non-lighted; Keycap: Square–lighted and non-lighted; Rectangular–non-lighted
- Variety of colored lens and keycaps
- Standard or Hi-brite LED's
- Connector mounting options: 39-800001–In-line mount; 39-800002–Right-angle mount
- Electrical Rating: .25 amp @ 30 VDC max. RES

KEYCAP STYLE BUTTONS

Part No.	Lighted	Color
80-390101	Yes*	White
80-390102	Yes*	Light Grey
80-390103	Yes*	Dark Grey
80-390105	No	White
80-390106	No	Light Grey
80-390107	No	Dark Grey

*Requires light pipe–P/N 80-390100

PANEL CUTOUT RECOMMENDATIONS



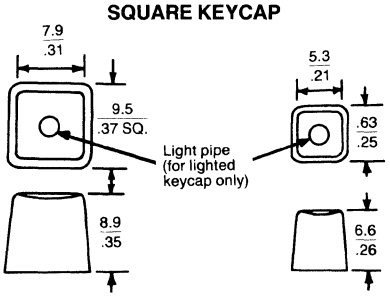
Maximum panel thickness: 1.78 / .070

SWITCHES

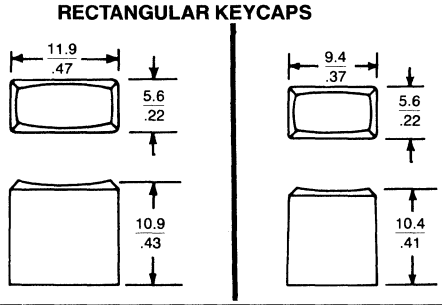
Part No.	Lighted	Button Color	Button Style	Switch Action
39-12101	Yes*	Clear	Standard	Momentary
39-12111	Yes*	Red	Standard	Momentary
39-12113	Yes*	Green	Standard	Momentary
39-12114	Yes*	Smoke	Standard	Momentary
39-12201	Yes	Clear	Standard	Momentary
39-12211	Yes	Red	Standard	Momentary
39-12312	Yes	Green	Standard	Momentary
39-12413	Yes	Yellow	Standard	Momentary
39-12502	No	White	Standard	Momentary
39-12503	No	Red	Standard	Momentary
39-12509	No	Black	Standard	Momentary
39-13211	Yes	Red	Standard	Maintained
39-22100	Yes	—	Keycap	Momentary
39-22500	No	—	Keycap	Momentary
39-23100	Yes	—	Keycap	Maintained

*LED not included–LED support P/N–80-390003 supplied in bulk

SQUARE KEYCAP



RECTANGULAR KEYCAPS

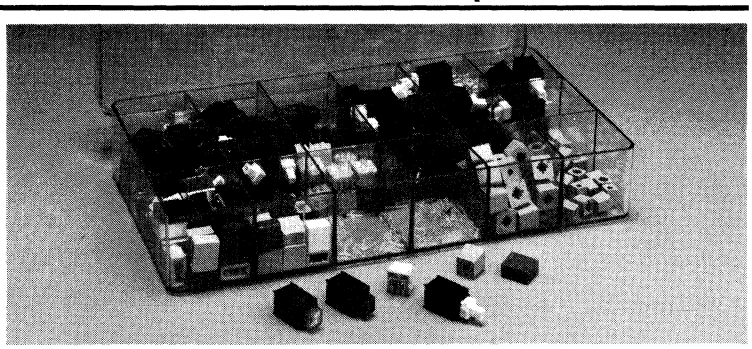


Millimeters
Inches

SERIES 39 PUSHBUTTON KIT

Now available is the ITW Switches SERIES 39 PUSHBUTTON KIT. This kit is filled with over 300 Series 39 switches, buttons, keycaps, light pipes, connectors to build hundreds of Series 39 switch combinations. With this kit, you can build the switch you need immediately.

To order: 39-KIT

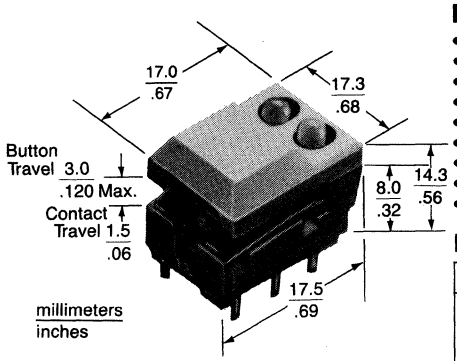


ITW Switches *6615 W. IRVING PARK ROAD • CHICAGO, IL 60634*

Other versions are available. Call (312) 282-4040

TW PUSHBUTTON SWITCHES

SERIES 61 MINIATURE PC MOUNT DATA SWITCH



The above dimensions are for 1½ station keycaps.
For single station keycap substitute 12.3 (.48) for 17.3 (.68)

FEATURES

- Infinite flexibility of keytop styles
- 11 colors as standard
- Unique light pipe design
- Tactile feel
- Short travel
- Momentary or alternate
- Anti-static windows (up to 15KV protection)
- Gold or silver contacts
- Gamma style button cap also available

TECHNICAL DATA

CONTACT ARRANGEMENT	SPDT
Travel	≤3 mm/.12 in.
Housing and key top material	ABS or Polyester
Contact Material	Brass + Ni + Ag or Au
Operating Life — momentary	3,000,000 cycles
Operating Life — Alternate	500,000 cycles
Temperature range	−25 + 85°C/−13° + 185°F

LED SPECIFICATIONS

	ALPHA		
Color	Red	Green	Yellow
Typical Ratings			
Forward Voltage (v) @ 20 mA	1.7	2.2	2.2
Intensity (mcd) @ 10mA	0.8	5.5	2.5
Forward Current (mA)	40	30	20
Reverse Voltage (v)	5	5	5

	Momentary		Alternate			Momentary		Alternate	
	Gold	Silver	Gold	Silver		Gold	Silver	Gold	Silver
	61-101XX00	61-301XX00	61-201XX00	61-401XX00		61-1A2XX0Y[2]	61-3A2XX0Y[2]	61-2A2XX0Y[2]	61-4A2XX0Y[2]
	61-102XX00	61-302XX00	61-202XX00	61-402XX00		61-105XXY[1]Y[2]	61-305XXY[1]Y[2]	61-205XXY[1]Y[2]	61-405XXY[1]Y[2]
	61-1A1XX0Y[2]	61-3A1XX0Y[2]	61-2A1XX0Y[2]	61-4A1XX0Y[2]		61-106XXY[1]Y[2]	61-306XXY[1]Y[2]	61-206XXY[1]Y[2]	61-406XXY[1]Y[2]

ORDERING INFORMATION

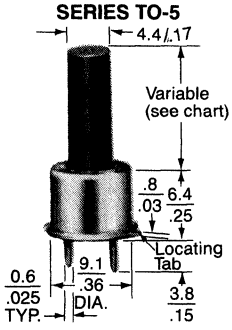
KEYCAP COLORS
Where XX
00 — Red
01 — Orange
02 — Green
03 — Blue
04 — Black
05 — Yellow
06 — Light Grey
07 — Dark Grey
08 — White
09 — Brown
10 — Beige

LEDS
(Left Position)
Where Y[1]
0 — No LED
1 — Red
2 — Green
3 — Yellow

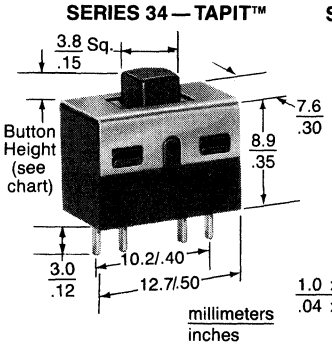
(Right or center position)
Where Y[2]
0 — No LED
1 — Red
2 — Green
3 — Yellow

SERIES TO-5 MINIATURE, SERIES 34 TAPIT™ SERIES 44 ECONOMITE®

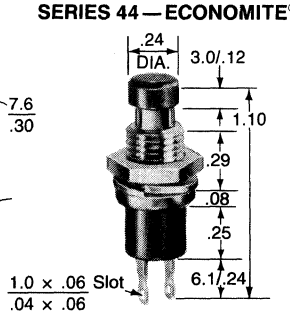
SERIES TO-5



SERIES 34 — TAPIT™



SERIES 44 — ECONOMITE®



Part No.	Switch Type	Mounting	Button Height	Button Color
034-440-002	TO-5	PC	.50″	Black
034-500-002	Tapit	PC	.09″	Black
034-550-001	TO-5	PC	.06″	Black
034-550-006	TO-5	PC	.25″	Black
034-550-010	TO-5	PC	.38″	Black
034-550-015	TO-5	PC	.19″	Black
044-111-011	Economite	Panel	—	Black
044-111-021	Economite	Panel	—	Red

FEATURES:

SERIES TO-5 MINIATURE PCB MOUNT
- Circuit: SPST-NO momentary
- Gold contacts • PCB mount
- Life expectancy: in excess of 1,000,000 actuations
- Optional panel mounted version with threaded bushing available
- Wide range of actuator lengths and colors
- Optional vinyl protective boot
- Temperature range: − 30°C to + 65°C
- Contact Rating: 100 ma 125 VAC

SERIES 34 MINIATURE TAPIT™ PCB
- Circuit: SPST-NO & SPST-NC Form "Z" alternate circuits
- Gold contacts • PCB mount
- Life expectancy: 5,000,000 actuations
- Other button colors and lengths available
- Temperature range: − 40°C to + 100°C
- Contact Rating: 100 ma 125 VAC

SERIES 44 MINIATURE ECONOMITE®
- Contact combinations: SPST-NO & SPST-NC
- Silver or gold contacts
- Life expectancy: 50,000 actuations
- Button colors — black, red, green
- Mounts: 9/32″ diameter panel hole
- Temperature range: − 30°C to + 68°C
- Contact Rating: Silver — 1 amp @ 125 VAC
  Gold — 500 ma @ 125 VAC

TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

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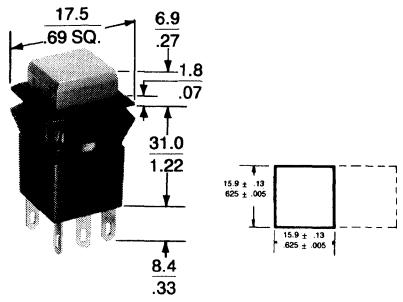
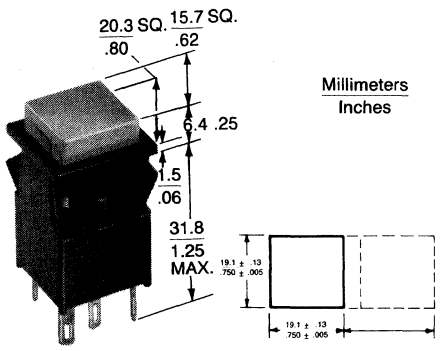
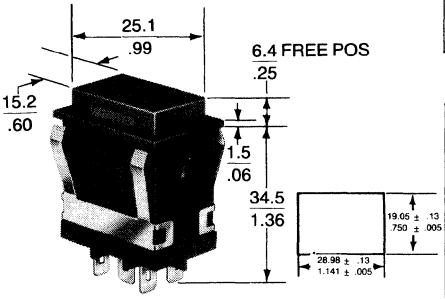
ITW PUSHBUTTON SWITCHES

SERIES 05, 05-6, 05-7





Millimeters
Inches



FEATURES

- Single and double pole
- Momentary and maintained action
- Contacts are silver plated
- 05 & 05-6: Lighted, non-lighted & indicator only versions. LED or T-1¾ wedge base incandescent lamp
  05-7: T-1¾ flange base incandescent, non-lighted and neon versions
- 05 & 05-6: .110 quick disconnect or PC board terminals
  05-7: .187 quick disconnect/solder terminals
- Circuitry options:
  05—SPST-NO, SPDT, DPST-NO
  05-6—SPST-NO, DPST-NO, DPDT
  05-7—DPST-NO, SPST-NO
- Options include: variety of colored lens caps, insertable legend buttons, hot stamping and pad printing, lens barriers
- Ratings:
  05 —1 amp RES, 125 VAC, UL Recognized and CSA Certified 10 MA @ 5VDC
  05-6—1 or 3 amps @ 125 VAC max., UL Recognized
  06-7—10 amps @ 125/250 VAC, UL Recognized File No. E27957 and CSA Certified LR16388-27

SWITCHES

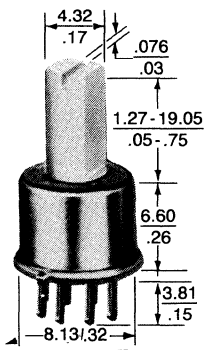
Part No.	Lamp Type	Terminal	Circuitry/Action
05-115	Incandescent	.110 QC	SPST-NO/Mom.
05-135	Incandescent	.110 QC	SPDT/Mom.
05-145	Incandescent	.110 QC	SPDT/Maint.
05-165	Incandescent	PCB	SPST-NO/Mom.
05-185	Incandescent	PCB	SPDT/Mom.
05-215	None	.110 QC	SPST-NO/Mom.
05-265	None	PCB	SPST-NO/Mom.
05-46501	Red LED	PCB	SPST-NO/Mom.
05-62115	None	.110 QC	SPST-NO/Mom.
05-62125	Incandescent	.110 QC	SPST-NO/Mom.
05-65125	Incandescent	PCB	SPST-NO/Mom.
05-712008	Incandescent	.187 QC	DPST-NO/Mom.
05-722008	Incandescent	.187 QC	DPST-NO/Maint.

BUTTONS

Part No.	Lamp Type	Color	Part No.	Lamp Type	Color
80-050007	Incandescent	White	80-050603	Incandescent	Red
80-050008	Incandescent	Red	80-050604	Incandescent	Green
80-050009	Incandescent	Green	80-050605	Incandescent	Blue
80-050011	Incandescent	Yellow	80-050606	Incandescent	Yellow
86-050011	LED	White	80-057014	Incandescent	Red
80-050012	Incandescent	Amber	80-057015	Incandescent	Green
80-050014	Incandescent	Clear	80-050111	N/A	White insert
86-050017	LED	Black	80-050112	N/A	Red insert
80-050602	Incandesncent	White	80-050113	N/A	Green insert

ITW ROTARY SWITCHES

SERIES TO-5 SPASAVER ROTARY



Millimeters
Inches

FEATURES

- Subminiature package size (.36″ diameter)
- Up to 8 positions at 45° indexing, 1 pole
- Low energy switch contacts (gold over nickel plating)
- Glass to metal sealed header
- 0.025″ PC terminals on 0.200″ bolt circle
- Shaft diameter 0.170″ with flat and slot
- Shaft length 0.31″ or 0.44″ from PC board
- Contact rating: 500 ma @ 125 VAC
- Life expectancy: in excess of 10,000 operations
- Options available: Vinyl protective boot and plastic knob

Part No.	Positions	Shaft Length*	Part No.	Positions	Shaft Length*
030-222-005	2	.05″	030-404-018	4	.18″
030-303-005	3	.05″	030-505-005	5	.05″
030-303-018	3	.18″	030-707-005	7	.05″
030-404-005	4	.05″	030-808-005	8	.05″

*Shaft length measures with no bushing. With bushing .30″ actuator is flush with top of bushing.

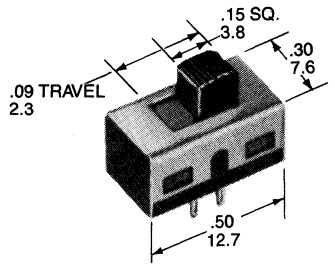
ITW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

TW SLIDE SWITCHES

MINI MIKE™

Miniature Snap-Action Slide



Inches
Millimeters

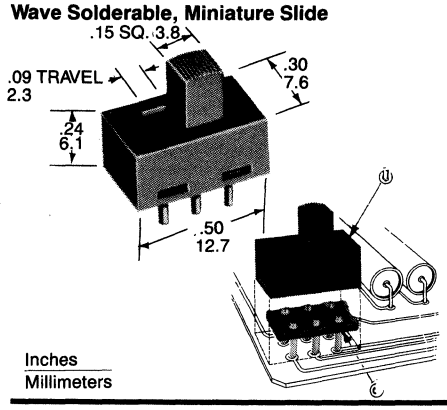
FEATURES

- Available in SPST, SPDT, DPDT, Form Z circuits
- Contacts are hard gold over barrier
- Terminal types—straight, "T", right-angle, PC, standoff PC
- Various actuator lengths
- Some versions UL recognized
- Available button heights from .10 to .50
- Custom actuators, terminals, button colors and hot stamping available
- Temperature range: –40°C to +100°C

Part No.	Circuit	Mount	Height	Color	Rating
023-020-002	DPDT	PC	—	—	250 ma @ 9 VDC
023-020-003	SPDT	PC	—	—	250 ma @ 9 VDC
023-021-008	SPDT	PC	.14	Black	0.5 amp @ 125 VAC/75 VDC
023-021-017	SPST	Panel	.20	Black	1 amp @ 125 VAC
023-021-031	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-040	SPST	PC	.20	Black	1 amp @ 125 VAC
023-021-105	SPDT	PC	.20	Black	250 ma @ 30 VDC
023-021-112	SPDT	Panel	.20	Black	250 ma @ 30 VDC
023-021-113	DPDT	Panel	.20	Black	100 ma @ 125 VAC
023-021-114	DPDT	PC	.20	Black	100 ma @ 125 VAC
023-021-304	Form Z	PC	.14	Black	500 ma @ 125 VAC
029-000-009	SPST	PC	.20	Black	250 ma @ 30 VDC/125 VAC

MR. CLEAN®

Wave Solderable, Miniature Slide



Inches
Millimeters

FEATURES

- Surface mount version available
- Low cost
- Anti-contamination design
- Unique 2-piece assembly
- Gold contacts
- Insert molded base
- Standard configurations: SPST, SPDT, DPST, DPDT, Form Z
- Life expectancy (mechanical): 10,000 actuations
- Temperature range: –40°C to +100°C

Part No.	Circuit	Terminal	Rating
124-240-020	SPDT	PC	250 ma @ 125 VAC
124-440-020	DPDT	PC	250 ma @ 125 VAC

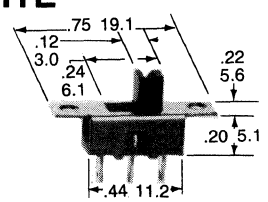
HOW IT WORKS

① Insert lower base half into P.C. board by hand or with automatic insertion equipment. Then wave solder same as other components on board. Clean board in standard manner to remove excess flux.

② After board is cleaned and dried—simply snap the clean uncontaminated upper switch half in place—by hand. No tools, special equipment or orientation needed.

ECONOMITE®

Miniature Slide



Inches
Millimeters

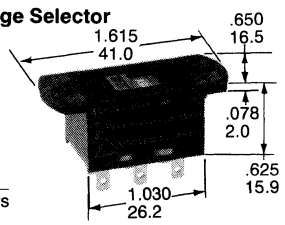
FEATURES

- Available in SPDT, SP 3-position, DPDT, DP 4-position circuits
- Choice of actuators and terminals
- Silver plated contacts standard
- Rating: 125 VAC, 12 VDC resistive

Part No.	Circuit	Current	Mounting	Contacts
043-000-121	SPDT	0.5 amp	Panel	Silver plated
043-000-132	SP 3 pos	0.3 amp	PC	Silver plated
043-200-227	DPDT	0.5 amp	PC side	Silver plated
043-901-121	SPDT	0.5 amp	PC	Silver plated

SERIES SE

Line Voltage Selector



Inches
Millimeters

CEE24

FEATURES

- Variety of terminals
- Top of flush handle stamped to indicate which voltage is selected; various markings available
- Electrical Life: 10,000 cycles
- Handle Height: Flush or 11/32
- International Approvals: UL-CSA-VDE-SEV Designed to meet requirements of CEE Publication 24 and the IEC
- Contact Ratings: UL, CSA & SEV–10 amp 125 VAC; 5 amp 250 VAC
  VDE–4A 125 V~2 (0.5)A 250V~T85

Part No.	Terminals	Dimensions
18-000-0016	Solder	1.615L x .650W x .625H
18-000-0017	Solder	1.615L x .650W x .625H
18-000-0019	Right-angle	1.030L x .650W x .625H
18-000-0022	PC	1.030L x .650W x .625H

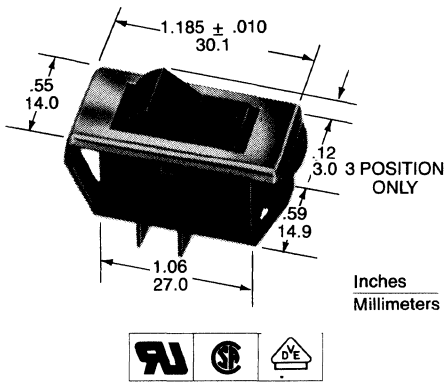
TW Switches *6615 W. IRVING PARK ROAD • CHICAGO, IL 60634*

Other versions are available. Call (312) 282-4040

ITW ROCKER SWITCHES

SERIES 16X

Single Pole Lighted and Non-Lighted



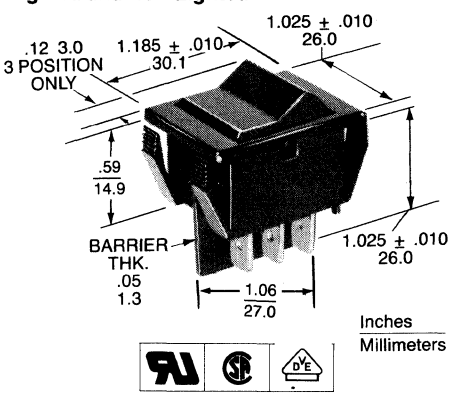
FEATURES

- Snaps into panels from .015″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .48″ (12.2) × 1.08″ (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options—quick connect and solder lugs
- Variety of colors; including custom
- Matte or gloss finish • Hot stamping & metal bezels
- Matching panel lights available • Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  161 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  162 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  163 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
161-009-009	10A	White	Black	SPST	Non
161-009-029	10A	White	Black	SPDT	Non
161-029-004	10A	Red	Black	SPST	Lighted
161-029-006	10A	Red	Black	SPST	Lighted
161-029-009	10A	Red	Black	SPST	Non
161-049-006	10A	Amber	Black	SPST	Lighted
161-099-009	10A	Black	Black	SPST	Non
161-099-019	10A	Black	Black	SPST No mom.	Non
161-099-029	10A	Black	Black	SPDT	Non
161-099-049	10A	Black	Black	SPDT 3 pos.	Non
163-029-006	16A	Red	Black	SPST	Lighted
163-049-006	16A	Amber	Black	SPST	Lighted
163-099-009	16A	Black	Black	SPST	Non

SERIES 17X

Double-Pole and Single-Pole Lighted and Non-Lighted



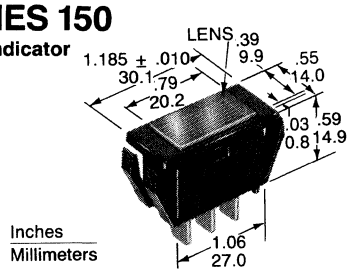
FEATURES

- Snaps into panels from 0.15″ (0.4) to .125″ (3.2) thick
- Recommended cutout: .880″ + .005/– .000 (22.4) × 1.080″ ± .005 (27.4)
- Wide range of circuits, some VDE approved
- Variety of incandescent and neon lamps
- Terminal options—quick connect and solder lugs
- Variety of colors; including custom • Hot stamping & metal bezels
- Matching panel lights available • Paddle versions available; non-lighted only
- Ratings: UL Recognized and CSA Approved
  171 Series: 10A, ½ HP, 125 VAC; 8A, ½ HP, 250 VAC, 10A, 28 VDC
  172 Series: 12A, ½ HP, 125 VAC; 10A, ½ HP, 250 VAC, 12A, 28 VDC
  173 Series: 16A, ¾ HP, 125 VAC; 12A, ¾ HP, 250 VAC, 16A, 28 VDC

Part No.	Rating	Color		Circuit	Lighted or Non-Lighted
		Rocker	Case		
171-009-109	10A	White	Black	SPST	Non
171-029-106	10A	Red	Black	DPST	Lighted
171-029-109	10A	Red	Black	SPST	Non
171-029-306	10A	Red	Black	DPST	Lighted
171-099-109	10A	Black	Black	SPST	Non
171-099-129	10A	Black	Black	SPDT	Non
173-099-109	16A	Black	Black	SPST	Non

SERIES 150

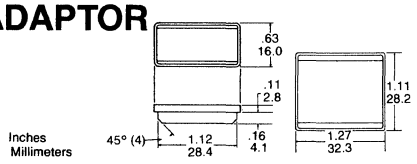
Panel Indicator Lights



These indicators matches the 16X and 17X series rocker and paddle switches. Features for the panel indicators are the same as the 16X and 17X series.

Part No.	Terminal	Color		Lamp
		Lens	Case	
150-009-109	Slip-on	White	Black	125V neon
150-029-109	Slip-on	Red	Black	125V neon
150-049-109	Slip-on	Amber	Black	125V neon

ADAPTOR



The adaptor bezel allows our rocker and paddle switches and our 150 indicator lights to fit standard .550 × 1.125 and 1.000 × 1.125 panel cutouts.

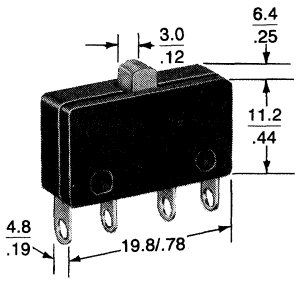
Part No.	Color	Cutout
55-001-659	Black	.550 × 1.125
55-001-719	Black	1.000 × 1.125

ITW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

BASIC SNAP-ACTION SWITCHES

TYPE 16



MIL Spec

Millimeters
Inches

FEATURES

- Features the Butterfly® double-break momentary mechanism
- Wide variety of terminal configurations and styles
- Gold plated or silver contacts standard
- Variety of actuators available
- Ratings: UL Recognized at 10.1 Amps @ 125/250 VAC; CSA Certified at 10.1 Amps @ 125/250 VAC
- 16-188051 meets requirements of MS25476-1; 16-388051 meets requirements of MS27217-2; 16-488051 meets requirements of MS27217-1

ELECTRICAL RATINGS @ 28 VDC

		Sea Level	70,000 Feet
Form C 2 Circuit	Res.	10	10
	Ind.*	3	1.5
	Lamp	3	—
Form Z 2 Circuit	Res.	10 Amps	10 Amps
	Ind.*	5 Amps	2 Amps
	Lamp	3 Amps	—

*L/R = .026

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 5 oz. + 3 oz. – 2 oz.
Release Force: 2 oz. min.
Movement Differential: .020 ± .005
Movement Differential
Type 16-403 Only: .012 ± .005

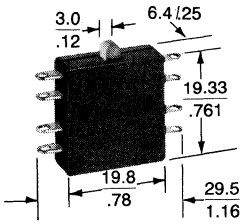
SPECIFICATIONS

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated
16-104	SPDT Form Z	To 275°F Ambient	X	
16-10401				X
16-1042		To 400°F Ambient①	X	
16-114		To 275°F Ambient	X	
16-188051		Ref. MS 25476-1		X

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated
16-204	SPDT Form Z	To 275°F Ambient	X	
16-304		To 275°F Ambient	X	
16-388051		Ref. MS 27217-2		X
16-403	SPDT Form C	To 275°F Ambient	X	

Part Number	Circuit	Temperature Index	Contacts: Fine Silver	Contacts: Gold Plated
16-404	SPDT Form Z	To 275°F Ambient	X	
16-40401				X
16-4042		To 400°F Ambient	X	
16-488051		Ref. MS 27217-1		X
16-504	SPDT Form Z	To 275°F Ambient	X	

TYPE 26



MIL Spec

Millimeters
Inches

FEATURES

- DPDT (Form ZZ) contact arrangement
- Provides the option of controlling up to 4 isolated circuits
- May be wired externally to provide two commons to form standard DPDT (Form CC) switch
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 8 Amps @ 125/250 VAC 75-80% PF
- 26-888051 and 26-988051 meets requirements of MIL-S-8805/77

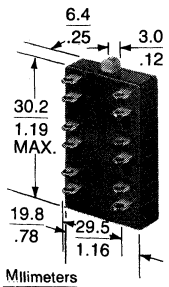
MECHANICAL CHARACTERISTICS

Pretravel: .050 max. Overtravel: .012 min. Operating Force: 12 ± 4 oz.
Release Force: 5 oz. min. Movement Differential: .020 + .010 – .005

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
26-804	DPDT-DB (Form ZZ)	Simultaneous*	Silver	End Solder
26-804010		Non-Simultaneous	Silver	End Solder
26-904		Simultaneous*	Silver	Side Solder
26-988051		Ref. M 8805/77-002	Gold Plated	Side Solder

*Within .004" of plunger travel

TYPE 36



Millimeters
Inches

MIL Spec

FEATURES

- Uses three momentary double-break Butterly® switching mechanisms; 3PDT-DB Form ZZZ
- Standard contacts are fine silver or gold plated
- End or side solder terminals
- Variety of actuators available
- Ratings: UL Recognized File No. E27957 7.5 Amps @ 125/250 VAC 75-80% PF
- Meets requirements of MIL-S-8805/78

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .012 min.
Operating Force: 16 ± 4 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .010

Part No.	Circuitry	Simultaneity	Contact Material	Terminal
36-604	3 PDT-DB (ZZZ)	Simultaneous*	Silver	End Solder
36-704		Simultaneous*	Silver	Side Solder

*Within .004" of plunger travel

ACTUATORS

Actuator P/N & Style	Switch Series	Oper. Force	Release Force	Pretravel	Over-travel	Movement Diff.
76-1200 Roller Lever	16	4 oz max	1 oz min	.125 max	.025 min	.045 ± .011
	26	8 oz max	1½ oz min	.130 max	.026 min	.054 ± .022
	36	12 oz max	1½ oz min	.125 max	.025 min	.055 ± .022
76-1210 Lever	16	2.5 oz max	1 oz min	.125 max	.025 min	.047 ± .013
	26	7 oz max	2 oz min	.155 max	.025 min	.065 max
	36	9 oz max	2 oz min	.155 max	.025 min	.065 max
76-1220 Short Roller Lever	16	5 + 3 oz – 2 oz min	2 oz min	.050 max	.023 min	.020 ± .005
	26	16 oz max	5 oz min	.050 max	.012 min	.020 + .010 – .005
	36	16 ± 4 oz	4 oz min	.050 max	.012 min	.020 + .010 – .005
76-1420 Long Lever	16	1.5 oz max	10 grams min	.312 max	.080 min	.135 ± .035
	26	2½ oz max	½ oz min	.450 max	.030 min	.200 max
	36	3½ oz max	½ oz min	.450 max	.030 min	.200 max

NOTE: Characteristics may vary depending on type of basic switch used in assembly

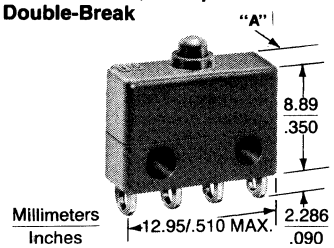
TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

BASIC SNAP-ACTION SWITCHES

TYPE 18

Sub-Miniature, 7 Amp Double-Break



MECHANICAL CHARACTERISTICS

Operating Force: 5 +3 oz. – 2 oz.
Release Force: 1½ oz. min.
Pretravel: .030 max.
Overtravel: .006 min.
Movement Differential: .015 ± .005

MIL Spec

FEATURES

- Single-pole, double-break
- Utilizes Butterfly® double-break mechanism
- Gold plated contacts, solder lug or PC terminals are standard
- 18-488051 meets requirements of MIL-S-8805/78
- Ratings: UL Recognized File No. E27957, 7 Amps 125/250 VAC 75-80% PF

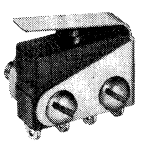
CHARACTERISTICS

"A" Dimension	Electrical Rating	Current	Pretravel	Over-Travel	Operating Force	Release Force	Movement Differential
3.96 $^{+0.00}_{-0.13}$ / .156 $^{+.000}_{-.003}$	Form X or Y	7 amps 125/250 VAC 8 amps 28 VDC IND 4 amps 125/250 VAC	0.89 / .035 Max.	0.15 / .006 Min.	142 $^{+85}_{-57}$ Grams / 5 $^{+3}_{-2}$ oz.	42 gm. / 1.5 oz Min.	0.46 ± 0.20 / .018 ± .008
	Form Z	3 amps 28 VDC IND					
5.08 / .200	Single Ckt Form Z	8 amp. RES. 7 amp IND. 28 VDC	.030 Max.	.006 Min.	5 $^{+3}_{-2}$ oz.	1½ oz. Min.	.015 ± .005
	2-Circuit Form Z	5 amp RES. 3 amp IND. 28 VDC					

SPECIFICATIONS

Part No.	Contact Arrangement	Contacts	Terminals
18-404202	SPDT-DB Form Z	Gold Plated	Solder Lug
18-40421	SPDT-DB Form Z	Gold Plated	Solder Lug
18-488051	MS27257-1 Form Z	Gold Plated	Solder Lug

ACTUATOR FOR TYPE 18

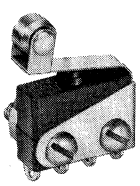


78-3000

78-3000 Spring Lever Actuator. Integral with Mounting Bracket.

MECHANICAL CHARACTERISTICS

Pretravel: .125″ max.
Overtravel: .030″ min.
Movement Differential: .030 ± .015
Operating Force: 6 ± 2 oz.
Release Force: 2 oz. min.
Operating Point: .325 ± .030



78-3100

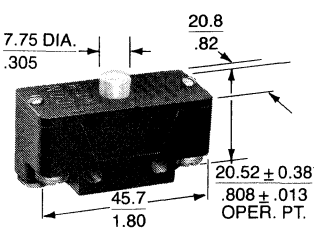
78-3100 Pivot Roller. For cam and slide operation.

MECHANICAL CHARACTERISTICS

Pretravel: .125″ max.
Overtravel: .030″ min.
Movement Differential: .035 ± .015
Operating Force: 6 ± 2 oz.
Release Force: 2 oz. min.
Operating Point: .560 ± .030

TYPE 14

20 Amp, Double-Break



MIL Spec

FEATURES

- Designed to handle loads up to 20 amps
- Features Butterly® double-break mechanism
- Available in standard and heavy duty mounting, with basic button, overtravel plunger or pivoted lever actuators
- Sealed button version also available
- Semirefractory contacts and offset #6 screw type terminals with cup washers are standard
- Ratings: UL Recognized File No. E27957, 20 Amps @ 125/250/480 VAC. 75-80% PF; CSA Certified No. 16388, 1 HP, 125 VAC, 2 HP 250 VAC

Part No.	Circuitry	Mounting	Terminal	Operating Force	Release Force	Pre-Travel	Over-Travel	Standard Movement Differential	Operating Point	Actuator Style
14-124	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.030 Min.	.020 ± .007		Standard Button Actuator
14-12804	SPDT-DB Form Z	Heavy Duty		12 ± 3 oz.	4 oz. Min.	.074 Max.	.030 Min.	.040 ± .007		Standard Button Actuator
14-324	SPDT-DB Form Z	Standard		12 ± 3 oz.	4 oz. Min.	.074 Max.	.219 Min.	.020 ± .007		Overtravel Panel Mount
14-724	SPDT-DB Form Z	Standard	#6 Screw with Cup Washer	5 ± 2 oz.	2 oz. Min.	.156 Max.	.060 Min.	.046 ± .012	1.406 ± .031	Roller Lever Actuator

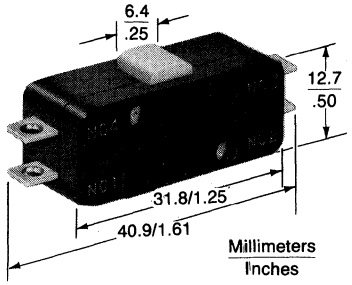
TW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

BASIC SNAP-ACTION SWITCHES

TYPE 11

Miniature, 10 Amp, Double-Break



MIL Spec

FEATURES

- Available in standard and low force momentary action, as well as reset action
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals and actuators
- Ratings: UL Recognized File No. E27957; CSA File No. 16388
- 11-388051 meets requirements of MIL-S-8805/11*

ELECTRICAL CHARACTERISTICS

Circuity	125/250 VAC	28 VDC
SPST-DB N.C. (Form Y) or N.O. (Form X)	10 amp (75-80% PF) ½ HP 125 VAC ¾ HP 250 VAC	10 amp IND. 15 amp RES.
SPDT-DB (Form Z)		
SPDT-SB (Form C)		4 amp IND. 6 amp RES.

SPECIFICATIONS

Part No.	Circuit	Terminal
11-102	SPST-DB N.O. (Form X)	End Solder
11-104	SPDT-DB (Form Z)	End Solder
11-114	SPDT-DB (Form Z)	End Solder
11-202	SPST-DB N.O. (Form X)	#4 Screw
11-204	SPDT-DB (Form Z)	#4 Screw
11-304	SPDT-DB (Form Z)	Side Solder
11-314	SPDT-DB (Form Z)	Side Solder
11-504	SPDT-DB (Form Z)	Quick Disconnect .250
11-388051	SPDT-DB (Form Z)*	Side Solder

MECHANICAL CHARACTERISTICS

Pretravel: .050 max.
Overtravel: .015 min.
Operating Force: 8 ± 3 oz.
Release Force: 4 oz. min.
Movement Differential: .020 ± .007

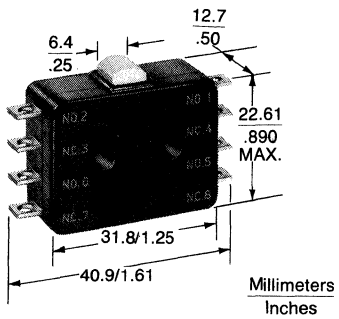
ACTUATORS MECHANICAL CHARACTERISTICS**

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
71-1040	Roller Lever	3.5 oz. Max.	2 oz. Min.	.093 Max.	.062 Min.	.030 .015	.671 ± .031
71-2010	Over Travel	8 oz. ± 3 oz.	4 oz. Min.	.050 Max.	.215 Min.	.020 .005	.828 ± .015

**Mechanical characteristics when used with Basic Switch 11-104

TYPE 22

Miniature 10 Amp, Double-Break



MIL Spec

FEATURES

- Contains two individual switching elements which function simultaneously (within .004" of plunger travel)
- Fine silver contacts are standard; Gold plated contacts also available
- Wide variety of terminals styles and actuators
- Ratings: UL Recognized File No. E27957, 10 Amps @ 125/250 VAC, 75-80% PF ½ HP @ 125 VAC, ¾ HP @ 250 VAC
- MIL-S-8805/15 listed units available

ELECTRICAL CHARACTERISTICS

Circuity	Voltage	Current
DPST-DB N.O. or N.C. (Form XX or YY)	28VDC	15 amp RES. 10 amp IND.
DPDT-DB (Form ZZ)	28VDC	10 amp RES. 7 amp IND.

SPECIFICATIONS

Part No.	Circuit	Terminal
22-104	DPDT-DB (Form ZZ)	End Solder
22-202	DPST-DB N.O. (XX)	#4 Screw
22-204	DPDT-DB (Form ZZ)	#4 Screw
22-304	DPDT-DB (Form ZZ)	Side Solder
22-504	DPDT-DB (Form ZZ)	¼" Quick Disconnect

MECHANICAL CHARACTERISTICS

Pretravel: .060 max.
Overtravel: .015 min.
Operating Force: 17 ± 5 oz.
Release Force: 4 oz. min.
Movement Differential: .030 ± .009
Terminals: Solder (side or end)
#4 screw ¼" quick disconnect

ACTUATORS–MECHANICAL CHARACTERISTICS*

Part No.	Actuator	Operating Force	Release Force	Pre-Travel	Over-Travel	Movement Differential	Operating Point
72-1160	Roller Lever (1)*	10 oz. Max.	1.5 oz. Min.	.150 Max.	.035 Min.	.070 ± .015.	1.000 ± .031
72-2080	Over Travel (2)* Plunger	17 ± 5 oz.	4 oz. Min.	.060 Max.	.215 Min.	.030 ± .007	.828 .031

(1)* when used with 22-104 Basic Switch or 22-204 Basic Switch
(2)* when used with 22-304 Basic Switch

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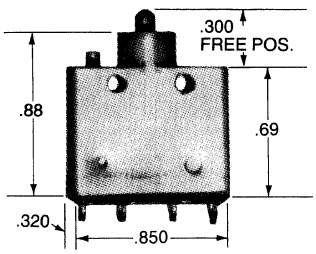
ITW SEALED SWITCHES

TYPE 65



MIL Spec

FEATURES

- Ratings up to 15 amps resistive @ 28 VDC
- Provides the ruggedness and reliability to meet demands of industrial & military applications
- Available with variety of basic switches: Type 11, Type 16, Type 22
- Meets the (watertight) requirements per MIL-S-8805 enclosure design symbol 3
- Wide choice of circuitry, actuators and mountings
- Optional electrical connections — solder, quick disconnect or screw terminals
- Wire leads with or without connectors or plugs
- Temperature range for standard units – 65°F to + 185°F

SUBMINIATURE SEALED SWITCHES
(SOLDER LUG TERMINALS STANDARD)

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.	M.D.
65-2010	Pin Plunger	SPDT-DB Form Z	.050 max.	.012 min.	24 ± 8 oz.	8 oz. min.	.010-.030
65-3010	Roller Lever	SPDT-DB Form Z	.120 max.	.025 min.	16 oz. max.	5 oz. min.	.058 max
65-4012	Over Travel	SPDT-DB Form Z	.070 max.	.187 min.	2¼ lb. max.	8 oz. min.	.010-.030 max.

Electrical Ratings: 5A IND — 28 VDC 5A RES — 125, 250 VAC

MINIATURE SEALED SWITCHES

Part No.	Actuator	Circuitry	P.T.	O.T.	O.F.	R.F.
65-430098	Over Travel	SPDT-DB Form Z	.070 max.	.140 min.	4.8 lb. max.	1.8 lb. min.

Electrical Ratings: 7.5A IND, 15A RES — 28VDC 10A RES — 125, 250 VAC

BASIC SWITCH KIT

The ITW Switches Basic Switch Kit is now available. It is filled with 9 different styles of Type 16 basic switches and 4 different Type 76 actuators. Many different variations can be built using the basic switches and the actuator parts (44 switches and 24 actuators & hardware).

To order: ask for 16-KIT

ITW Switches 6615 W. IRVING PARK ROAD • CHICAGO, IL 60634

Other versions are available. Call (312) 282-4040

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

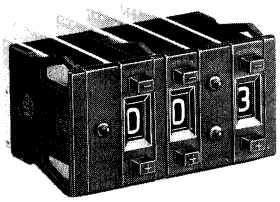
Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories ..... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary ..... **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide ..... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide ..... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

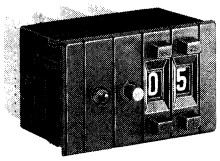
Pushwheel Switches

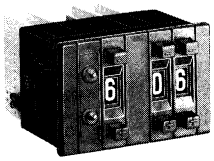
Product Group S

Front Mount

C 002 | C 003 | C 005 | C 006



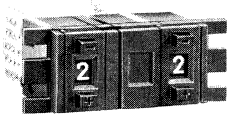


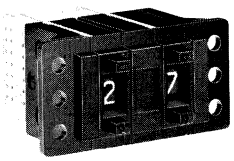


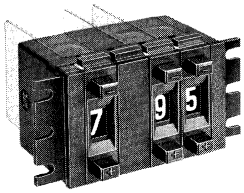
Front dimensions: 7.62 x 15 mm | 7.62 x 24 mm | 10 x 33 mm | 8 x 33 mm

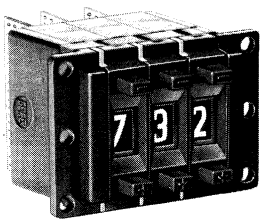
Rear Mount

C 022 | C 077 | C 055 | C 088





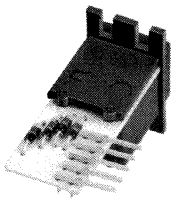


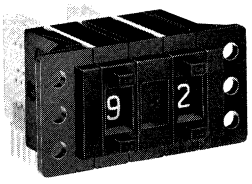


Front dimensions: 7.62 x 15 mm | 8 x 18 mm | 10 x 30 mm | 8.9 x 25.4 mm

Rear Mount with right angle connections:

C 222 | C 777





Front dimensions: 7.62 x 15 mm | 8 x 18 mm

Codes: BCD
BCD complement
Decimal
Hexadecimal
Repeating +/–, 0/1, or 0/5

Resistance Codes
Kelvin-Varley
Aiken
Gray
Custom and special codes

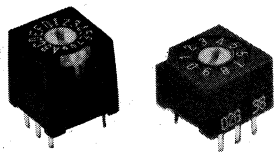
Options and Accessories:
Side plates
Spacers
Blank housings
Blank with LED
Diodes
Resistors
Connectors

Solder pins
Front protection
Custom colors or figures
Stop pins
Internal lighting
Complete switch/cable assemblies

1-800-932-0489

JAE Electronics, Inc.
1901-A EAST CARNEGIE AVE., SANTA ANA, CA 92705
714/250-8770 • (800) JAE-PART (523-7278) • FAX (714) 250-8957 • TELEX: 681-438 (JAE US)

ROTARY DIP SWITCHES 41J/42J SERIES



SPECIFICATIONS:

No. of switching positions: 10, 16 positions • **Life:** 10,000 detent operations min. • **Operating force:** 300 g-cm max. at rotor center • **Operating temperature range:** −10°C to +60°C • **Storage temperature range:** −25°C to +75°C • **Max. recommended non-switching load:** 100 mA at 50 VDC • **Max. recommended switching load** • 100 mA at 5 VDC • **Dielectric withstanding voltage:** • 200 Vrms for one minute • **Insulation resistance:** 1000 megohms min. • **Switch circuit resistance:** 100 milliohms max. (10 mA 5 VDC) • **Weight:** 1 gram (Approx.) • **Materials: Housing:** Nylon; **Contact:** Phosphor bronze, gold over nickel; **PC disk:** Glass epoxy, gold over nickel • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Weight:** 0.9 gram (Approx.).

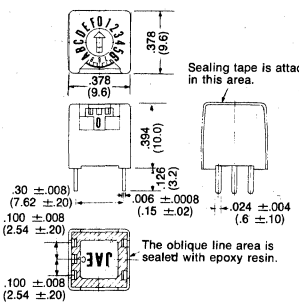
SWITCH MODEL No.:

Model No.	Code Description	Rotor Color	No. of Positions	Truth Table
41J02G	BCD 1-2-4-8	Orange	10	B02
41J12G	BCD 1-2-4-8 Complement	Yellow	10	C12
41J34G	Binary 1-2-4-8, 1 ~ 9, A ~ F Marking	Orange	16	B07
41J41G	Binary 1-2-4-8, 1 ~ 9, A ~ F, Marking Complement	Yellow	16	C16

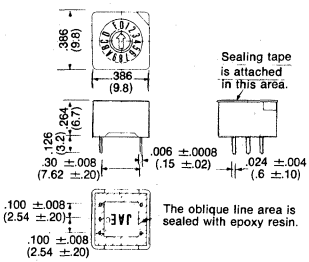
Model No.	Code Description	No. of Positions	Housing Color	Rotor Color	Truth Table
42J02G	BCD 1-2-4-8	10	Blue	Orange	B02
42J12G	Binary 1-2-4-8 Complement	10	Blue	Yellow	C12
42J34G	Binary 1-2-4-8	16	Black	Orange	B07
42J41G	BCD 1-2-4-8 Complement	16	Black	Yellow	C16

OUTLINE DIMENSIONS INCHES (mm)

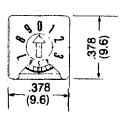
41J — 16 POSITION



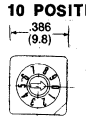
42J — 16 POSITION



10 POSITION



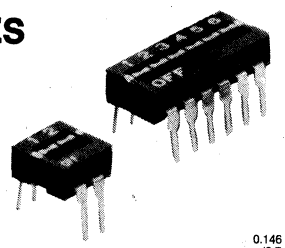
10 POSITION



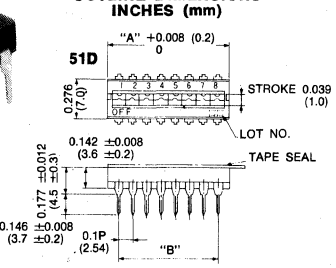
SLIDE-DIP SWITCHES 5*D SERIES

FEATURES

- Low profile slide-DIP switch
- Conforms to TO-116 standard IC packages (51D and 52D)
- Machine-insertable with standard automatic insertion equipment
- Recessed actuator types (51D), raised actuator types (52D) and right angle types (53D) available for virtually all applications
- Factory-sealed with removable, heat-resistant polyester tape to withstand automatic solder and cleaning processes



OUTLINE DIMENSIONS INCHES (mm)



ORDERING INFORMATION

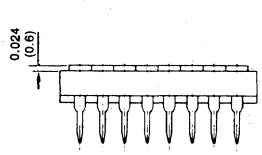
XXD-XX XX

51D: Recessed actuator type
52D: Raised actuator type
53D: Right angle type

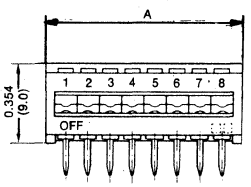
Number of poles: 02-10

Blank: Without seal tape (51D and 52D) Bottom ON without seal tape (53D)
01: With seal tape (51D and 52D) Bottom ON with seal tape (53D)
02. Bottom OFF without seal tape (53D)
03: Bottom OFF with seal tape (53D)

For other requirements, consult JAE.

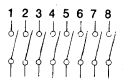


52D

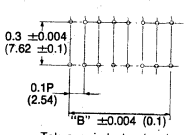


53D

CIRCUIT



HOLE PATTERN



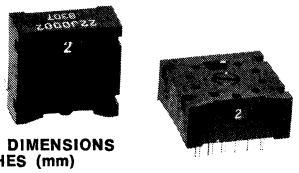
SPECIFICATIONS:

Number of poles: 2-10 • **Contact Rating: Switching Load:** 100 mA at 50 VDC max. • **Non-switching Load:** 100 mA at 5 VDC max. • **Minimum Switching Load:** 10A at 5 VDC min. • **Contact Resistance:** 100 MΩ at 1mA, 5 VDC max. • **Insulation Resistance:** 1000 MΩ at 100 VDC • **Dielectric Withstanding Voltage:** 500 VDC for 1 minute • **Operating Force:** 600g max. **Resistance to Soldering Heat: Solder Bath:** 260°C, 10 sec. • **Hand Solder:** 350°C, 3 sec. • **Solderability:** 235°C, 2 sec. • **Operating Temperature Range:** −25°C-+70°C • **Storage Temperature Range:** −40°C-+85°C • **Life:** 2000/pole min. • **Materials:** Contact: Phosphor bronze, gold over nickel • **Actuator:** Nylon 94HB • **Housing:** PBT 94V-0.

STATION	2	3	4	5	6	7	8	9	10
A	0.263 (6.68)	0.363 (9.22)	0.463 (11.76)	0.563 (14.30)	0.663 (16.84)	0.763 (19.38)	0.863 (21.92)	0.963 (24.46)	1.063 (27.00)
B	0.1 (2.54)	0.2 (5.08)	0.3 (7.62)	0.4 (10.16)	0.5 (12.70)	0.6 (15.24)	0.7 (17.78)	0.8 (20.32)	0.9 (22.86)

JAE Electronics, Inc.
1901-A EAST CARNEGIE AVE., SANTA ANA, CA 92705
714/250-8770 • (800) JAE-PART (523-7278) • FAX (714) 250-8957 • TELEX: 681-438 (JAE US)

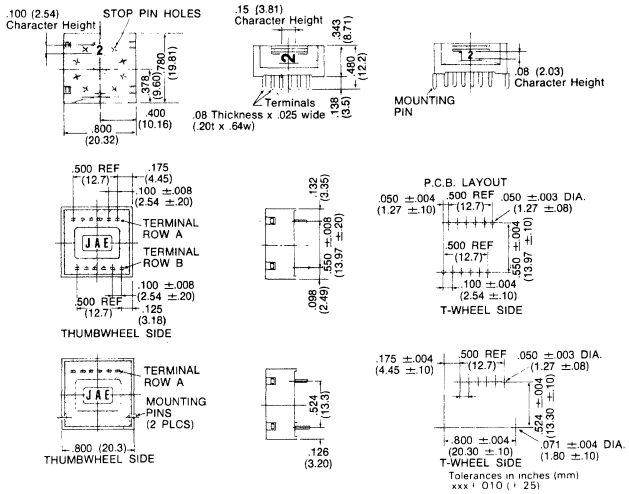
DIGITAL THUMBWHEEL SWITCHES 22J SERIES



SPECIFICATIONS:

No. of switching positions: 10 positions • **Life:** 250,000 detent • **Operating force:** 400g (max.) • **Operating temperature range:** −25°C to +70°C • **Storage temperature range:** −40C° to +100°C • **Dielectric withstanding voltage:** 500 Vrms for one minute • **Insulation resistance:** 1000 megohms (100 VDC) • **Switch circuit resistance:** 0.100 ohms max. initial; 0.200 ohms max. after life test • **Weight:** 3 grams (Approx.) • **Standard color:** Black • **Electrical ratings: Max. recommended non-switching load:** 3A at 28 VDC; **Max. recommended switching load:** 0.125A at 28 VDC; **Min. recommended switching load:** 10 μA at 0.020 VDC • **Materials: Housing:** Black nylon; **Metal contacts:** Phosphor bronze for spring, gold over nickel; **Circuit disk:** Glass, epoxy, gold over nickel; **Dummy pin:** Tin-plated phosphor bronze.

OUTLINE DIMENSIONS INCHES (mm)



SWITCH MODEL No.:

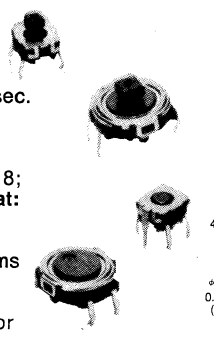
Model No.	Code Description	Number of Positions
22J**01G	DECIMAL	10
22J**02G	BCD 1-2-4-8	10
22J**12G	BCD 1-2-4-8 Complement Only	10
22J**28G	BCD 1-2-4-8 with Complement	10
22J**56G	BCD 1-2-4-8 with Separate Common To Not True Bits	10
22J**11G	2 Pole Repeating + and −	10

** To complete model number, replace ** with Orientation Number.

TACTILE-PUSH SWITCHES 61/62T SERIES

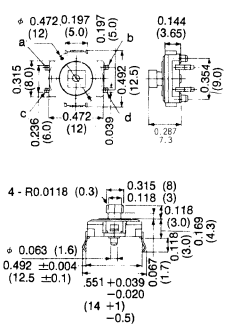
SPECIFICATIONS:

No. of switching positions: 62T Series: SPST Momentary • **Max. recommended switching load: 61T Series:** 30 mA at 12 VDC • **Min. recommended switching load:** 0.1 mA 5 VDC • **Contact bounce: 61T Series:** 4 msec. max.; **62T Series:** 10 msec. max. • **Contact resistance:** 100m ohms max. at 1 mA 5 VDC • **Insulation resistance:** 100 meg ohms min. at 250 VDC • **Dielectric withstanding voltage:** 250 Vrms for one minute • **Operating force/Stroke: 61T Series:** 140 ±30g/0.010 ~ 0.018; **62T Series:** 110 30g/0.010 ±0.004 • **Resistance to solder heat:** Solder bath 260°C 5 sec.; Hand solder 350°C 3 sec. • **Solderability:** Solder bath 230°C 2 sec.; Hand solder 230°C 6 sec. • **Shock: 61T Series:** 20G. 11 ms; **62T Series:** 50G. 11 ms • **Operating temperature range:** −25°C ~ +70°C • **Storage temperature range:** −40°C ~ +80°C • **Life: 61T Series:** 1.000.000; **62T Series:** 300.000 • **Materials: Contact:** Phosphor bronze, silver; **Pusher:** 15% GF PBT; **Housing:** 15% GF PBT.

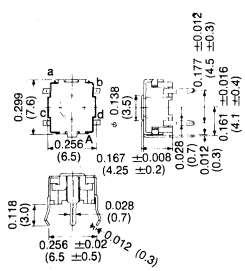


OUTLINE DIMENSIONS INCHES (mm)

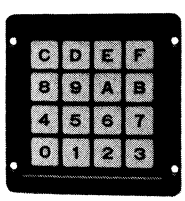
61 T SERIES



62 T SERIES



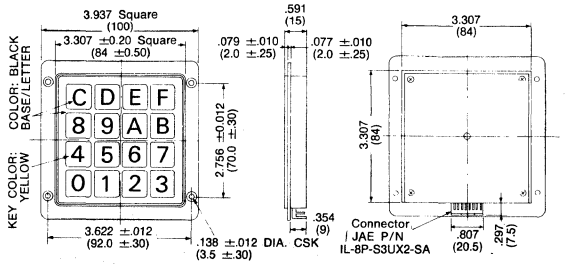
PANEL SWITCHES FP5 SERIES



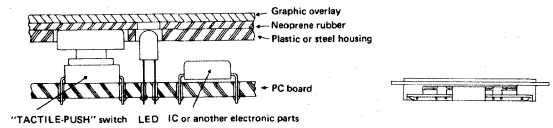
SPECIFICATIONS:

No. of switching positions: 1 SPST • **Life:** 1,000,000 cycles per key • **Contact ratings:** 300 mA, 12 VDC • **Contact resistance:** 1 ohm max. • **Contact bounce:** 4 millisecond max. • **Key travel:** 0.3 to 0.5mm (0.01 to 0.02) • **Key operating force:** 150 ±40g • **Insulation resistance:** 100 megohms min. at 100 VDC • **Dielectric withstanding voltage:** 250 Vrms for 1 minute • **Operating temperature range:** −30°C to +70°C • **Storage temperature range:** −40°C to +80°C.

OUTLINE DIMENSIONS INCHES (mm)



STRUCTURE:



FOR COMPLETE ORDERING INFORMATION CONSULT FACTORY

Series "A" Miniature Rotary Selector Switches

QPL MIL-S-3786

- TOTALLY ENCLOSED
- EXPLOSION PROOF

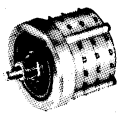
Series A-15 — 15°

Max. Positions: 24
Body Diameter: 2″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A15-1 Series 1 pole/deck
A15-2 Series 2 pole/deck
A15-3 Series 3 pole/deck
A15-4 Series 4 pole/deck
A15-6 Series 6 pole/deck

Series A-20 — 20°

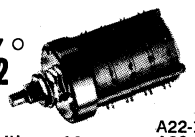


Max. Positions: 18
Body Diameter: 2″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Available only in single pole per deck construction.

Series A-22 — 22½°

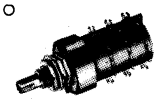


Max. Positions: 16
Body Diameter: 1.5″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A22-1 Series 1 pole/deck
A22-2 Series 2 pole/deck
A22-4 Series 4 pole/deck

Series A-30 — 30°



Max. Positions: 12
Body Diameter: 1.036″

ELECTRICAL RATING:
2 amps 115 v ac Res.
1 amp 28 v dc Res.
0.5 amp 28 v dc Ind.

A30-1 Series 1 pole/deck
A30-2 Series 2 pole/deck
A30-3 Series 3 pole/deck
A30-4 Series 4 pole/deck
A30-6 Series 6 pole/deck

"M" Series
See MIL-S-3786/4

Series A-36 — 36°

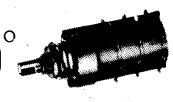
Max. Positions: 10
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

A36-1 Series 1 pole/deck
A36-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/4

Series A-45 — 45°



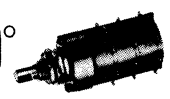
Max. Positions: 8
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

A45-1 Series 1 pole/deck
A45-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/4

Series A-60 — 60°



Max. Positions: 6
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
3 amps 28 v dc Res.
2 amps 28 v dc Ind.

Available only in single pole per deck construction.
"M" Series See MIL-S-3786/4

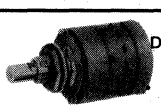
Series A-90 — 90°

Max. Positions: 4
Body Diameter: 1.036″

ELECTRICAL RATING:
5 amps 115 v ac Res.
5 amps 28 v dc Res.
2.5 amps 28 v dc Ind.

Available only in single pole per deck construction.
"M" Series See MIL-S-3786/4

Series	Index
AA30	— 30°
AA36	— 36°
AA45	— 45°



Directly interchangeable with "A" Series above.

ADJUSTABLE STOPS

Max. Positions: AA30-12 AA36-10 AA45-8
Body Dia.: 1.036″ Meets MIL-S-3786

JANCO CORPORATION

Series "B" Micro-Miniature Rotary Selector Switches

QPL MIL-S-3786

- TOTALLY ENCLOSED
- EXPLOSION PROOF
- UNITIZED CONSTRUCTION

All switches offer maximum protection against radio frequency interference.

Body Diameter: .623″

Electrical Rating Continuous:
8 amps at 28 v dc

Switching Rate:
0 to 0.25 amp resistive
0 to 28 v dc
0 to 0.25 amp resistive
0 to 115 v ac
0 to 0.12 amp inductive
0 to 28 v dc

Torque: 5 to 9″ ounces
Contact Resistance:
.005 ohms average
Insulation Resistance:
100,000 megohms minimum at 100 volts
10,000 megohms minimum at 500 volts
Designed and Built to meet the environmental and functional requirements of MIL-S-3786

Series B-30 — 30°

Max. Positions: 12
Body Diameter: .623″

B30-1 Series 1 pole/deck
B30-2 Series 2 pole/deck
B30-3 Series 3 pole/deck

"M" Series
See MIL-S-3786/13

Series B-36 — 36°

Max. Positions: 10
Body Diameter: .623″

B36-1 Series 1 pole/deck
B36-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/13

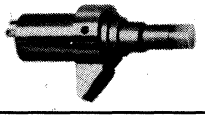
Series B-45 — 45°

Max. Positions: 8
Body Diameter: .623″

B45-1 Series 1 pole/deck
B45-2 Series 2 pole/deck

"M" Series
See MIL-S-3786/13

Typical Unique Applications of Janco Rotary Switches



DOUBLE MOMENTARY ACTION

Push button switch designed for grip stick applications. Actuation to first momentary detented position closes first circuit. Second detented position completes second circuit.

FEATURES UNIQUE ON-OFF OPERATION

Actuated by pulling knob out and rotating to "on" positions. While in "on" positions, circuitry cannot be shut off until knob is returned to "off" position and depressed.

MASTER COMMUNICATIONS SWITCH

Provides standard coded outputs and offers unique switching functions by longitudinal shaft movement. Momentary or maintained contact positions actuated by pulling shaft.

JET ENGINE START SWITCH

Knob is depressed and contacts are held in by the solenoid. After jet engine reaches desired RPM, system removes power disengaging solenoid. Lighted knob indicates function.

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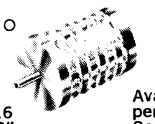
Box 3038 • 3111 Winona Ave., Burbank, CA 91504 • (818) 846-1800 • TWX #910-498-2701 • FAX #818-842-3396

Series "C" Rotary Selector Switches

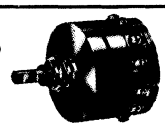
Series C-22 — 22½°



Max. Positions: 16
Body Diameter: 3″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
6 amps 28 v dc Ind.
Available only in single pole per deck construction.
Screw terminals only.

Series C-30 — 30°



Max. Positions: 11 plus off
Body Diameter: 2.180″

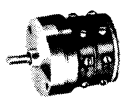
ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C30-1 Series 1 pole/deck
C30-3 Series 3 pole/deck
Screw terminals only.

Series C-36 — 36°

Max. Positions: 9 plus off
Body Diameter: 2.375″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
Available only in single pole per deck construction.
Screw terminals only.

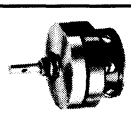
Series C-45 — 45°



Max. Positions: 7 plus off
Body Diameter: 1.93″

ELECTRICAL RATING:
10 amps 115 v ac Res.
10 amps 28 v dc Res.
5 amps 28 v dc Ind.
C45-1 Series 1 pole/deck
C45-2 Series 2 pole/deck
Screw terminals only.

Series C-90 — 90°



Max. Positions: 4
Body Diameter: 2.12″
Screw terminals only.

ELECTRICAL RATING:
1 pole construction:
15 amps Res. 115 v ac
15 amps Res. 28 v dc
10 amps Ind. 28 v dc
2 pole construction
7.5 amps Res. 115 v ac
7.5 amps Res. 28 v dc
5 amps Ind. 28 v dc
C90-1 Series 1pole/deck
C90-2 Series 2 pole/deck

Series "E" Rotary Selector Switches PRINTED CIRCUIT

Series	Indexing	No. of Positions
MINIATURE	EA45	45° 8
	EA36	36° 10
	EA30	30° 12
	EA22	22° 16
MICRO-MINIATURE	EB45	45° 8
	EB36	36° 10
	EB30	30° 12
MINIATURE	EC45	45° 8
	EC36	36° 10
	EC30	30° 12
	EC22	22° 16
	EC18	18° 20
	EC15	15° 24
ED	ED	30° 12
		36° 10
		45° 8
EE	EE	30° 12
		36° 10
		45° 8

- Totally enclosed, explosion proof.
- Printed circuit construction.
- Make and break:
  .125 amp Res. @ 28 v dc
  .125 amp Res. @ 115 v ac
  .05 amp Ind. @ 28 v dc
- All standard codes available.
- Current carrying capacity, 3 amps continuous.
- Will meet or exceed the environmental requirements of MIL-S-3786 and MIL-S-22710.
- O ring sealed shaft available
- For "ED" and "EE" Series, .100 Amp Res. at 115 VAC or at 28 Vdc.

JANCO CORPORATION

Since 1947

Series "D" Pushbutton Rotary Switches

QPL MIL-S-22710

FEATURES: • Totally enclosed, explosion proof. • Printed-circuit construction. • Black or white numbers on black or white background indicate switch positions (black numbers on white background for lighted switches). • All standard codes available. Available in 8, 10, 12 or 16 positions. • Plastic covered buttons, available in black, red, green, yellow, white or blue.

Series	Indexing	No. of Positions
D45U	45°	8
D36U	36°	10
D30U	30°	12
D22B D22U	22½°	16
D45B	45°	8
D36B	36°	10
D30B	30°	12
DA45U	45°	8
DA36U	36°	10
DA30U	30°	12

MAKE AND BREAK
.125 amp res. at 28 v dc and 115 v ac
.05 amp ind. at 28 vdc

PUSH FORCE:
55 oz. max.

CONTACT RESISTANCE:
Initial .100 ohms
After life .160 ohms

LIFE:
50,000 cycles
Cycle consists of 720° rotation

INSULATION RESISTANCE:
5,000 megohms

ALTITUDE:
70,000 ft.

TEMPERATURE RANGE:
−65°C to +85°C

PLUNGER TRAVEL:
.180 approx.

DIELECTRIC STRENGTH:
750 volts RMS

WEIGHT:
½ oz. approx.

GENERAL SPECIFICATIONS

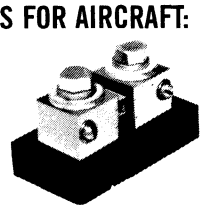
All switches offer maximum protection against radio frequency interference.
ELECTRICAL RATING:
Carry 10 amps continuous.
Make and Break — see individual switch data.
VOLTAGE DROP:
0.1 volt or less at rated amperage.
Initial Contact Resistance: .003 ohm.
LIFE:
10,000 double cycles make and break rated amperage.
TORQUE:
1 to 3 inch lbs.
SWITCHES DESIGNED AND BUILT IN ACCORDANCE WITH THE FOLLOWING SPECS.:
MIL-S-6807 (rotary switches enclosed)
MIL-S-3786 (rotary switches)
MIL-E-5272 (environmental testing)

ON MOST OF THE SWITCHES LISTED, THE FOLLOWING FEATURES ARE AVAILABLE:

- O-ring Shaft and Panel Seal
- Combination of Decks
- Bridging contacts
- Momentary positions
- Isolated positions
- Adjustable stops
- Solenoid driven
- Keylock
- Gang switches
- Concentric shaft switches

ELECTRICAL HARDWARE PRODUCTS FOR AIRCRAFT:

- External Ammeter Shunts MIL-S-61-B
- Flexible Bus Assemblies
- Bus Bars • Bonding Jumpers



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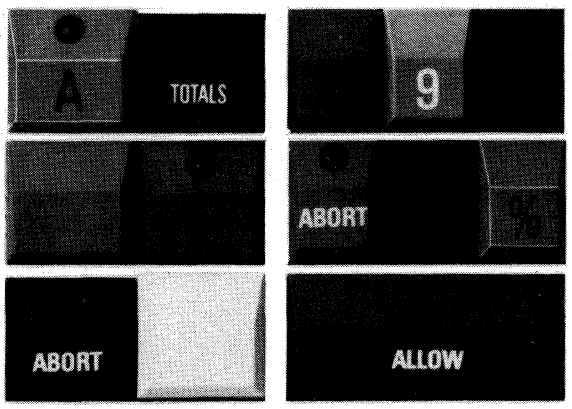
Lucas Ledex Keyboard, Security, & Code Switches*

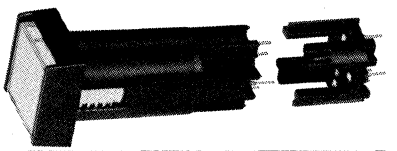
Keylite® keyboard switches–comprehensive line of tactile feel momentary or latching switches for solder mounting on boards, shown at right. Many choices of 12 or 17 mm size, shape, color, LEDs. Request catalog.
Elastomeric pushbutton–miniature 9 and 12 mm pushbuttons for snap fit board mounting after soldering is completed. Request catalog.
Keyloc® rotary security switches–6 position key operated rotary switch, 22 mm dia., 10 colors, 1024 combinations and variations. Request catalog.
Subminiature rotary code switches–panel or PC board mount with extreme reliability and wide code capability. Std. variations include binary and hex, with up to 4 pole 8 way capability. Request catalog.



*Manufactured by Lucas NSF of England, marketed by Lucas Ledex Inc.

Series 75 Switches*

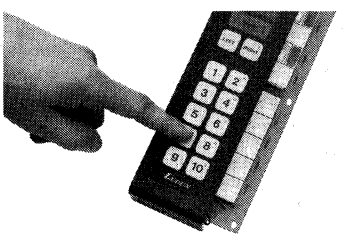
Also available in watertight version.



Switch	Series 75-SL	Series 75-SL (watertight)	Series 75-PC	Series 75-PC (watertight)
Housing with bezel	Makrolon	Durethan BKV	Makrolon	Durethan BKV
Contact enclosure	Thermosetting plastic	Thermosetting plastic	Durethan BKV	Thermosetting plastic
Outer lens	Makrolon	Makrolon	Makrolon	Makrolon
Key lock	Cylinder lock with 4 operating positions and 3 keys		Cylinder lock with 4 operating positions and 3 keys	
Operating stroke	2.5 mm (.1")	2.5 mm (.1")	2.5 mm (.1")	2.5 mm (.1")
Operating force	3 to 5 N (10.8 oz. to 18 oz.) max.	3 to 6.5 N (650p) (10.8 to 23.4 oz.)	3 N (10.8 oz.)	3 N (10.8 oz.)
Contacts	Spring-loaded silver contacts, non-shorting		Self-cleaning bridging contact, 5μ gold plated	Self-cleaning bridging contact, 8μ gold plated
Life (mechanical)	Momentary >2 x 10^6 Push-Push >1 x 10^6		Momentary >2 x 10^7 Push-Push >1 x 10^6	
Switching	4 amps at 250 VAC		250 mA @ 50 VAC or DC	
Weight	.53 oz. max. (lockable latching pushbutton 1.4 oz. max.)		.53 oz. max.	

For detailed specifications, request literature. *Licensee rights by Rafi of West Germany.

Series RF 15/19 Flat Panel Switches*



Housing	Actuator Cap	Reflector	Lens	Spring Contact	Fixed Contact	Voltage max.	Current max.
PBT (Pocan)	Polycarbonate (Makrolon)	PBT (Pocan)	PMMA (Resarit)	Au Model X 12 Cr Ni 177 1.5 μ Au (contact material); Connection material 4... 8 μ Sn Pb 60/40; Ag model X 12 Cr Ni 177 5 μ Ag (contact material); Connection material 4... 8 μ Ag	Cu Zn 28 F 43, 2 μ Ni, μ Au (contact material); Connection material 4... 8 μ Sn Pb 60/40; Ag Model Cu Zn 28 F 43, 2 μ Ni, 5 μ Au (contact material), Connection material 0.5 μ Ag	42 V⎓Au 60 V Ag	100 mA⎓Au 250 mA Ag

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Lucas Ledex

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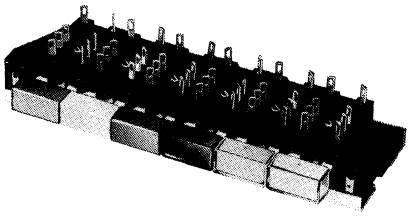
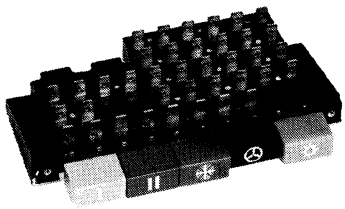
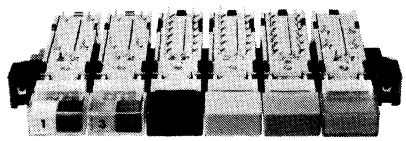
FAX: 513-898-8624

Pushbutton Switches*







Series	Cap Size	Legend	Function	Cap Colors	Switching per module	Module capacity	Rating	Contact material	Terminals	Illumination
1400	⅜" x ¾" ¾" x ¾"	Hot stamp Engraved Film inserts	Momentary Push/push Reciprocal release Master release Reciprocal + master release Interlock	Red, yellow, green, blue, black, gray, white, clear	2P 2T Non-shorting	1-20 per frame	4A/125 VAC 2A/250 VAC	Silver (std.) Gold (opt.)	Solder or PC	6,12,24V lamps
1500	.49" x .97"	Hot stamp Engraved	Momentary Push/push Reciprocal release Master release Reciprocal + master release Interlock	Red, yellow, green, blue, black, gray, white, clear	1NO 3NC thru 4NO 1NC Non-shorting	1-15 per frame	16A/250 VAC	Silver plated Brass	Spade	Nonilluminated
1800	⅜" x ¾"	Hot stamp Engraved Film inserts	Momentary Push/push Reciprocal release Master release Reciprocal + master release Interlock	Red, yellow, green, blue, black, gray, white, clear, split screens	Lo-level to 4P 2T Hi-level to 1NO 2NC	1-20 per frame	10mA/5 VDC 6A/250 VAC	Silver plated Brass	Solder or PC	2,12,24V lamps Single or dual

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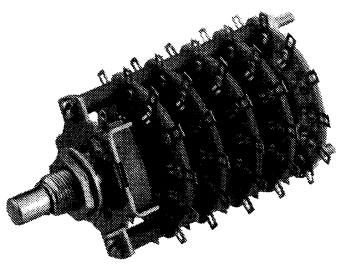
Rotary Manual Switches



Series	206	208	210	212	304	306	312	404	406	412	504	506	512	524
Poles – throws per deck	6P60°T	8P45°T	10P36°T	12P30°T	4P90°T	6P60°T	12P30°T	4P90°T	6P60°T	12P30°T	4P90°T	6P60°T	12P30°T	24P15°T
Combinations	6	4	5	6	2	6	6	2	6	7	2	6	7	8
Contact ratings	Brass, Silver plated		Solid Silver					Brass, Silver plated		Solid Silver				
Make/break	.5A/28VDC .25/110VAC		1A/28VDC .5A/110VAC					1A/28VDC .5A/110VAC		2A/28VDC 1A/110VAC				
Carry	5A		5A					5A		5A				
Dielectric	750 volts, contact to contact							1000 volts, contact to contact 500 volts when contacts are insulated back to back						

For more information, request literature.

Lucas Ledex

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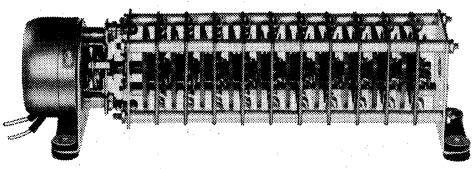
Stepping Switches (Stock Models)

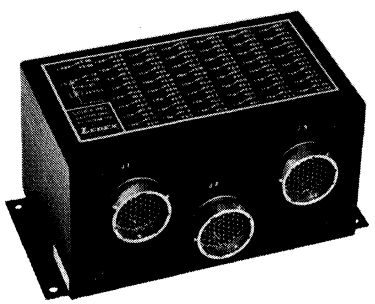


Specifications

Electrical positions	4	6	8	10	10	12	12
Poles—throws per deck	3P4T	2P6T	3P8T	1P10T	2P10T	1P12T	1P12T
No. of load decks	4	5	2	7	4	5	9
Control deck Additional circuit on control deck	notch 1P4T	notch 1P6T	notch 1P8T	notch	notch	notch	notch
Total Circuitry	13P4T	11P6T	7P8T	7P10T	8P10T	5P12T	9P12T
Carry amperes, res. max.	5	5	5	5	5	5	10
Break amp. res. max @ 28 VDC (@120 VDC)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	2.5 (0.5)	5 (1)
Dielectric, clip-to-clip, VRMS Insulated back-to-back clips	1000 500	1000 500	1000 500	1000 500	1000 500	1000 500	1000 500
Coil to case dielectric	1200 VRMS	1200 VRMS	1200 VRMS	1200 VRMS	1200 VRMS	1000 VRMS	1200 VRMS
Weight	6 oz.	6½ oz.	1 lb. 4 oz.	1 lb. 5 oz.	1 lb. 4½ oz.	7 oz.	1 lb. 4 oz.

For more information, request literature.

Packaged Switches (Stock Models)



Poles—throws per deck	5P2T	13P2T	18P2T	22P2T	26P2T	35P2T	40P2T
Operating Voltage	28 VDC	28 VDC	28 VDC	28 VDC	28 VDC	28 VDC	28 VDC
Current @ rated coil voltage	2.5 amps	2.5 amps	3.5 amps	3.5 amps	4.9 amps	5 amps	3.6 amps
Coil Duty Cycle	1/10	1/10	1/10	1/10	1/10	1/10	1/4
Dielectric strength (VRMS) coil	1000	1000	1200	1200	1200	1200	1200
Coil resistance @ 20°C (Ohms ±5%)	11.03	11.03	8.02	8.02	5.67	5.67	7.72
Dielectric strengths (VRMS) decks	500	500	500	500	1000	500	500
Circuit deck ratings Carry amps resistive, max. Break amps, resistive, @ 28 VDC (@ 120 VAC)	5 1 (.5)	5 1 (.5)	5 2 (1)	5 2 (1)	5 2 (1)	5 2 (1)	5 2 (1)
Weight	10 oz. max.	1 lb. max.	1 lb. 8 oz. max.	1 lb. 15 oz. max.	2 lb. 14 oz. max.	2 lb. 8 oz. max.	3 lb. 8 oz. max.

For more information, request literature.

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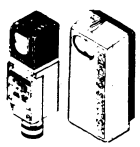
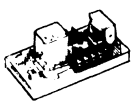
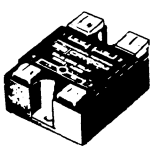
TOGGLE SWITCHES

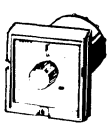

PHOTOELECTRICS

RELAYS

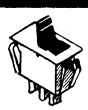

LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

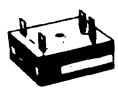
TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS


PADDLE SWITCHES

TRANSFORMERS

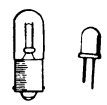

TIMERS

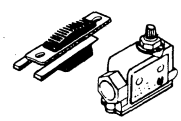
COUNTERS

FANS

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

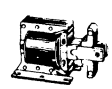
KNOBS


LAMPS & LEDS


SWITCHES

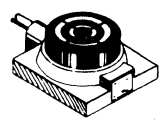
RELAYS

INDICATOR LIGHTS


SOLENOIDS

SOCKETS

PUSHBUTTON SWITCHES


PROXIMITY CONTROLS

CABINETS
BUD

CIRCUIT BREAKERS
Airpax
Aromat
Carlingswitch
Heinemann
Potter & Brumfield

CONNECTORS & SOCKETS
Amphenol
Aromat
Curtis
Custom Connector
Idec
Lumberg
Master Electronics
Potter & Brumfield
Souriau
Vernitron-Beau
Welcon/Wells

COUNTERS
Engler
Hecon
IVO
Kessler-Ellis
Master Electronics
Omron
Redington
Red Lion
Sodeco/Maxmar
Stemco
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DIODES
General Instr.

FANS
Aromat
U.S. Toyo

FILTERS
Curtis

RELAYS
Aleph International
Allied Controls
American-Zettler
Aromat
AT&T
Bosch
C.P. Clare
Coto
Crydom Controls
EAC
Elec-Trol
Fujitsu
Gordos
Grayhill
Guardian
Hi-G
Idec
ITT
Line Electric
Magnecraft
Master Electronics
MEC
Midtex
Omron
Potter & Brumfield
RBM
Schrack
Siemens
Sigma
Standex
Stantel
Struthers-Dunn
Telemecanique
Theta-J
Triridge

FUSES
Bussmann
Littelfuse
Underwriters Safety

HARDWARE & WIRING DEVICES
Aavid
Buchanan
Electrovert
Harvey Hubbell
H.H. Smith
Modor

KNOBS
Cosmo/Kurz-Kasch
Raytheon/Panel Products

SWITCHES
Acro
Alco
American Switch
Aromat
Arrow Hart
Carlingswitch
C&K
EECO
Electro-Mech
Electronic Comp. Group
Grayhill
Landis & Gyr
Linemaster
Master Specialties
McGill
Microswitch
Omron
Oslo
OTTO
Saia
Unimax

INDICATORS, LAMPS & LED
Idec
IDI
IEE
JKL
Leecraft
Lumex
Stanley
Sylvania

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Jeffers
Microtran
Stancor
Triad

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Aromat
Dolan-Jenner
Electro
Omron
Photoswitch/AB
Skan-A-Matic

PROXIMITY
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Crouzet
Eagle Signal
Guardian
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Magnecraft
Master Electronics
Midtex
National Controls
Omron
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SSAC
Struthers-Dunn
Syracuse Electronics

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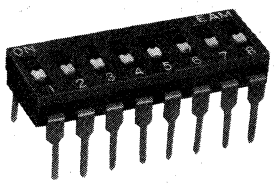
ORDERS PLACED BY 3 P.M. ARE SHIPPED THE SAME DAY

SURFACE MOUNT DIP SWITCHES
AUTO INSERTION DIP SWITCHES

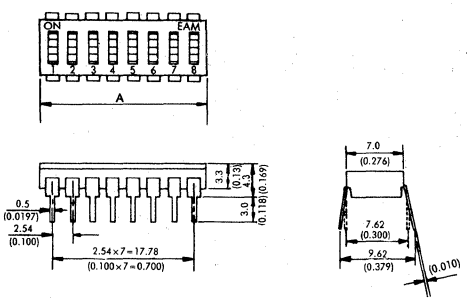
FEATURES

1-1 End stackable for standard 0.1″ integrated circuit pitch.
1-2 Molded 0.3″ integrated circuit packing outline allowing automatic insertion.
1-3 Smaller size makes better heat convection during PC board wave soldering.
1-4 Top tape sealed to withstand wave soldering, board washing.
1-5 All materials are UL94V-Ograde fire retardant plastics.
1-6 Twin contact designed to ensure stable contact.
1-7 Gold plated contact to ensure low contact resistance and long operation life.
1-8 From Two and up to 10 position.

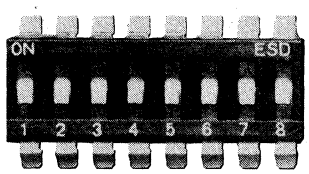
EAM SERIES–AUTO INSERTION.



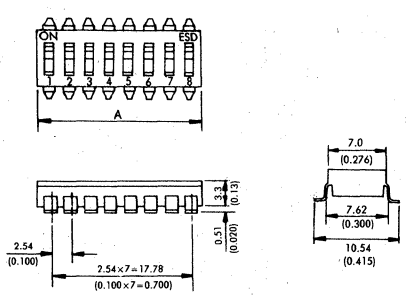
DIMENSIONS AND CIRCUITRY



ESD SERIES–SURFACE MOUNT.



DIMENSIONS AND CIRCUITRY

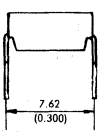


SPECIFICATIONS

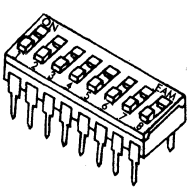
2-1 ELECTRICAL
2-1-1 Contact Rating
a) Switching 100mA, 5VDC
b) Non-Switching 100mA, 50VDC
2-1-2 Contact Resistance
a) Initial 50mΩ max
b) After life test 100mΩ max
2-1-3 Insulation Resistance 1,000MΩ min at 100VDC
2-1-4 Dielectric Strength 500VDC min for 1 minute
2-1-5 Capacitance between adjacent switches 5PF max.
2-2 MECHANICAL AND ENVIRONMENTAL
2-2-1 Temperature Rating
a) Operating −25°C–+70°C
b) Storage −40°C–+85°C
2-2-2 Operation Life 2,000 Operations
2-2-3 Humidity 95% RH, 40°C for 96 Hrs
2-2-4 Vibration Per MIL-STD-202, METHOD 204B
2-2-5 Solderability Per MIL-STD-202, METHOD 208
2-2-6 Heat Shock 260±5°C for 5±1 Second

OPTIONS

5-1 Special marking and case color available.
5-2 Standard IC Pin out 0.3″ pitch available.



5-3 Extended Actuator



Unit: mm (inch)

PART NUMBERING SYSTEM

EAM 1 08 T

- T: Actuator and Sealing: T: Top Tape Sealed and Low Profile Actuator; L: Low profile Actuator; E: Extended Actuator
- 08: Number of Positions (2 to 10)
- 1: Contact Form: SPST
- EAM: Type Name: EAM: Automatic insertion type; ESD: Surface mounting type

Example 1: EAM 110T. Auto Insertion Type, SPST, 10 positions top tape sealed and low profile actuator.
Example 2: ESD 104L. Surface Mount Type, SPST, 4 positions, low profile actuator.

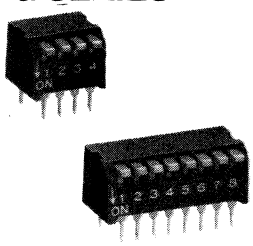
LZR ELECTRONICS, INC.
8174 Beechcraft Ave., Gaithersburg, MD 20879
TEL: 301-921-9440
FAX: 301-670-0436

DIP SWITCHES PC BOARD MOUNT
EPG/EDG SERIES

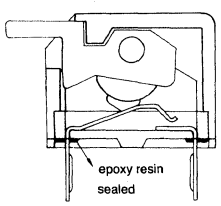
SPECIFICATIONS

1 Operating temperature range: −40°C−+85°C.
2 Contacts rating:
  a) 50 VDC 100mA at steady state.
  b) 24VDC 25mA at make and break.
3 Contact resistance:
  a) 30mΩ Max at initial.
  b) 100mΩ Max after life test.
4 Operation life: 10,000 operation min per pole.
5 Operation force: 150 ± 80g
6 Solderability test: After immersing the terminal in the flux and applied to the solder bath with temperature of 230 ± 5°C for 3 ± 0.5sec more than 75% of the terminal shall be covered by solder.
7 Heat shock resistance: The switch shall resist the heat shock of 260 ± 5°C for 5 ± 1sec on terminals without any deration on electrical characteristics or mechanical damage.
8 Vibration test: Per MIL-STD-202, Method 204B, no mechanical or intermittent change of switch settings during or after test.
9 UL 94VO fire retardant plastics used.
10 Bottom epoxy sealed standard to insure free of flux immersion during wave soldering.

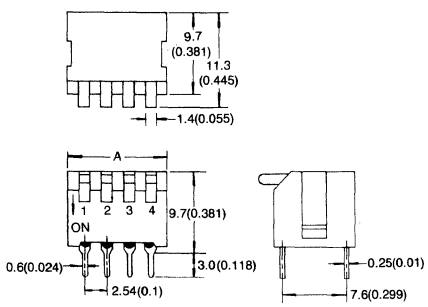
EPG SERIES



CONSTRUCTION



DIMENSIONS AND CIRCUITRY



Edge Actuated
(Piano Type)
EPG Series

SPST:
4-10 Positions

DIMENSION A **Unit: mm (inch)**

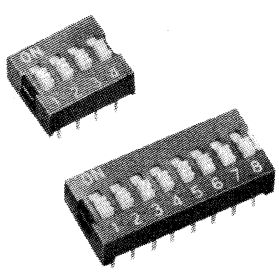
Positions	4	6	8	10
A	11.7 (0.461)	16.7 (0.657)	22.1 (0.87)	26.7 (1.05)

PART NUMBERING SYSTEM

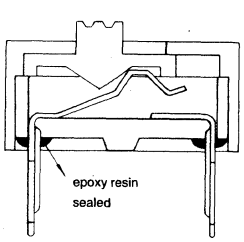
EPG 1 08 A

- Actuator and Sealing:
  - A: Top side "OFF"
  - B: Top side "ON"
  - AT: Top side "OFF" and tape sealed
  - BT: Top side "ON" and tape sealed.
- Number of Positions: From 04 to 10
- Contacts Form:
  1. SPST
  2. DPST
  3. SPDT
  4. 3PST
  5. 4PST
  6. DPDT
- Type Name: EPG: Piano type Gold Plated Contacts
  EPS: Piano type silver Plated Contacts

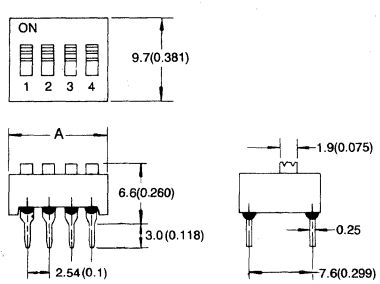
EDG SERIES



CONSTRUCTION



DIMENSIONS AND CIRCUITRY



SPST:
4-10 Positions

DIMENSION A **Unit: mm (inch)**

Positions	4	6	8	10
A	11.7 (0.461)	16.7 (0.657)	21.7 (0.85)	26.7 (1.05)

PART NUMBERING SYSTEM

EDG 1 08 S

- Actuator and Sealing:
  - S: Standard
  - L: Low Profile Actuators
  - T: Low Profile Plus Tape Sealed
  - ST: Standard Plus Tape Sealed
- Number of Positions: From 04 to 10
- Contacts Form:
  1. SPST
  2. DPST
  3. SPDT
  4. 3PST
  5. 4PST
  6. DPDT
- Type Name: EDG: Gold Plated Contacts
  EDS: Silver Plated Contacts

LZR ELECTRONICS, INC.
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TEL: 301-921-9440
FAX: 301-670-0436

MarLee Switch Company

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SWITCHES MATRICES SYSTEMS

TYPES:

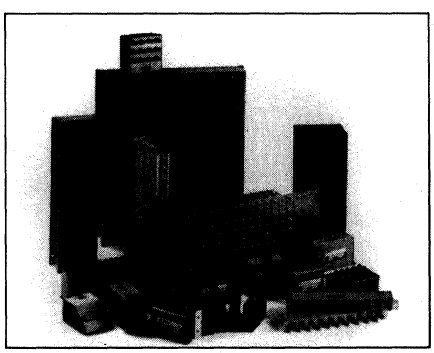
- AUDIO
- DATA
- VIDEO
- R.F.
- MULTI-WIRE
- BALANCED LINE
- COAX
- TWINAX

OPTIONS:

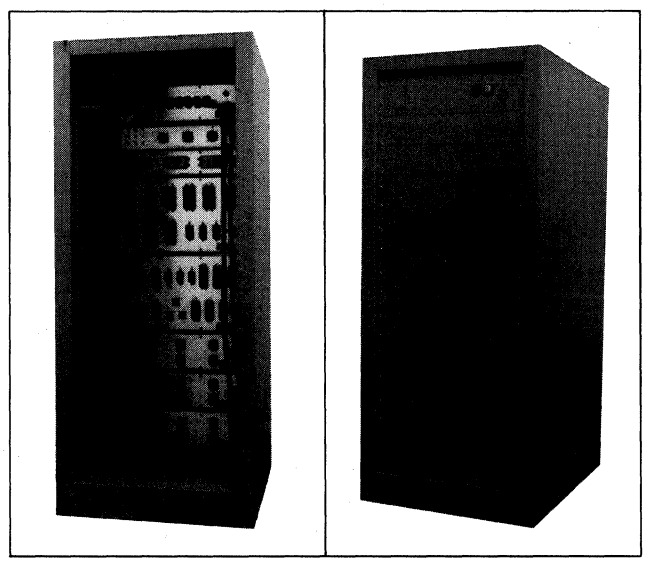
- PROGRAMMABLE
- COMPUTER INTERFACE
- ELECTRO-MECHANICAL
- SOLID STATE
- DESK TOP
- RACK MOUNT
- MODULAR
- COMPLETE SYSTEMS

MarLee Switch Company uses the latest designs and highest quality components, to provide superior performance and reliable operation. In addition we specialize in modifying our standard products to meet your specific requirements. We have a proven record of delivering on time and at a very competitive price.

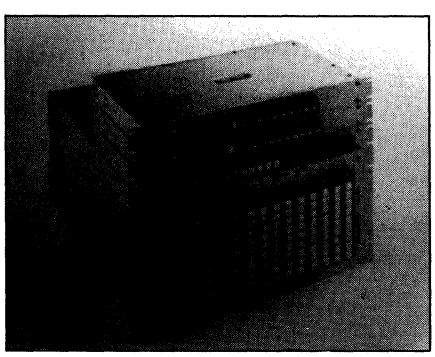
When they need their signals switched, many of the world's leading businesses come to MarLee Switch Company.



MODULAR SWITCHES AND MATRICES



1000 WIRE A-B SWITCHING SYSTEM



MULTI SWITCH MATRIX SYSTEMS

TYPICAL SPECIFICATIONS:

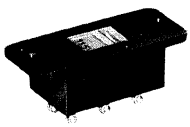
Switches:	1 to N poles, 1 to N throws
Matrices:	1 to N inputs, 2 to N outputs
Frequency Range:	DC to 1.2 GHz
Switching Speed:	100 ms. down to 1 ns.
Switching Types:	Solid State, Reed, Relay
Switch Life:	Greater than 100 million operations
Isolation (open contact):	To −110 db
Insertion Loss (RF):	Less than 0.5 db, typically 0.2 db
VSWR:	1.5 to 1
Shock:	200 G max., 11 ± 1 msec.
Vibration:	20 G max. @ 0 to 600 Hz
Temperature Range:	−50° to +150°F
Xtalk Between Channels:	To −180 db

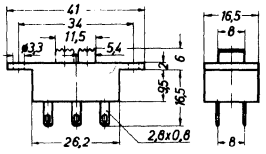
Let us show you how WE can satisfy your switching requirements.
Call or write for complete specifications and our new catalog.

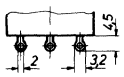
MARQUARDT

Slide Switch

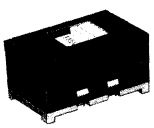
4021 SERIES LINE VOLTAGE SELECTOR SWITCHES

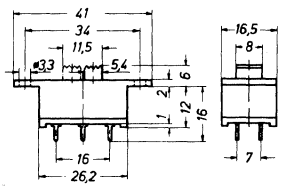


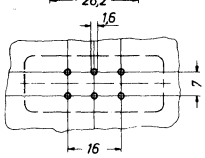




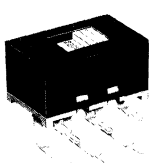
DOUBLE POLE, DOUBLE THROW SOLDER TERMINALS R48 5A 250VAC 10A 125VAC

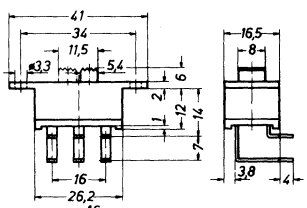


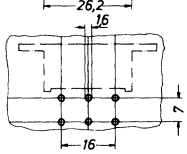




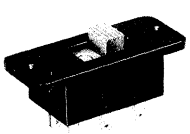
DOUBLE POLE, DOUBLE THROW STRAIGHT PC TERMINALS

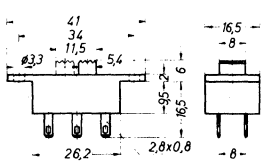






DOUBLE POLE, DOUBLE THROW RIGHT ANGLE PC TERMINALS





DOUBLE POLE, DOUBLE THROW, SLIDE BUTTON, QUICK CONNECT TERMINALS (Combination Solder or Plug-In)

Circuit	Function	Terminals	Catalog Number
DPDT	ON-ON	Solder	4021.0214 (Black Slider, No Marking)
DPDT	ON-ON	Quick Connect	4021.0506 (No UL & CSA) (Red Slider - 220V-240V Marking)
DPDT	ON-ON	Quick Connect	4021.0512 (Red Slider - 115V-230V Marking)
DPDT	ON-ON	Quick Connect	4021.0513 (Red Slider - High-Low Marking)
DPDT	ON-ON	Quick Connect	4021.0521 (Black Slider - No Marking)
DPDT	ON-ON	Quick Connect	4021.0522 (Red Slider - 230V-115V Marking)
DPDT	ON-ON	Quick Connect	4021.0525 (Red Slider - No Marking)
DPDT	ON-ON	Quick Connect	4021.0526 (Red Slider - 115V-220V Marking) (100 Microinch Silver)
DPDT	ON-ON	Quick Connect	4021.0527 (Red Slider - 120V-240V) (100 Microinch Silver)
DPDT	ON-ON	Quick Connect	4021.0530 (Red Slider - 115V-220V)
DPDT	ON-ON	Quick Connect	4021.0532 (Red Slider - 100V-250V)
DPDT	ON-ON	Quick Connect	4021.0820 (Red Slider Button - No Marking)
DPDT	ON-ON	Quick Connect	4021.0821 (Black Slider Button - No Marking)
DPDT	ON-ON	Quick Connect	4021.1912 (Red Slider - - No Marking) (No Mounting Ears)
DPDT	ON-ON	Quick Connect	4021.1913 (Black Slider - 115V -230V White Marking) (No Mounting Ears)
DPDT	ON-ON	Quick Connect	4021.1914 (Black Slider - High, Low White Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4220 (Red Slider - 220V-115V Black Marking)
DPDT	ON-ON	Right Angle P.C.	4021.4221 (Red Slider - 115V-220V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4302 (No UL & CSA) (Red Slider - 240-220V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4321 (Red Slider - 230-115V Black Marking)
DPDT	ON-ON	Straight P.C.	4021.4322 (Black Slider - No Markings)
DPDT	ON-ON	Straight P.C.	4021.4420 (Black Slider Button - No Marking) (No Mounting Ears)
DPDT	ON-ON	Straight P.C.	4021.4620 (Red Slider - 230-115V Black Marking) (No Mounting Ears)
DPDT	ON-ON	Straight P.C.	4021.4621 (Black Slider - No Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C. RH	4021.4711 (Red Slider - 230-115V - Black Markings) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4720 (Red Slider - 220V-115V - Black Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4721 (Red Slider - 115V-230V - Black Marking) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4722 (Red Slider - No Markings) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C. LH	4021.4723 (Red Slider - 230-115V) (No Mounting Ears)
DPDT	ON-ON	Right Angle P.C.	4021.4725 (Red Slider 0, — Black Marking) (No Mounting Ears)
DPDT	ON-ON	Left Side P.C.	4021.4920 (Red Slider - 230-115V - Black Marking) (No Mounting Ears)
SPDT	ON-ON	Left Side P.C.	4021.5920 (Red Slider 0, — Black Marking) (No Mounting Ears)

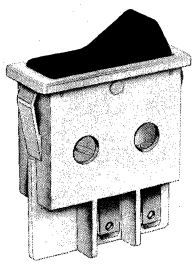
Technical Data: Double pole, double throw with sliding contact.
Resistance to Tracking: ⊏◎< KB 175 ⊨> KB 250 ⊏▯< KB 175
Life Endurance: Mechanical 10,000 Cycles; Electrical 10,000 Cycles. Screw fixing, mounting holes ϕ 3.3 mm

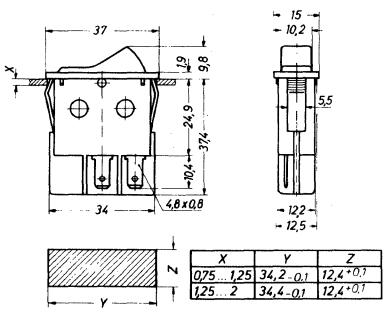
Materials: Slide made of thermoplastic; housing made of black thermoplastic; ground plate made of nature thermoplastic; glass fiber reinforced, contacts CuSn/Cu silver-plated; terminals silver-plated

MARQUARDT

Rocker Switch

1540 SERIES





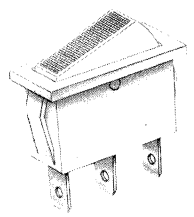
X	Y	Z
0,75 ... 1,25	34,2 -0,1	12,4 +0,1
1,25 ... 2	34,4 -0,1	12,4 +0,1

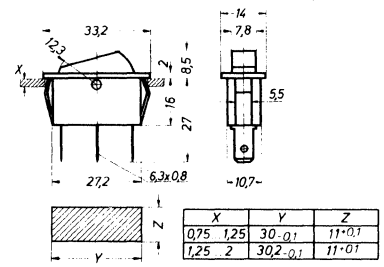
Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1542.1121 R70 (Black Rocker & Base - White Markings — ON, 0-OFF)
DPST	ON-OFF	6.3 (.250)	1542.1123 R70 (Black Base & Rocker - White Markings I, 0)
DPST	ON-OFF	6.3 (.250)	1545.1120 R72 (White Base - Lighted Red Rocker - 220V Bulb)
DPST	ON-OFF	6.3 (.250)	1545.1122 R72 (Black Base - Lighted Red Rocker - 110V Bulb)

DOUBLE POLE R70 16A 125V-250V AC 1/4HP 125VAC 1/2HP 250VAC R72 16A 250VAC 1/2HP

Mechanical — 50,000 Operations
Electrical — 10,000 Cycles

1600 SERIES





X	Y	Z
0,75 1,25	30 -0,1	11 +0,1
1,25 2	30,2 -0,1	11 +0,1

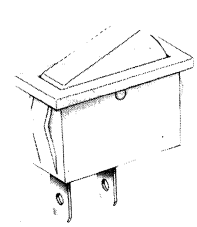
SINGLE POLE ILLUMINATED R19 16A 125V AC 1/8HP

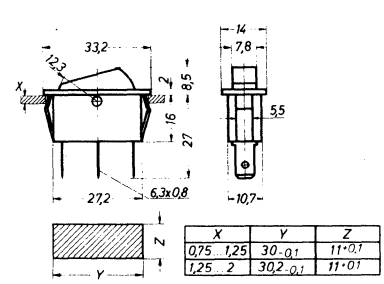
Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals silver-plated

Circuit	Function	Terminals	Catalog Number
SPST	ON-OFF	6.3 (.250)	1600.0120 R19 (Black Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0121 R19 (White Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0125 R19 (Black Base - Red Rocker- 220V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0126 R19 2-3.5mm Panel (Black Base - Red Rocker - 110V Bulb - Frame Alum)
SPST	ON-OFF	6.3 (.250)	1600.0127 R19 (Brown Base - Red Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0128 R19 (Black Base - Green Rocker - 110V Bulb)
SPST	ON-OFF	6.3 (.250)	1600.0420 R19 (Black Base - Red Rocker - 110V Bulb - Frame Alum)
SPST	ON-OFF	6.3 (.250)	1600.0421 R19 Black Base - Green Rocker - 110V Bulb — Frame Alum)
SPST	ON-OFF	Solder	1600.3108 R19 (White Base - Green Rocker - 110V Bulb)

1601 SERIES





X	Y	Z
0,75 1,25	30 -0,1	11 +0,1
1,25 2	30,2 -0,1	11 +0,1

SINGLE POLE NON-ILLUMINATED R62 10A 250VAC 1/3HP 16A 125VAC 1/8HP

Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals, silver-plated

Contact Resistance < 10 milliohms — Dielectric Resistance > 5 megohms

Circuit	Function	Terminals	Catalog Number
SPST	ON-OFF	6.3 (.250)	1601.0117 R62 (Black Base & Rockers, Markings - White OFF-ON, Horizontal Mtg.)
SPST	ON-OFF	6.3 (.250)	1601.0118 R62 (White Base & Rockers, Markings - Black OFF-ON, Horizontal Mtg.)
SPST	ON-OFF	6.3 (.250)	1601.0120 R62 (White Base & Rocker)
SPST	ON-OFF	6.3 (.250)	1601.0121 R62 (Black Base & Rocker)
SPST	ON-OFF	6.3 (.250)	1601.0122 R62 (Black Base & Rocker, 3.5mm Panel)
SPST	ON-OFF	6.3 (.250)	1601.0123 R62 (Black Base & Rocker, White Marking 0 on Bezel)
SPST	ON-OFF	6.3 (.250)	1601.0124 R62 (White Base & Rocker - Black I, 0)
SPST	ON-OFF	6.3 (.250)	1601.0125 R62 (Black Base & Rocker, Marking White OFF-ON, Vertical Mtg.)

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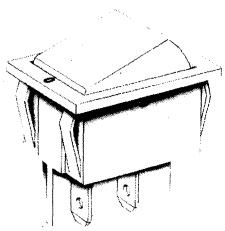
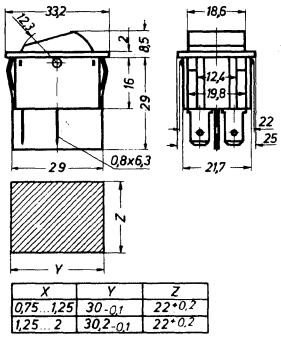
MARQUARDT

Rocker Switch

1602 SERIES





X	Y	Z
0,75...1,25	30 -0,1	22 +0,2
1,25...2	30,2 -0,1	22 +0,2

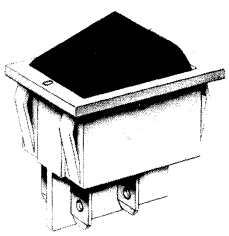
NON-ILLUMINATED DOUBLE POLE
R46 16A 125V AC 10A 250V AC
R62 16A 125V AC 1/8HP
10A 250V AC 1/3 HP

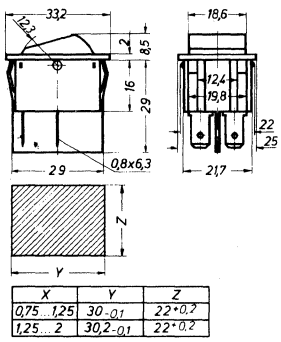
Technical Data:
Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, contacts made of Ag, terminals silver-plated

Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1602.0114 R46 (White Base & Rocker - Marking Black 0, I
DPST	ON-OFF	6.3 (.250)	1602.0120 R62 (White Base & Rocker - Marking - Red - 0 on Bezel
DPST	ON-OFF	6.3 (.250)	1602.0121 R62 (Black Base & Rocker - Marking Red - 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1602.0125 R62 (Black Base & Rocker - Marking White - 0, I)
DPST	ON-OFF	6.3 (.250)	1602.0126 R62 (Black Base & Rocker - Marking - White OFF-0 ON-1)
DPST	ON-OFF	6.3 (.250)	1602.0127 R62 (Black Base, Red Rocker - Marking - Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1602.4120 R62 (White Base & Rocker - Side Guards on Rocker - Marking Red 0 on Bezel)
DPDT	ON-ON	6.3 (.250)	1604.0120 R62 (White Base & Rocker)

1605 SERIES





X	Y	Z
0,75...1,25	30 -0,1	22 +0,2
1,25...2	30,2 -0,1	22 +0,2

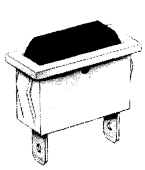
ILLUMINATED DOUBLE POLE
R19 16A 125V AC 1/8 HP
R61 10A 250V AC 1/3HP

Technical Data:
Resistance to Tracking: > KB250
Life Endurance: Mechanical—100,000 operation; Electrical—10,000 cycles
Snap in Fixing: for a wall thickness (X) of 0.75. . .2mm recommended cut-out (Y x Z) see table under dimensions

Materials: Rocker and housing made of thermoplastic, illuminated rockers and windows of lights made of transparent thermoplastic, contacts made of Ag, terminals silver-plated

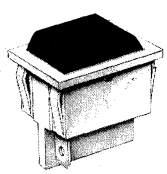
Circuit	Function	Terminals	Catalog Number
DPST	ON-OFF	6.3 (.250)	1605.0120 R19 (Black Base, Red Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0121 R61 (Black Base, Red Lens, 220V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0122 R19 (White Base, Red Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0123 R19 (White Base, Green Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0124 R19 Black Base, Green Lens, 110V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0126 R61 (Black Base, Green Lens, 220V Bulb Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0127 R61 (Black Base, Orange Lens, 220V Bulb, Marking Red 0 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0128 R61 (White Base, Green Lens, 220V Bulb Marking Black 0-1 on Bezel)
DPST	ON-OFF	6.3 (.250)	1605.0427 R61 (White Base, Red Lens, 220V Bulb Marking Black 0, I)

1607 SERIES Pilot Light



6.3 (.250) 1607.0420
(White Base, Red Lens, 110V Bulb)

6.3 (.250) 1607.0520
(Black Base, Orange Lens, 110V Bulb)



6.3 (.250) 1607.5101
(White Base, Red Lens, 220V Bulb)

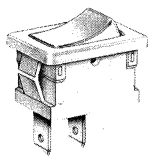
6.3 (.250) 1607.5110
(White Base, White Lens, 220V Bulb)

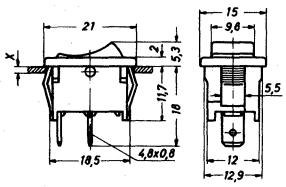
Not UL or CSA Approved
(Approval Pending)

MARQUARDT

Rocker Switch

1800 SERIES





X	Y	Z
0,75...1,25	19,2 -0,1	12,9 +0,1
1,25...2	19,4 -0,1	12,9 +0,1
2 ...3	19,8 -0,1	12,9 +0,1

Technical Data:
Resistance to tracking > KB250 > KB 175
Life endurance, mechanical:
ST, DT — 100,000 operations
DT with off-position — 50,000 operations
Life endurance, electrical:
ST, DT 6(4)A — 50,000 cycles
ST, DT 10(4)A — 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended
cut-out (Y x Z) see table under dimensions

SINGLE POLE

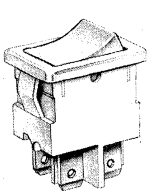
R30 6A 125V-250V AC 1/4 HP 125 - 1/2 HP 250V AC
R50 10A 125V-250V AC 1/3 HP 125V - 1/2 HP 250V AC
R52 6A 125V - 4A 250V AC 1/10 HP 125V-250V AC
R58 6A 125V-250V AC 1/8 HP
R73 10A 125V AC - 1/3 HP
R87 6A 250V AC - 1/2 HP

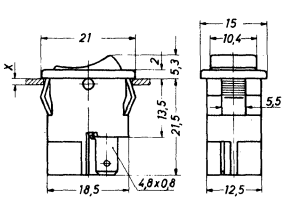
Materials
Rocker and housing made of thermoplastic
Contacts Ag/Cu silver-plated
Terminals silver-plated

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	4.8(.187)	1800.1121 R73 (Black Base, Red Lighted Rocker, 125V Bulb)
SPST	ON-OFF	Solder	1801.0102 R30 (Black Base & Rocker)
SPST	ON-OFF	Solder	1801.0120 R30 (White Base & Rocker)
SPST	ON-OFF	Solder	1801.0121 R50 (Black Base & Rocker)
SPST	ON-OFF	Solder	1801.0122 R30 (Black Base, Red Rocker)
SPST	ON-OFF	Solder	1801.0123 R30 (Brown Base & Rocker)
SPST	ON-OFF	Solder	1801.0124 R30 (Black Base & Rocker, Marking, Red —)
SPST	ON-OFF	Solder	1801.0130 R30 (Black Base, Orange Rocker, Marking, Black 0, I)
SPST	ON-OFF	Solder	1801.0134 R50 (Brown Base & Rocker)
SPST	ON-OFF	Solder	1801.0136 R50 (Black Base & Rocker White Marking 0, —)
SPST	ON-OFF	Solder	1801.0138 R30 (Black Base & Rocker, Marking, White - 0)
SPST	ON-OFF	Solder	1801.0149 R30 (Black Base & Rocker, Marking, Red 0, —)
SPST	ON-OFF	4.8(.187)	1801.1102 R30 (Black Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1110 R30 (Brown Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1121 R50 (Black Rocker & Base)
SPST	ON-OFF	4.8(.187)	1801.1124 R50 (Brown Rocker & Base, Red Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1139 R30 (Black Rocker & Base, White Marking 0, —)
SPST	ON-OFF	4.8(.187)	1801.1142 R30 (White Rocker & Base, Black Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1143 R30 (Black Rocker & Base, White Bar on Rocker)
SPST	ON-OFF	4.8(.187)	1801.1144 R30 (Black Base, Red Rocker)
SPST	ON-OFF	4.8(.187)	1801.1147 R50 (Brown Base & Rocker)
SPST	ON-OFF	4.8(.187)	1801.1148 R50 (Black Base & Rocker, White Marking 0, —)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1210 R52 (Brown Base & Rocker)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1221 R52 (Black Base & Rocker)
SPNO	ON-OFF Momentary	4.8(.187)	1801.1222 R52 (Black Base, White Rocker)
SPST	ON-OFF	P.C.	1801.2152 (Black Base & Rocker, 30mA, 12VDC)
SPNC	ON-OFF Momentary	P.C.	1801.2322 R52 (Brown Base & Rocker)

Circuit	Function	Terminal	Catalog Number
SPDT	ON-ON	Solder	1803.0107 R50 (Brown Base & Rocker)
SPDT	ON-ON	Solder	1803.0120 R50 (White Base & Rocker)
SPDT	ON-ON	Solder	1803.0121 R50 (Black Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1120 R30 (White Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1121 R50 (Black Base & Rocker)
SPDT	ON-ON	4.8(.187)	1803.1122 R50 (Brown Base & Rocker)
SPDT	ON-ON Momentary	4.8(.187)	1803.1221 R52 (Black Base & Rocker)
SPDT	ON-ON Momentary	4.8(.187)	1803.1222 R52 (Brown Base & Rocker)
SPDT	ON-OFF-ON	Solder	1808.0121 R58 (Black Base & Rocker)
SPDT	ON-OFF-ON	Solder	1808.0124 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF-ON	Solder	1808.0220 R58 (White Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0320 R58 (White Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0321 R58 (Black Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0323 R58 (Black Base & White Rocker)
SPDT	Mom ON -OFF- Mom ON	Solder	1808.0324 R58 (Black Base & Red Rocker)
SPDT	ON-OFF-ON	4.8(.187)	1808.1121 R58 (Black Base & Rocker)
SPDT	ON-OFF-ON	4.8(.187)	1808.1123 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF-ON	4.8(.187)	1808.1204 R58 (Brown Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	4.8(.187)	1808.1321 R58 (Black Base & Rocker)
SPDT	Mom ON -OFF- Mom ON	4.8(.187)	1808.1322 R58 (Brown Base & Rocker)

1852 SERIES





NON-ILLUMINATED R52 6A 125V 4A 250V AC
1/10 HP 125V-250V AC
MAX. INRUSH - 51A 125V AC

X	Y	Z
0,75...1,25	19,2 -0,1	12,9 +0,1
1,25...2	19,4 -0,1	12,9 +0,1
2 ...3	19,8 -0,1	12,9 +0,1

Technical Data:
Single pole or double pole ST
Lifting contact
Resistance to tracking > KB 250
Life endurance:
Mechanical - 50,000 operations
Electrical - 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended
cut-out (Y x Z) see table under dimensions

Circuit	Function	Terminal	Catalog Number
DPST	ON-OFF	Solder	1852.0122 R52 (Black Base & Rocker, White Marking on Rocker —, 0)
DPST	ON-OFF	4.8(.187)	1852.1121 R52 (Black Base & Rocker, Red Marking, 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1122 R52 (Black Base, Red Rocker, White Marking, 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1123 R52 (Black Base, Red Rocker, White Marking, on Rocker I, 0)
DPST	ON-OFF	4.8(.187)	1852.1124 R52 (Black Base & Rocker, White Marking OFF-ON on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1125 R52 (Black Base & Rocker, White Marking 0 I on Rocker)
DPST	ON-OFF	4.8(.187)	1852.1126 R52 (Black Base, Red Rocker, White Marking on Rocker 0, —)
DPST	ON-OFF	4.8(.187)	1852.1128 R52 (Black Base & Rocker, White Marking on Rocker 0, I)
DPST	ON-OFF	2.8(.110)	1852.3122 R52 (Black Base & Rocker)
DPST	ON-OFF	P.C. Right Angle	1852.5120 R52 (Black Base & Rocker) White Marking, 0)

Materials
Rocker and housing made of thermoplastic
Contacts made of Ag
Terminals silver-plated

Additional Models
Rocker, window and housing in other colors
Rocker with different symbols

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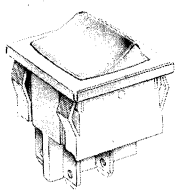
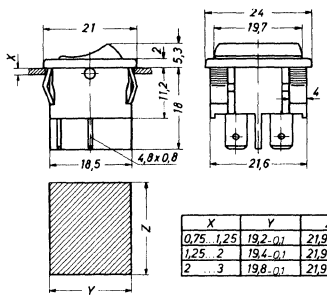
MARQUARDT

Rocker Switch

1802 SERIES





X	Y	Z
0,75...1,25	19,2 -0,1	21,9 +0,1
1,25...2	19,4 -0,1	21,9 +0,1
2...3	19,8 -0,1	21,9 +0,1

DOUBLE POLE

R30 6A 125V-250V AC
1/4 HP 125 - 1/2 HP 250V AC
R50 10A 125V-250V AC 1/3 HP 125V - 1/2 HP 250V AC
R52 6A 125V - 4A 250V AC 1/10 HP 125V-250V AC
R55 6A 125V AC 1/4 HP
R58 6A 125V-250V AC 1/8 HP
R73 10A 125V 1/3 HP
R87 6A 250V AC 1/2 HP

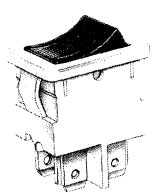
Technical Data:
Resistance to tracking > KB250 > KB 175
Life endurance, mechanical:
ST, DT — 100,000 operations
DT with off-position — 50,000 operations
Life endurance, electrical:
ST, DT 6(4)A — 50,000 cycles
ST, DT 10(4)A — 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended cut-out (Y x Z) see table under dimensions

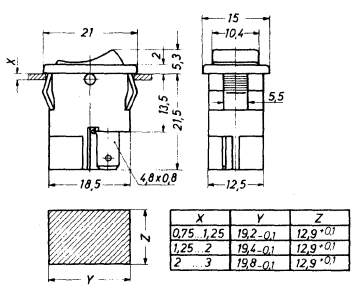
Materials
Rocker and housing made of white or black thermoplastic
Window made of red transparent thermoplastic
Contacts Ag/Cu silver-plated
Terminals silver-plated

Circuit	Function	Terminal	Catalog Number
DPST	ON-OFF	Solder	1802.0121 R50 (Black Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	Solder	1802.0122 R50 (White Base & Rocker, Black Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1112 R50 (Brown Base, Red Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1113 R50 (Black Base, Red Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1120 R50 (White Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1121 R50 (Black Base & Rocker, Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1122 R50 (Black Base, White Rocker) Red 0 on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1123 R50 (Black Base & Rocker, White Markings 0, I)
DPST	ON-OFF	4.8(.187)	1802.1124 R50 (Brown Base & Rocker, White Marking 0, —)
DPST	ON-OFF	4.8(.187)	1802.1127 R30 (Dark Gray Base & Rocker, White 0, on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1130 R30 (Black Base & Rocker, Red 0, on Rocker)
DPST	ON-OFF	4.8(.187)	1802.1133 R50 (Black Base & Rocker, White Marking - ON, OFF on Rocker)

Circuit	Function	Terminal	Catalog Number
DP.NO	ON-OFF Momentary	4.8(.187)	1802.1221 R52 (Black Base & Rocker)
DPST	ON-OFF	P.C.	1802.2402 (No UL, CSA) (Black Base & Rocker, Red Marking 0 on Rocker)
DPDT	ON-ON	Solder	1804.0102 R30 (Black Base & Rocker)
DPDT	ON-ON	Solder	1804.0103 R30 (Black Base & Rocker, White Marking Bar on Rocker)
DPDT	ON-ON	4.8(.187)	1804.0121 R50 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1121 R50 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1124 R30 (Black Base & Rocker)
DPDT	ON-ON	4.8(.187)	1804.1152 (White Base & Rocker, Contact Gold, 30mA - 12 VDC)
DPDT	ON-ON	4.8(.187)	1804.1153 (Black Base & Rocker, Contact Gold, 30mA - 12VDC)
DPDT	CN-ON	P.C.	1804.2152 (Black Base & Rocker, Contact Gold, 30mA - 12VDC)
DPST	ON-OFF	4.8(.187)	1805.1102 R87 (Black Base, Red Lighted Rocker, White Marking 0 on Rocker, 220V Bulb)
DPST	ON-OFF	4.8(.187)	1805.1121 R55 (Black Base, Red Lighted Rocker, White Marking 0 on Rocker, 125V Bulb)
DPDT	ON-OFF -ON	4.8(.187)	1809.1121 R58 (Black Base & Rocker)
DPDT	Mom ON -OFF- Mom ON	4.8(.187)	1809.1302 R58 (Black Base & Rocker)

1850 SERIES





X	Y	Z
0,75...1,25	19,2 -0,1	12,9 +0,1
1,25...2	19,4 -0,1	12,9 +0,1
2...3	19,8 -0,1	12,9 +0,1

ILLUMINATED

R69 4A 250V AC 1/10 HP
R53 6A 125V AC 1/10 HP

Technical Data:
Single pole or double pole ST
Lifting contact
Resistance to tracking > KB 250
Life endurance:
Mechanical - 50,000 operations
Electrical - 10,000 cycles
Snap in fixing:
for a wall thickness (X) of 0,75...3 mm recommended cut-out (Y x Z) see table under dimensions
Illumination:
neon lamp with Rv 220V or 110V AC (not interchangeable)

Materials
Rocker and housing made of thermoplastic
Contacts made of Ag
Terminals silver-plated

Circuit	Function	Terminal	Catalog Number
SPST	ON-OFF	4.8(.187)	1850.1121 R69 (Black Base, Red Lighted Rocker, 220V Bulb)
SPST	ON-OFF	4.8(.187)	1850.1122 R53 (White Base, Red Lighted Rocker, 125V Bulb)
SPST	ON-OFF	4.8(.187)	1850.1123 R53 (Black Base, Red Lighted Rocker, 125V Bulb)
DPST	ON-OFF	4.8(.187)	1855.1122 R53 (Black Base, Green Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1123 R53 (White Base, Red Lighted Roeker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1124 R53 (Black Base, Red Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1125 R53 (Black Base, Amber Lighted Rocker, 125V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1126 R69 (Black Base, Green Lighted Rocker, 220V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1127 R69 (Black Base, Red Lighted Rocker, 220V Bulb, White Marking, 0)
DPST	ON-OFF	4.8(.187)	1855.1128 R69 (Black Base, Orange Lighted Rocker, 220V Bulb, White Marking, 0)

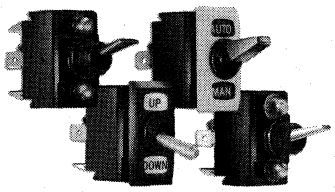
Additional Models
Rocker, window and housing in other colors
Rocker with different symbols
With incandescent lamp

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

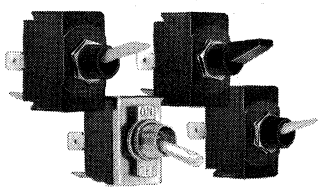
TOGLITE™ LIGHTED TOGGLE SWITCHES



- **Broad Selection** of bat styles, colors, indicating plates and legends to fit design and functional requirements.
- **Reliable, long-life mechanisms** for exceptional performances.
- **Variety of circuit arrangements.**
- **Environmental ratings**—150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.
- **Choice of lights:** 6V, 14V, 28V or 250V AC, 125V AC Standard.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole
Case Dimensions
1.35″ x .80″
15/32″-32 thd. bushing
UL Listed
CSA Approved

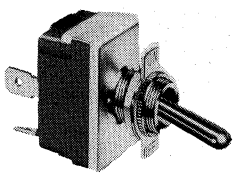
DESIGNER LINE TOGGLE SWITCHES



- **Choice of designer-style lighted or unlighted bats** in colors to your specifications.
- **Reliable, long-life mechanism** for exceptional performance.
- **Polycarbonate or die-cast zinc coverplates.**
- **25,000-hour 14V incandescent standard** (other incandescent and neon lamps available on special order).
- **Environmental ratings:** 150°F., 85% relative humidity.
- **Choice of terminals:** Screw, 1/4″ wide spade, or solder.

15 Amp 277V AC
3/4 HP 125-277V AC
Single Pole & Double Pole.
Case Dimensions: 1.35″ x .80″
15/32″ thd. bushing
UL Listed
CSA Approved

STANDARD TOGGLE SWITCHES



- **Wide selection of circuitry, ratings, terminals.**
- **Time-proven, reliable long-life mechanism.**
- **Variety of bat styles and colors.**
- **SP, DP, 3+4 pole models available.**

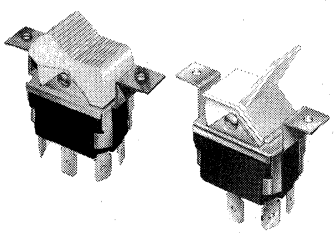
UL Listed
CSA Approved

20 Amp SP Toggle

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Terminals		
A	B	C		Screw	Solder	Spade
ON	—	OFF	SPST	90-0001	90-0002	90-0003
ON	OFF	ON	SPDT	91-0001	91-0002	91-0003
ON	—	ON	SPDT	92-0001	92-0002	92-0003
(ON)	OFF	(ON)	SPDT	93-0001	93-0002	93-0003
ON	OFF	(ON)	SPDT	93-1001	93-1002	93-1003
(OFF)	—	ON	SPST	93-2001	93-2002	93-2003
(ON)	—	OFF	SPST	93-3001	93-3002	93-3003
ON	—	(ON)	SPDT	93-4001	93-4002	93-4003

( ) = Momentary. Indicating plate supplied with on-off circuit only.

ROCKER AND PADDLE SWITCHES



- **Distinctive styling**—With your choice of standard or specially designed actuators to meet style requirements.
- **Reliability**—Mechanical excellence from one of the most experienced manufacturers of switches of this type.
- **Extra electrical capacity**—20 Amp models provide an extra margin of reliability.
- **Broad range of variations**—Terminals, circuitry, coverplates, actuators are available or can be engineered to fit your needs.

0801 SP and 0801 DP Series

UL Listed	CSA Approved
20 Amp 277V AC	16 Amp 277V AC
1 1/2HP 125-250V AC	1 1/2HP 125-250V AC

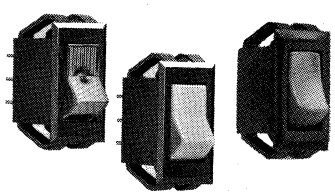
20 Amp 12V DC

1801 SP and 1801 DP Series

UL Listed	CSA Approved
6 Amp 125V AC	
3 Amp 250V AC	
1/4HP 125-250V AC	

6 Amp 12V DC
Case Dimensions: 1 15/64″ x 51/64″

MINIATURE ROCKER SWITCHES



- **Choice of Stylette™**—(new softer designer lines that enhance product styling) **or standard miniature rocker switches.**
- **Choice of illuminated or solid** two surface smooth colored rocker.
- **Rocker colors available**—Light-Clear-Amber-Red-*Green-*Blue Non-lighted-White-Black-Red (other colors, consult factory).
- **Plastic snap-in bezels**—for fast easy installation.
- **Available in black & white bezels** (other colors, consult factory).
- **Terminals**—1/4″ quick disconnect-standard. Also available 16-ga. wire.
- **Lamps**—115V AC neon standard. Also available 6V AC or DC, 14V AC or DC, 28V AC or DC & 250V AC neon.

McGILL MANUFACTURING COMPANY, INC., ELECTRICAL DIVISION, VALPARAISO, IN 46383

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

0150 & 0151 Series Toglite™

Circuit Arrangement A B C				SINGLE POLE CATALOG NUMBERS				DOUBLE POLE CATALOG NUMBERS		
A	B	C	Poles	Screw Terminals	Spade Terminals	Solder Terminals	Poles	Screw Terminals	Spade Terminals	Solder Terminals
ON	—	OFF	SPST	0150-2001	0150-2009	0150-2017	DPST	0151-2001	0151-2009	0151-2017
ON	OFF	ON	SPDT	0150-2002	0150-2010	0150-2018	DPDT	0151-2002	0151-2010	0151-2018
ON	—	ON	SPDT	0150-2003	0150-2011	0150-2019	DPDT	0151-2003	0151-2011	0151-2019
(ON)	OFF	(ON)	SPDT	0150-2004	0150-2012	0150-2020	DPDT	0151-2004	0151-2012	0151-2020
(ON)	—	OFF	SPST	0150-2005	0150-2013	0150-2021	DPST	0151-2005	0151-2013	0151-2021
(ON)	—	ON	SPDT	0150-2006	0150-2014	0150-2022	DPDT	0151-2006	0151-2014	0151-2022
ON	OFF	(ON)	SPDT	0150-2007	0150-2015	0150-2023	DPDT	0151-2007	0151-2015	0151-2023
(OFF)	—	ON	SPST	0150-2008	0150-2016	0150-2024	DPST	0151-2008	0151-2016	0151-2024

Black dress nut available for plastic bezel as an option.
Order part No. 0151-9101. ( ) = Momentary.

Select from four bat shapes in red, black, white or illuminated; lens caps in white, clear, amber, red, green or blue; black or white indicating plates with one or two windows. Legends; ON-OFF, High-Low, I-O, AUTO-MAN, FWD/REV, Up-Down, Cool-Heat, Test, Out-In, 12V-125V.

0150 & 0151 Plastic Series—Designer Line

Circuit Arrangement A B C				CATALOG NUMBERS				CATALOG NUMBERS		
A	B	C	Poles	Screw Terminals	Spade Terminals	Solder Terminals	Poles	Screw Terminals	Spade Terminals	Solder Terminals
ON	—	OFF	SPST	0150-1001	0150-1009	0150-1017	DPST	0151-1001	0151-1009	0151-1017
ON	OFF	ON	SPDT	0150-1002	0150-1010	0150-1018	DPDT	0151-1002	0151-1010	0151-1018
ON	—	ON	SPDT	0150-1003	0150-1011	0150-1019	DPDT	0151-1003	0151-1011	0151-1019
(ON)	OFF	(ON)	SPDT	0150-1004	0150-1012	0150-1020	DPDT	0151-1004	0151-1012	0151-1020
(ON)	—	OFF	SPST	0150-1005	0150-1013	0150-1021	DPST	0151-1005	0151-1013	0151-1021
ON	—	(ON)	SPDT	0150-1006	0150-1014	0150-1022	DPDT	0151-1006	0151-1014	0151-1022
ON	OFF	(ON)	SPDT	0150-1007	0150-1015	0150-1023	DPDT	0151-1007	0151-1015	0151-1023
(OFF)	—	ON	SPST	0150-1008	0150-1016	0150-1024	DPST	0151-1008	0151-1016	0151-1024

Die cast coverplate and bushing available on special order. Black anodized dress nut available for plastic bezel as an option. Order part number 0151-0101.

Bat Tip Color	Poles SPST	Screw Terminals	Spade Terminals	Solder Terminals
Red	ON-OFF	0151-7004	0151-7000	0151-7008
Amber	ON-OFF	0151-7005	0151-7001	0151-7009
Green	ON-OFF	0151-7006	0151-7002	0151-7010
Clear	ON-OFF	0151-7007	0151-7003	0151-7011

Select from four bat shapes in red, black, white or illuminated. Illuminated Toggles available in black plastic bezel. Colors: red, amber, green, clear. Order following part numbers:

15 Amp DP Toggle

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Terminals		
A	B	C		Screw	Solder	Spade
ON	—	OFF	DPST	0121-0001	0121-0017	0121-0009
ON	OFF	ON	DPDT	0121-0002	0121-0018	0121-0010
ON	—	ON	DPDT	0121-0003	0121-0019	0121-0011
(ON)	OFF	(ON)	DPDT	0121-0004	0121-0020	0121-0012
(ON)	—	OFF	DPST	0121-0005	0121-0021	0121-0013
ON	—	(ON)	DPDT	0121-0006	0121-0022	0121-0014
ON	OFF	(ON)	DPDT	0121-0007	0121-0023	0121-0015
(OFF)	—	ON	DPST	0121-0043	0121-0045	0121-0044

( ) = Momentary Available on special order: 20 amp. 277V AC, 1 HP 125-277V AC, U.L. Listed. CSA Approved.

6 Amp SP Toggle

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Terminals		
A	B	C		Screw	Solder	Spade
ON	—	OFF	SPST	3190-0001	3190-0002	3190-0003
ON	OFF	ON	SPDT	3191-0001	3191-0002	3191-0003
ON	—	ON	SPDT	3192-0001	3192-0002	3192-0003
(ON)	OFF	(ON)	SPDT	3193-0001	3193-0002	3193-0003
ON	OFF	(ON)	SPDT	3193-1001	3193-1002	3193-1003

( ) = Momentary. Indicating plate supplied with on-off circuit only.

6 Amp DP Toggle

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Terminals		
A	B	C		Screw	Solder	Spade
ON	—	OFF	DPST	1121-0001	1121-0017	1121-0009
ON	OFF	ON	DPDT	1121-0002	1121-0018	1121-0010
ON	—	ON	DPDT	1121-0003	1121-0019	1121-0011
(ON)	OFF	(ON)	DPDT	1121-0004	1121-0020	1121-0012
(ON)	—	OFF	DPST	1121-0005	1121-0021	1121-0013
ON	—	(ON)	DPDT	1121-0006	1121-0022	1121-0014
ON	OFF	(ON)	DPDT	1121-0007	1121-0023	1121-0015
(OFF)	—	ON	DPST	1121-0043	1121-0045	1121-0044

( )=Momentary.

Single Pole Rocker

.375" offset, 1.625" centered, 2-hole mounting rocker switches.

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Spade Terminals	
A	B	C		20 A	6 A
ON	—	OFF	SPST	0801-0310	1801-0310
ON	OFF	ON	SPDT	0801-0311	1801-0311
ON	—	ON	SPDT	0801-0312	1801-0312
(ON)	—	OFF	SPST	0801-0313	1801-0313
(ON)	OFF	(ON)	SPDT	0801-0314	1801-0314
(ON)	ON	ON	SPDT	0801-0315	1801-0315
(ON)	OFF	ON	SPDT	0801-0316	1801-0316
ON	—	(OFF)	SPST	0801-0317	1801-0317
(ON)	—	ON	SPDT	0801-0318	1801-0318

( )=Momentary.

Double Pole Rocker

.375" offset, 1.625" centered, 2-hole mounting rocker switches.

Circuit Arrangement A B C			Poles	CATALOG NUMBERS Spade Terminals	
A	B	C		20 A	6 A
ON	—	OFF	DPST	0811-0310	1811-0310
ON	OFF	ON	DPDT	0811-0311	1811-0311
ON	—	ON	DPDT	0811-0312	1811-0312
(ON)	—	OFF	DPST	0811-0313	1811-0313
(ON)	OFF	(ON)	DPDT	0811-0314	1811-0314
(ON)	ON	ON	DPDT	0811-0315	1811-0315
(ON)	OFF	ON	DPDT	0811-0316	1811-0316
ON	—	(OFF)	DPST	0811-0317	1811-0317
(ON)	—	ON	DPDT	0811-0318	1811-0318

( )=Momentary.

3-pole and 4-pole models also available.

12 Amp 125 AC
1/2 HP, 125-250V AC
Also available:
16 Amp 125V AC
10 Amp 250V AC
10 Amp 30V DC
1/2 HP, 125-250V AC
Case Dimensions: .890" x .490"

Single Pole Rocker (black bezel white rockers) and Stylette™ curved rocker

Circuit Arrangement A B C			Poles	Lights	Single Pole Rocker Catalog Numbers Spade Terminals	Stylette Rocker Catalog Numbers Spade Terminals
ON	—	OFF	SPST	NONE	0815-1213	0815-2213
ON	—	ON	SPDT	NONE	0815-1243	0815-2243
ON	OFF	ON	SPDT	NONE	0815-1253	0815-2253
ON	—	OFF	SPST	1 (115V AC)	0815-5213	—

*Lighted version available in SPST circuitry.
For catalog numbers for other bezel, rocker and lens colors or terminals, consult factory.
*Note: green & blue lighted rockers to be used with 6-14 or 28V lamps only.

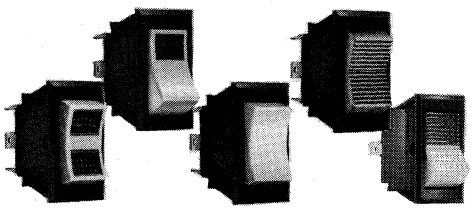
SWITCH BUYER HOTLINE (800) 233-8828; FAX (219) 465-2456; PHONE (219) 465-2200

engineered switches

McGILL®

McGILL MFG. CO., INC., ELECTRICAL DIV.,
VALPARAISO, IN 46383 (800) 233-8828

LIGHTED ROCKER SWITCHES WITH SNAP-ON COLORED CAPS



0851, 1851, 1861, 0871, 1871, 0881 and 1881 switch series standard construction features:
These switches have black plastic bezels for snap-in-mounting, 1/4" quick-disconnect spade terminals, 115V neon lamps. Available with 6-28V DC incandescent lamp consult factory. Optional splash-resistant gasket model available—request new Sealtite™ switch.

Underwriters' Lab. Inc. Listed
CSA Approved
0851, 0861, 0871, 0881
15 Amp 277V AC
3/4 HP-125 277V AC

1851, 1861, 1871, 1881
6 Amp 125V AC
3 Amp 277V AC
1/4 HP-125 277V AC

SINGLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0851)	6 A (1851)
ON	—	OFF	SPST	1	0851-1301	1851-1301
ON	OFF	ON	SPDT	2	0851-2302	1851-2302
ON	—	ON	SPDT	2	0851-2303	1851-2303
(ON)	—	OFF	SPST	1	0851-1304	1851-1304
(ON)	OFF	(ON)	SPDT	2	0851-2305	1851-2305
(ON)	OFF	ON	SPDT	2	0851-2306	1851-2306
ON	—	(OFF)	SPST	1	0851-1307	1851-1307
(ON)	—	ON	SPDT	2	0851-2308	1851-2308

( ) = Momentary.

SINGLE POLE LIGHTED (Black Bezel)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0871)	6 A (1871)
ON	—	OFF	SPST	1	0871-1601	1871-1601
ON	OFF	ON	SPDT	2	0871-2602	1871-2602
ON	—	ON	SPDT	2	0871-2603	1871-2603
(ON)	—	OFF	SPST	1	0871-1604	1871-1604
(ON)	OFF	(ON)	SPDT	2	0871-2605	1871-2605
(ON)	OFF	ON	SPDT	2	0871-2606	1871-2606
ON	—	(OFF)	SPST	1	0871-1607	1871-1607

( ) Momentary. Above numbers do not include cap.

SEALTITE™ SWITCHES

Protects switch against liquids, dust, dirt and many other contaminants. Lighted or unlighted versions. Consult factory for part number.

DOUBLE POLE (Black Bezel, White Rocker, Red Lens)

Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0861)	6 A (1861)
ON	—	OFF	DPST	1	0861-1301	1861-1301
ON	OFF	ON	DPDT	2	0861-2302	1861-2302
ON	—	ON	DPDT	2	0861-2303	1861-2303
(ON)	—	OFF	DPST	1	0861-1304	1861-1304
(ON)	OFF	(ON)	DPDT	2	0861-2305	1861-2305
(ON)	OFF	ON	DPDT	2	0861-2306	1861-2306
ON	—	(OFF)	DPST	1	0861-1307	1861-1307
(ON)	—	ON	DPDT	2	0861-2308	1861-2308

( ) = Momentary.

DOUBLE POLE LIGHTED (Black Bezel)

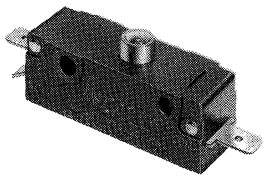
Circuit Arrangement A B C			Poles	Lights	CATALOG NUMBERS Spade Terminals	
A	B	C			15 A (0881)	6 A (1881)
ON	—	OFF	DPST	1	0881-1601	1881-1601
ON	OFF	ON	DPDT	2	0881-2602	1881-2602
ON	—	ON	DPDT	2	0881-2603	1881-2603
(ON)	—	OFF	DPST	1	0881-1604	1881-1604
(ON)	OFF	(ON)	DPDT	2	0881-2605	1881-2605
(ON)	OFF	ON	DPDT	2	0881-2606	1881-2606
ON	—	(OFF)	DPST	1	0881-1607	1881-1607
(ON)	—	ON	DPDT	2	0881-2608	1881-2608

( ) Momentary. Above numbers do not include cap.

SNAP-ON COLORED CAPS

Color	Full Cap Serrated	½ Cap Serrated	Curved Full Satin Clear Cap	Curved Full Satin Opaque Cap
White	0871-0000	0871-0010	0871-0020	0871-0030
Clear	0871-0100	0871-0110	0871-0120	0871-0130
Amber	0871-0200	0871-0210	0871-0220	0871-0230
Red	0871-0300	0871-0310	0871-0320	0871-0330
Green	0871-0400	0871-0410	0871-0420	0871-0430
Blue	0871-0500	0871-0510	0871-0520	0871-0530
Chrome	—	—	—	0871-0730
Black	0871-0800	0871-0810	—	0871-0830

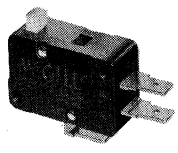
SNAP-ACTION SWITCHES



2600 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
SPDT & SPST, NO or NC
Less than .005" differential travel
Operating force 20 oz. max.
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 13/16" x 41/64" x 41/64"
Standard Terminals
Spade Terminals .250" x .032"

2700 Series
20 Amp 125-250V AC
1 HP 125-250V AC
2 HP 250V AC
Underwriters' Laboratories, Inc. Listed
CSA Approved
Dimensions 1 21/64" x 1-13/16" x 43/64"
Spade Terminals .250" x .032"

MINIATURE SNAP-ACTION SWITCHES



McGill® 4775 Series Rolling Cam* SNAP-ACTION SWITCHES. An engineering breakthrough that provides 150,000,000 cycle reliability, less contact bounce (1.5 millsec), LIGHT OPERATING FORCE—75gm. Max.

4777 Series available rated:
15 Amp 125-250V AC, 1/2 HP 125-250V AC
25 Amp 125-250V AC, 1 HP 125V AC
2 HP 250V AC, 85°C. Max. Ambient Temp.

10 Amp
125-250V AC
1/2 HP 125-250V AC
4 Amp "L" 125V AC

Underwriters' Laboratories, Inc. Listed;
CSA Approved
Optional UL 100,000 cycle listing and 20.1 Amp
Case Dimensions: 1 3/32" x 5/8" x 13/32"

ACTUATOR	CATALOG NUMBERS SPADE TERMINALS SPDT	SPST NO	SPST NC	OPERATING CHARACTERISTICS Operating Force Max. gm.	Release Force Min. gm.	Movement Diff. Max. In.	Pre-travel Max. In.	Total Over-travel Min. In.	Actuator Length
Basic plunger	4775-1100	4775-1200	4775-1300	75	10	.016	.047	.050	
Short rigid lever	4775-1120	4775-1220	4775-1320	75	9	.018	.052	.050	$^{27}/_{32}$
Long rigid lever	4775-1130	4775-1230	4775-1330	37	4	.037	.108	.090	$1^{13}/_{32}$
Short rigid lever w/roller	4775-1140	4775-1240	4775-1340	75	9	.018	.052	.050	$^{25}/_{32}$
Long rigid lever w/roller	4775-1150	4775-1250	4775-1350	37	4	.037	.108	.090	$1^{11}/_{32}$
Simulated roller	4775-1160	4775-1260	4775-1360	37	5	.033	.096	.090	$1^{9}/_{32}$

NOTE: Operating characteristics are given for levers mounted in the support farthest from the plunger. When the levers are mounted in the support closest to the plunger, multiply the given force values by .57 and the travel values by 1.76 to obtain the correct values.

4600 Series 15 Amp switches with berylium copper mechanism also available.

SWITCH BUYER HOTLINE (800) 233-8828; FAX (219) 465-2456; PHONE (219) 465-2200

MEI T-5 SERIES LIGHTED KEYSWITCHES

DESCRIPTION

The T-5 lighted keyboard switch has long life (greater than 10 million cycles), low bounce, gold-plated cross bar contacts usually found in more expensive switches.

Mechanically, the T-5 switch incorporates precision tracking surfaces providing a smooth "feel" throughout its .170 travel. Each switch has two alignment studs and four to six solder points. This makes hand or wave soldered PC board assemblies extremely rugged for the most demanding applications, while keeping the manufacturing costs down by eliminating the need for metal mounting frames.

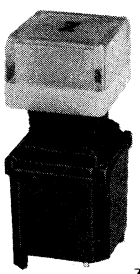
Electrical configurations include normally open, normally closed, double pole normally open, and alternate action. MEI stocks a 5V, 60 milliamp, 100,000 hour bulb for these switches. Lamp terminal spacing is .100 inch, to fit T-1 size lamps which can be changed from the front panel by end users. Lenses are stocked in eight colors.

MEI offers a complete line of non lighted T-5 switches and accessories for keyboard construction. These include the switches and keytops shown below, keytops for both 16mm and 19mm center arrays, relegendable keytops, space bars, wide keytops, leveling mechanisms, etc. In house engraving and printing is available for prototyping and low volume applications.

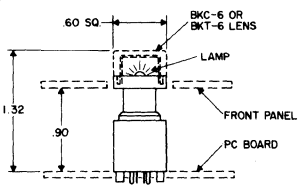
SPECIFICATIONS

CONTACT RATING, DC RESISTIVE: 3W max.
VOLTAGE: 24V max.
INITIAL CONTACT RESISTANCE: 100 mΩ max.
PLUNGER TRAVEL: .170 ±.010 in.
PRE-TRAVEL: .080 ±.030 in.
OPERATING FORCE
SINGLE POLE, MOMENTARY: 3.5 ±0.5 oz.
DOUBLE POLE AND/OR ALT. ACTION: 6.0 ±0.5 oz.
TEMPERATURE
OPERATING: −25°C to +65°C
STORAGE: −40°C to +70°C
CONTACT BOUNCE: 4 ms max.
MIN. ACTUATIONS, @ 5V, 100μ AMPS: 10 x 10^6

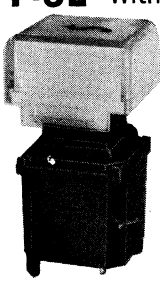
T-5K With Box Lens



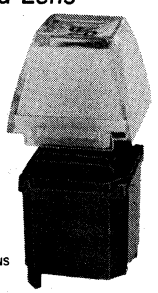
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED
- FOR 5/8" CENTER MOUNTING

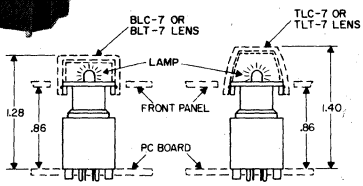


T-5L With Box Lens or Truncated Lens

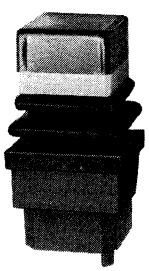


- FOR 3/4" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED

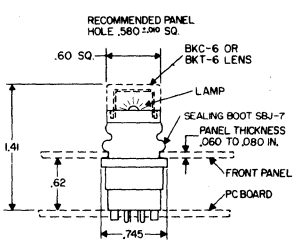




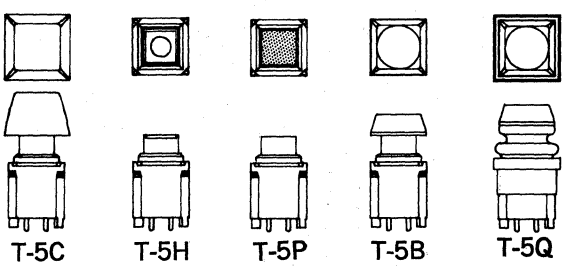
T-5J With Panel Sealing Boot and Box Lens



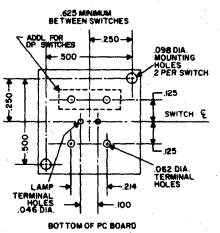
- ENVIRONMENTALLY SEALED ABOVE AND BELOW MOUNTING PANEL
- VINYL BOOT SEALS AGAINST LIQUID AND DUST
- FOR 3/4" CENTER MOUNTING
- LIGHTED WITH T-1 BI-PIN LAMP, SOCKETED



OTHER MODELS



PC BOARD LAYOUT



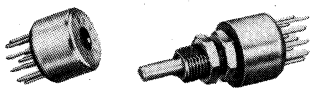
MECHANICAL ENTERPRISES INC.
461 CARLISLE DRIVE
HERNDON, VA 22070
(703) 435-9496
TWX 710-832-0942
FAX (703) 435-1837

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

ROTARY SWITCHES

MICROMINIATURE ROTARY SWITCH OEM SERIES 910 AND 912

DISTRIBUTOR SERIES 2ASB AND 2ASA



Mepco/Centralab's microminiature rotary switches have compact size and low profile which make them suitable for mounting on pc cards, and on front panels where space is at a premium. Choice of actuation includes knob, screwdriver, lever and thumbwheel.

SPECIFICATIONS

GENERAL

Contact and Terminal Material: Gold over nickel over brass.

Insulation Material: Polyester.

ELECTRICAL

Current and Voltage Rating: 0.5A @ 12 VDC, 0.3A @ 24 VDC.

Dielectric Strength:
Terminal to terminal; 1000 VAC @ 60 Hz.
Terminal to case; 1000 VAC @ 60 Hz.

Capacitance:
Terminal to terminal; 1 pF.
Terminal to case; 2 pF.

Contact Resistance Max:
Center common; <20 milliohm.

MECHANICAL

Stop Strength: 28 in. oz.

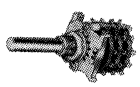
Allowable Axial Thrust: 30 lb.

Index Life: Center common; 100,000 operations.

Index Stops: Fixed.

SUBMINIATURE ROTARY SWITCH OEM SERIES 160, 180, AND 800

DISTRIBUTOR SERIES PSA AND PS



Mepco/Centralab's 1″ diameter subminiature rotary switches offer a two-ball-starwheel lateral thrust index with good torque control and feel. These switches are designed to meet the requirements of Military Switch Specification MIL-S-3786 Style SR05, and are available with ceramic, diallyl phthalate, or phenolic insulation material.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 0.55 amp. @ 28 VDC, 0.25 amp @ 115 VAC.

Current Carrying Capacity: 7 amp.

Dielectric Strength: 750 VAC between current carrying parts and ground.

Contact Resistance: Average initial 5.0 milliohms.

Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Dual-ball, side thrust.

Index Life: 50,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30°.

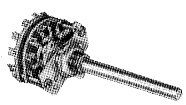
Index Stops: Adjustable.

Stop Strength: 10 in. lb. minimum.

Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 050

DISTRIBUTION SERIES SPRING RETURN



Mepco/Centralab's Series 050 has a star-wheel index utilizing a precision roller and coil spring to provide the optimum combination of both positive detent and reliable spring return. Four insulations are standard: phenolic, ceramic, diallyl phthalate or glass epoxy.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass, silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carrying Capacity: 9 amp.

Dielectric Strength: 1500 VAC between current carrying parts and ground

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Coil spring.

Index Life: 25,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Spring return, 30°.

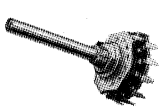
Index Stops: Fixed.

Stop Strength: 25 in. lb. minimum.

Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 070

DISTRIBUTOR SERIES PA-7000



Mepco/Centralab's Series 070 switches are economical single section switches using phenolic insulation. The formed spring index uses a small face plate area. These switches are available with up to twelve positions, and a low cost nylon shaft when ordered in large quantities.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass silver plated.

Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carrying Capacity: 9 amp.

Dielectric Strength: 1500 VAC beteen current carrying parts and ground.

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 500,000 megohms.

MECHANICAL

Construction: Open staked.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Formed spring, hill and valley.

Index Life: 25,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30°.

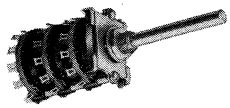
Index Stops: Fixed.

Stop Strength: 25 in. lb. minimum.

Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MINIATURE ROTARY SWITCH OEM SERIES 550 AND 557

DISTRIBUTOR SERIES PA-5000



Mepco/Centralab's Series 550 and 557 offer more features than any comparable size switch in the industrial line. A dual-ball side thrust index provides a good torque control. Phenolic, ceramic, diallyl phthalate, and glass epoxy are standard insulations.

SPECIFICATIONS

GENERAL

Clips and Rotor Contacts Material: Brass silver plated.

Insulation Material: Diallyl Phthalate, IAW. MIL-M-14F, Type SDG.

ELECTRICAL

Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp @ 115 VAC.

Current Carry Capacity: 9 amp.

Dielectric Strength: 1500 VAC between current carrying parts and ground.

Contact Resistance: Average initial 3.5 milliohms.

Surface Resistivity: Average in excess of 900,000 megohms.

MECHANICAL

Construction: Open bolted.

Mounting: Single hole, bushing mount.

Mounting Hardware: Nut and lockwasher supplied.

Index: Dual-ball, side thrust.

Index Life: 50,000 cycles minimum.

Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.

Index Angle: Positive, 30° and 60°.

Index Stops: Adjustable.

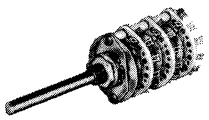
Stop Strength: 25 in. lb. minimum.

Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

ROTARY SWITCHES

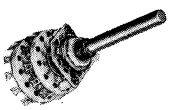
MINIATURE ROTARY SWITCH OEM SERIES 020 AND 024
DISTRIBUTOR SERIES PA-1000 AND PA-2000



Mepco/Centralab's Series 020 and 024 offers a small front plate with the quality feel of a ball and spring index mechanism. Phenolic, ceramic, glass epoxy, and diallyl phthalate insulations are available. Stops may be fixed or adjustable.

SPECIFICATIONS
GENERAL
QPL: MIL-S-3786, style SR02.
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE; Diallyl Phthalate, MIL-M-14F, Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.50 amp 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.5 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.
MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30° and 60°.
Index Stops: Adjustable.
Stop Strength: 10 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrision.

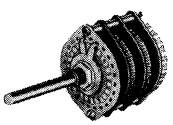
MINIATURE ROTARY SWITCH OEM SERIES 600 AND 602
DISTRIBUTOR SERIES PA-6000



Mepco/Centralab's Series 600 and 602 feature military qualifications under MIL-S-3786. Style SR03. Indexing is hill and valley ball type, available with phenolic, diallyl phthalate, ceramic, or glass epoxy insulation.

SPECIFICATIONS
GENERAL
QPL: MIL-S-3786, style SR03.
Clips and Rotor Contacts Material: Silver alloy treated for solderability.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422; Glass Epoxy, MIL-P-18177, Type GEE: Diallyl Phthalate, MIL-M-14F, Type SDG.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 2.6 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 12 amp.
Dielectrical Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 2.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.
MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Single-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Special. All metal parts non-corrosive material or suitably plated to meet 100 hour salt spray test.

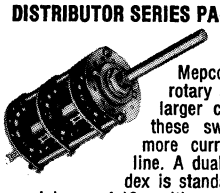
MINIATURE ROTARY SWITCH OEM SERIES 670
DISTRIBUTOR SERIES PA-4000



Mepco/Centralab's Series 670 indexing is provided by a dual-ball hill and valley index. Angle of throw is 15° with 24 maximum positions. All multiple section switches have "wing type" rotor drive which minimizes rotational lag.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Brass, silver plated.
Insulation Material: Phenolic MIL-P-3115P, Type BPEP; Glass Epoxy, MIL-P-18177, Type GEE.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 1.5 amp @ 28 VDC, 0.23 amp @ 115 VAC.
Current Carrying Capacity: 9 amp..
Dielectric Strength: 1000 VAC between current carrying parts and ground.
Contact Resistance. Average initial 5.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.
MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 15°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Material and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

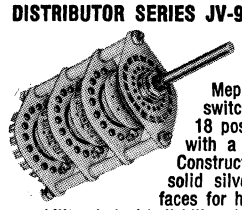
HEAVY DUTY ROTARY SWITCH OEM SERIES 300 AND 650
DISTRIBUTOR SERIES PA-3000, 1400 AND 2500



Mepco/Centralab's heavy duty rotary switches uses physically larger conductors which enable these switches to handle 50% more current than our miniature line. A dual-ball hill and valley index is standard. The Series 300 has a minimum of 12 positions with phenolic or ceramic insulation, and the Series 650 has a maximum of 18 positions with phenolic insulation.

SPECIFICATIONS
Clips and Rotar Contacts Material: Brass, silver plated.
Insulation Material: Phenolic, MIL-P-3115P, Type BPEP; Ceramic, MIL-1-10A, Grade L-422.
ELECTRICAL
Current and Voltage Rating: Make and brake resistive load 2.25 amp @ 28 VDC, 1.0 amp @ 115 VAC.
Current Carrying Capacity: 9 amp.
Dielectric Strength: 1500 VAC between current carrying parts and ground.
Contact Resistance: Average initial 3.0 milliohms.
Surface Resistivity: Average in excess of 500,000 megohms.
MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 30°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb. minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

POWER ROTARY SWITCH OEM SERIES 230
DISTRIBUTOR SERIES JV-9000



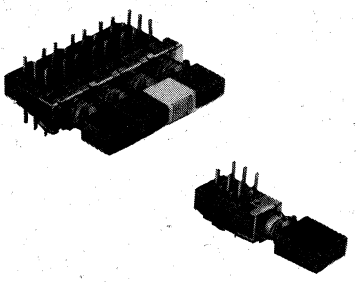
Mepco/Centralab's power switch has a maximum of 18 positions and is offered with a 20° angle of throw. Construction features include solid silver alloy contact surfaces for high current switching capability. A dual-ball hill and valley index provides high torque (100 in. oz. nominal) to ensure necessary accerelation to minimize contact arcing.

SPECIFICATIONS
GENERAL
Clips and Rotor Contacts Material: Silver alloy surface.
Insulation Material: Ceramic, MIL-1-10A. Grade L-422.
ELECTRICAL
Current and Voltage Rating: Make and break resistive load 11.0 amp @ 28 VDC, 9.0 amp @ 115 VAC.
Current Carrying Capacity: 17 amp.
Dielectric Strength: 3000 VAC between current carrying parts and ground.
Contact Resistance: Average initial 7.0 milliohms.
Surface Resistivity: Average in excess of 1 million megohms.
MECHANICAL
Construction: Open bolted.
Mounting: Single hole, bushing mount.
Mounting Hardware: Nut and lockwasher supplied.
Index: Dual-ball, hill and valley.
Index Life: 25,000 cycles minimum.
Index Torque: Standard Switches have lowest practical torque consistent with crisp detenting and smooth reliable operation.
Index Angle: Positive, 20°.
Index Stops: Adjustable.
Stop Strength: 25 in. lb minimum.
Materials and Finishes: Standard. All metal parts non-corrosive material or suitably plated to prevent rust or corrosion.

MEPCO/CENTRALAB
A NORTH AMERICAN PHILIPS COMPANY

PUSHBUTTON SWITCHES

PBS SERIES



Mepco/Centralab's PBS Series pushbutton switches mount horizontally and are available in single or multiple switch assemblies. The modular construction of the basic switch module allows design flexibility when combined with a variety of options.

SPECIFICATIONS

GENERAL
Materials: Switch Enclosure: Phenolic UL94HB. Switch Actuator: Acetal UL94HB. Terminals: Silver plated copper. Contacts: Nickel silver alloy with coin silver overlay. Mounting Hardware: Plated steel.

ELECTRICAL
Switch Function: Non-shorting, double-throw.
Contact Rating (Switching): 1.0A @ 28 VDC resistive load.
Contact Rating (Non-Switching): 11.0A.
Contact Resistance (Load of 100mA @ 2 VDC): 4 to 6 milliohms typical initial.
Dielectric Strength: Terminal to terminal; 1500 VAC. Terminal to bracket; 1500 VAC. Pole to pole; 1250 VAC.
Switch Capacitance: Terminal to terminal; 0.5pF maximum. One terminal to all others grounded. 3.5pF maximum.
Insulation Resistance (Average):

Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	100K
After 96 hrs. @ 95% RH @ 40°C. 500VDC	Terminal to Bracket Terminal to Terminal Pole to Pole	600 700 800

MECHANICAL
Switch Actuation: Momentary. Push-push.
Actuator Travel:

Actuation	Travel (Nominal)	Overtravel
Push-Push Momentary	.152 (3.86) .156 (3.96)	.050/.050 (1.27/1.52)

Actuator Force:

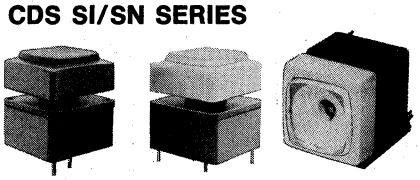
Poles	Silver Contact System
2	12-22 oz. (.34- .62) Kg
4	17-27 oz. (.48- .76) Kg
6	24-36 oz. (.68-1.02) Kg
8	30-46 oz. (.85-1.30) Kg

Button: Black button supplied attached.

CLEANING AND SOLDERABILITY
Solderability: Meets EIA standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Dry Time: 1 hour forced air dry at 52°C to 66°C.

NOTE: The performance of switches and the materials in the bracket are not adversely affected by the materials and processes encountered in typical wave soldering systems. Each customer must determine by direct experience which soldering and cleaning system is best suited to his particular needs.

CDS SI/SN SERIES



Mepco/Centralab's CDS SI (Illuminated) and CDS SN (Non-illuminated) keyswitches features a sealed contact system. The SI Style offers a wide range of backlighted legends with a variety of LED and keycap color combinations.

SPECIFICATIONS

MATERIALS
Module: Polyamide, glass reinforced UL94V0.
Actuator: Polycarbonate.
Terminals: Silver plated brass with nickel underplating.
Contact: Silver plated beryllium copper.
Keycap: Polycarbonate.
Lens: Polycarbonate.

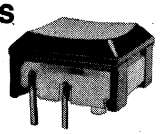
LEDS
Color: Red, green, or yellow.
Direct Current: 20mA.
Inverse Voltage: 4 VDC.
Direct Voltage: 2.4 VDC

MECHANICAL
Life: 2 million actuations.
Travel: .016" (0.40) nominal.
Actuation Force: 325 grams nominal.
Switching Action: Momentary.

ELECTRICAL
Contacts: SPST, N.O.
Voltage Rating: 24 VDC nominal—50 VDC maximum—100m VDC minimum
Current Rating: 125mA nominal.
Power Rating: 3W maximum (switched)
Contact Resistance: <20 milliohms @ 5 VDC and 10mA.
Contact Bounce: <5ms.

ENVIRONMENTAL
Operating Temperature: −25°C to +85°C. −13°F to +185°F.

CDS-PV SERIES



Mepco/Centralab's CDS-PV Series keyswitch is a versatile, economical, low profile switch. The module configurations is suited for automatic PCB insertion and is applicable to wave or drag soldering processes.

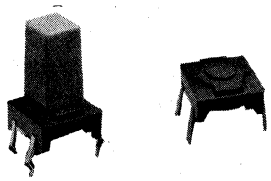
SPECIFICATIONS

MATERIALS
Module: Polycarbonate 20% glass fiber.
Contacts: Steel silver plated.
Dome Spring: Phosphor bronze silver plated.

MECHANICAL
Actuating Force: 275 gram (9.7 oz.).
Travel of Disc: 0.28-0.41mm (.011-.016 in.).
Maximum Mech. Overload: 5.45Kg (12 lb.), 60 sec. duration.
Life Expectancy: 3 million actuations.

ELECTRICAL
Contacts: SPST, N.O.
Maximum Voltage: 30 VAC.
Maximum Current: 10mA.
Contact Resistance: 100 milliohms initial, 1 ohm typical at 1 million actuations.
Operating Temperature: −20°C to +70°C (−40°F to +158°F).

CDS-PR SERIES



Mepco/Centralab's CDS-PR Series 9mm keyswitch is an SPST, momentary, snap action dome switch developed for space limiting electronic applications. This keyswitch is adaptable for automatic insertion into PWB's and compatible with automatic soldering and cleaning processes.

SPECIFICATIONS

ELECTRICAL
Contacts: SPST, N.O. Momentary.
Max. Switched Power: 10 VA.
Contact Rating: 50mA @ 20 VDC.
Max. Voltage: 50 VDC.
Contact Resistance: <20 milliohms initial (100mA @ 2 VDC). 500 milliohms after electrical endurance.
Electrical Endurance: 5 x 10^5 actuations @ maximum switching power.
Contact Bounce: <5 milliseconds.
Insulation: 100 megohms.
Dielectric Strength: 100 VAC.

MECHANICAL
Life: 1 million actuations.
Travel: .305mm (.012")
Actuation Force: 160 gr. minimum, 270 gr. maximum initial.
Return Force: <90% actuation force.

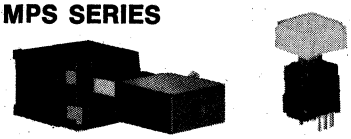
MATERIALS
Snap Dome: Silver plated phosphor bronze—nickel underplating.
Terminals: Silver plated brass—nickel underplating.
Module and Actuator: Polycarbonate 10%—glass fiber.

ENVIRONMENTAL
Operating Temperature: −10°C to 70°C.
Storage Temperature: −30°C to 85°C.
Solderability: EIA RS-178-1.
Flammability: UL94V0 Class SE.1

CLEANING AND SOLDERABILITY
Cleaning of the fluxes from the circuit board after soldering can be done with Freon* TMS or TMC fluorocarbon or equivalent solvents. Aqueous cleaning can be employed to remove aqueous flux.

*Trademark of E. I. DuPont DeNemours & Co.

MPS SERIES



Mepco/Centralab's MPS Series pushbutton switches are designed to mount vertically into pc boards and can be specified in single or multiple bracketed switch assemblies. The MPS Series offers a lighted version featuring a spot indicator of full lens illumination. Illumination is provided by an LED or an incandescent lamp.

NOTE: All products are available through distribution.

SPECIFICATIONS

GENERAL
Switch Enclosure: Molded UL94V-0 polyester.
Switch Actuator: UL94HB acetal.
Terminals: Tinned copper alloy with gold inlay.
Contacts: Gold alloy inlay on beryllium copper.
Brackets: Plated steel.

ELECTRICAL
Contacts: SPST, SPDT, and DPDT non-shorting.
Contact Rating (25 Watts Maximum): 0.5 amps resistive load @ 50 VDC or VAC. .125 amps resistive load @ 110-120 VAC.
Contact Resistance (With Load of 100 Milliamps @ 2 VDC): 50 milliohms maximum.
Contact Bounce: .5 milliseconds typical closing, 1.0 milliseconds typical opening.
Dielectric Strength: Terminal to terminal: 1250 VAC @ 60 Hz RMS for 1 minute. Bracket to terminal: 1250 VAC @ 60 Hz RMS for 1 minute.
Insulation Resistance (Average Reading):

Condition	Measured Between	Resistance (Megohms)
70% RH @ 23°C, 100 VDC	Terminal to ground Pole to Pole	1000 1000
After 96 hrs. @ 95% RH @ 40°C, 100 VDC	Terminal to ground Pole to Pole	10 10

MECHANICAL
Switch Actuation: Momentary, Push-Push.
Actuator Travel: 144 ±.004 (3.66 ±0.10).
Actuation Force At .135 (3,43) Travel):

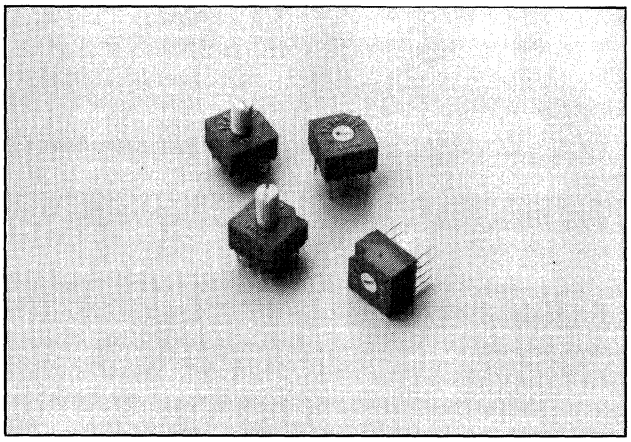
Switch Actuation	Typical Ounces (Grams)
Momentary SPST (N.O.)	2.82-3.88 (80-110)
Momentary Single Pole, DPST (N.O.), DPDT Push-Push—Single Pole	6.7-9.15 (190-260)
Push-Push—Double Pole	9.87-12.3 (280-350)

CLEANING AND SOLDERABILITY
Solderability: Meets EIE standard RS-178-A.
Wave Flow Soldering: 10 seconds @ 260°C.
PC Board Cleaning: When cleaning boards in aqueous solutions, it is recommended that the switches be completely dry prior to the application of power.
Maximum Dry Time: @ +18°C to +24°C, 40-50% RH is 24 hours; @ +66°C to +93°C, 0-10% RH is 2 hours; @ +121°C to +177°C, 0-10% RH is 15 minutes (not to exceed 1 hour).

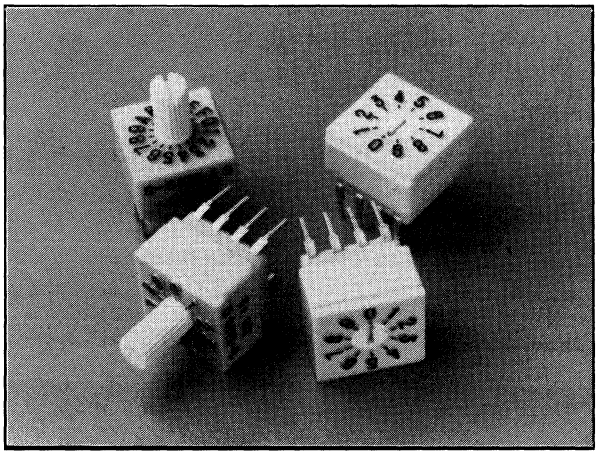
MEPCOPAL

Trimmers & Switches. Pure and Simple.

SELECTOR AND BINARY CODED DIP AND SMD ROTARY SWITCHES



Mepcopal's new **S-5000** sealed, dip rotary switches have built-in resistors and diode arrays



SS-10 SWITCHES

Switch	Number Of Positions	Type	Mounting	Size
CS-4	2 (Single Pole) 3 (Single Pole) 2 (Double Pole)	Selector Selector Selector	SMD SMD SMD	4 mm sq. 4 mm sq. 4 mm sq.
SS-10	6 (Single Pole) 3 (Double Pole)	Selector Selector	DIP DIP	10 mm sq. 10 mm sq.
S-1000	16 BCH	Digital	DIP	1/2" sq.
S-2000	10 BCD	Digital	DIP	1/2" sq.
S-5000	16 BCH* 10 BCD*	Digital Digital	DIP DIP	1/2" sq. 1/2" sq.

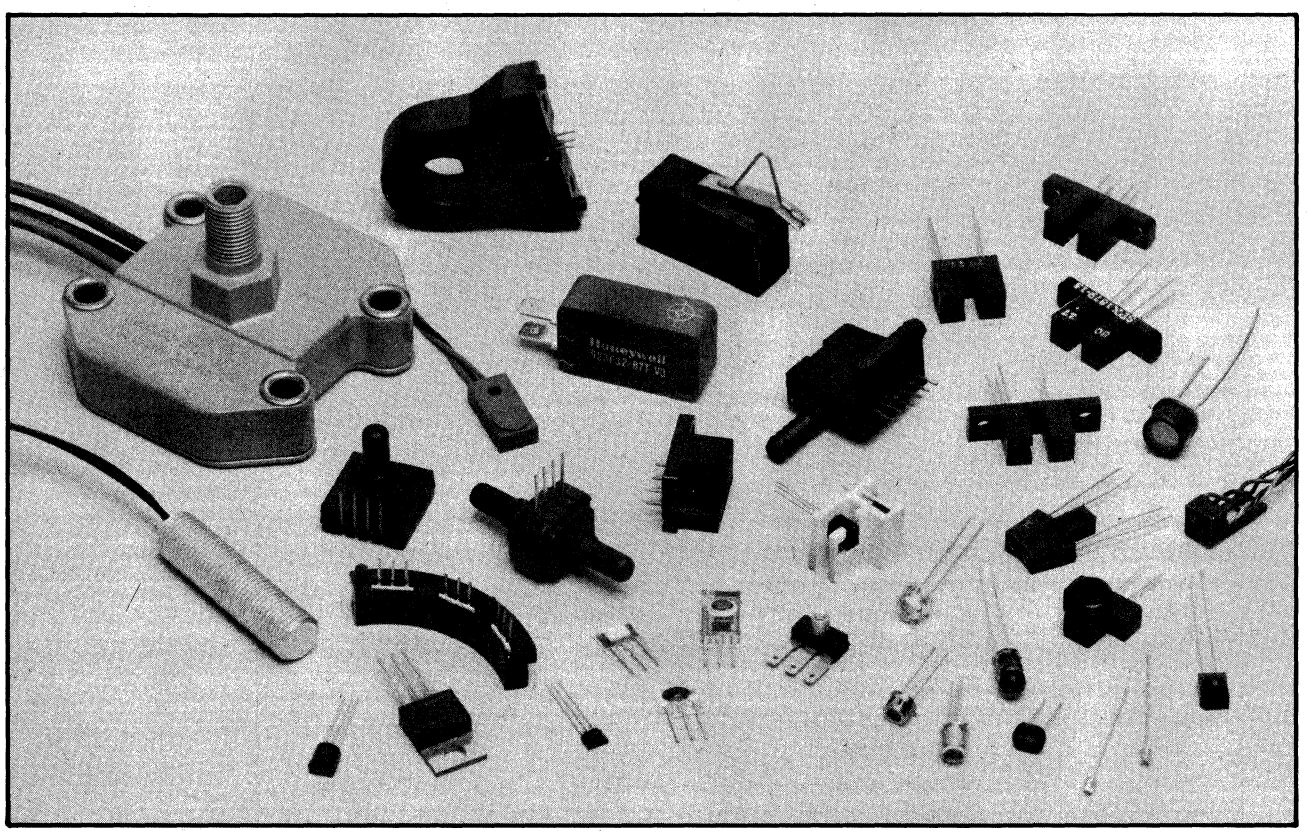
*Built-in resistor and/or diode arrays.

MEPCOPAL Mepcopal Company, 11468 Sorrento Valley Road, San Diego, California 92121
619/453-0332, FAX: 619/481-1123

Solutions for you from MICRO SWITCH, The Sensor Consultants

Sharpen your competitive edge

If you need sensors, switches, or manual controls in your product, talk to MICRO SWITCH first. You'll get the right combination of quality, reliability, price, and service that can help you thrive in today's competitive marketplace.



Solid State Sensors

Reliability, long life, and direct compatibility with other electronic circuitry combine with a multitude of other options to give you the sensor solutions you need. Whatever your choice, you can be sure that MICRO SWITCH quality means you're getting the best in solid state sensors.

- Position Sensors - Hall Effect, Inductive, and Permalloy
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- Current Sensors
- Vane Sensors
- Pressure Sensors
- Temperature Sensors
- Optoelectronic Products
- Fiber Optic Products
- Modifications, Custom Packages and Subassemblies
- Development - Other Silicon-Based Technologies

Request Catalog 20 (for pressure sensors, request Catalog 15)

Basic Switches

The originators of the first precision, snap-action basic switch, MICRO SWITCH offers you a wide variety of sizes, housings, actuators, and operating characteristics to meet your switching needs.

- Standard Size Basic Switches
- Miniature and Subminiature Basics
- Hermetically Sealed Basic Switches
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- Mercury Switches
- Modifications and Subassemblies

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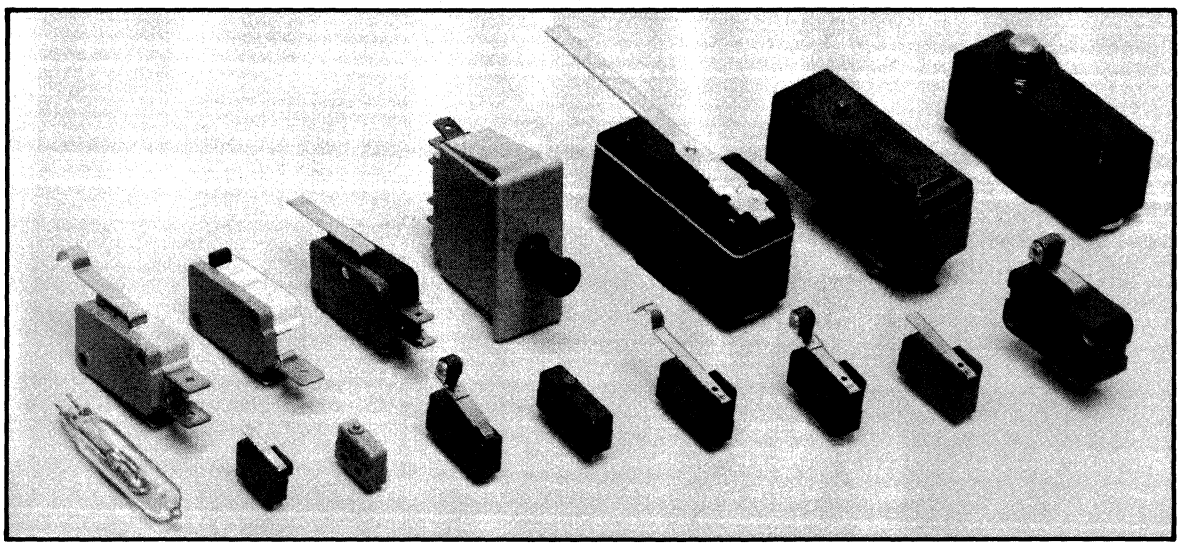

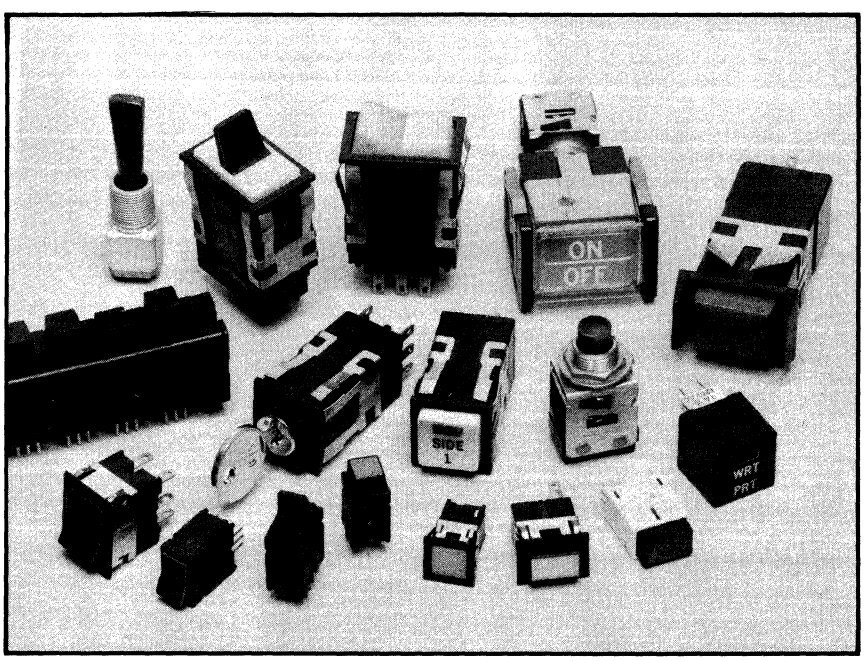

Manual Controls

Whether you're prototyping a new design or updating an existing panel, consider our broad line of standard and miniature manual controls, including our industry standard AML Advanced Manual Line. You'll get almost limitless options while improving your product's appearance and useability.

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- Rockers, Paddles, and Toggles
- Interlock Switches
- Keylocks
- Rotary Selectors
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Want more information?

See the EEM Yellow Pages for the location of your nearest branch office or authorized distributor. Or for FREE catalogs, or pricing and delivery information, call or write The Sensor Consultants at MICRO SWITCH, Dept. 740E, Freeport, IL 61032.

815-235-6600

Together, we can find the answers.

MICRO SWITCH
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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
μF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

Service to the Customer ... Worldwide

molex®

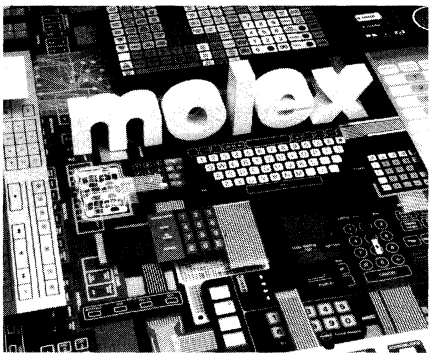
Custom-Designed and Standard Membrane Switches

The 10900 Membrane Switch consists of silver contacts deposited on two sections of a thin, flexible polyester sheet. A spacer layer with openings to create a contact gap is sandwiched between the two circuit halves and sealed with adhesive. Upon actuation the contact gap in the membrane decreases until both silver contact surfaces meet and close the circuit.

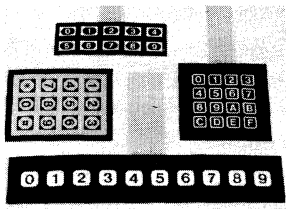
They are designed to be used in any application with low energy logic level switching requirements (28 V DC, 30mA) and resistance at termination in the 10/15 Ohm range or greater.

A custom graphic overlay is generally added for aesthetic appeal. As many as 15 colors are available on various laminates including velvet, suede, gloss or matte polyester or polycarbonate. Embossing, metallic finishes, and backlighting can also be specified as well as various circuitry and mounting options.

Tactile feedback and hybrid construction are also available



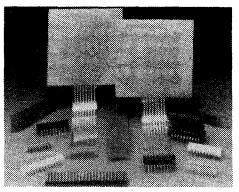
Molex Standard Membrane Switches



Molex realizes that often times your touch panel requirements could be satisfied by a **standard configuration** designed to easily interface with most common digital circuits.

We have, therefore, established a line of **readily available** Membrane keypads for those applications that do not justify a custom switch.

Standard switches are available from your local Molex distributor and may be purchased with or without standard graphic overlays and adhesive mounting sheets.



Molex Connectors for Membrane Switch Tails

Specifications (Standard switches)

Electrical:

Contact Rating - 28V DC, 30mA max.
Life - 5 million operations min. at maximum contact rating
Termination Resistance - 10/15 ohms nominal (depends on circuit configuration); 100 ohms max.
Contact Bounce - Less than 3 milliseconds
Switch Capacitance - Less than 20 Pf
Available Circuit Codes -
a. SPST with 2 outputs per switch
b. SPST with common bus
c. X-Y Matrix
d. Other circuit variations available upon request

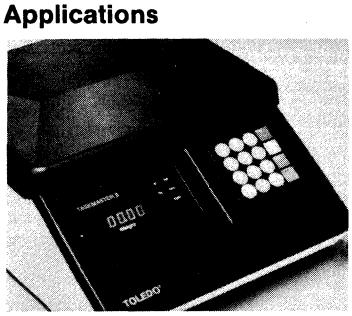
Mechanical:

Actuation Force - 2 to 8 ounces
Button Travel - .005 to .008
Shock - 50 G. (3 hits on each axis)
Panel Thickness - .025/.040 typical
Graphics - 2nd surface printing of multiple colors; special effects, textures and embossing
Mounting - Adhesive back or mounting holes

Environmental:

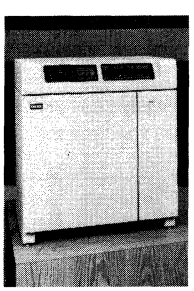
Temp. Range (storage & oper.) - 40°C to 70°C
Humidity - Per Mil STD 202E, Method 103B
Salt Fog - 5% salt solution for 48 hours

Applications



Commercial Counting Scales

Television Controls



Industrial Controls

Telecommunications

Also: Security systems, Professional music synthesizers, Audio-visual equipment, Data processing equipment, Electronic typewriters, Electronic organs, Microwave ovens, Electronic games

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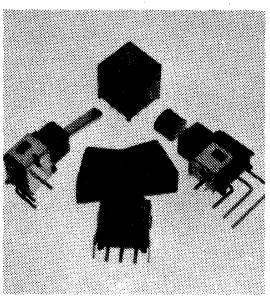
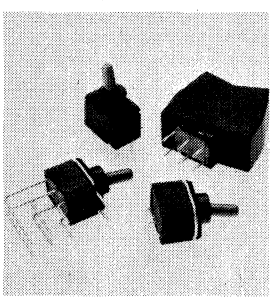


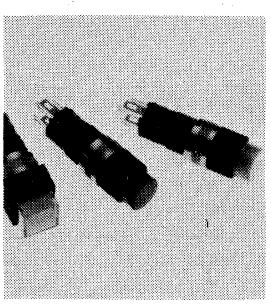
SUPER-SUBMINIATURE PCB WASHABLES

Toggles, paddles, rockers & pushbuttons can be assembled to PC boards for time- & money-saving wave soldering & cleaning. Award-winning STC contacts for high reliability, dry circuit operation. Anti-static bushings. Companion slide actuated switches available.



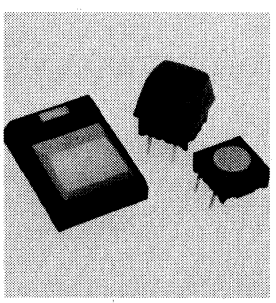
WORLD'S SMALLEST WASHABLES

Micro-subminiature G & GB Series toggles, rockers, & pushbuttons are sealed to allow contamination-free automated wave soldering & washing. Patented STC contacts for unmatched logic-level reliability. Straight, vertical & right angle terminals match standard .100" PCB grid spacing.



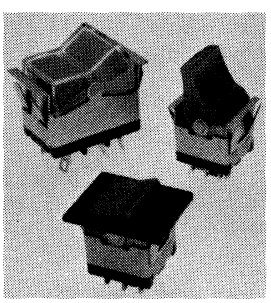
ULTRA-SMALL LED PUSHBUTTONS

HB Series SPDT momentary & alternate action LED pushbuttons perform the same functions as many competitive types twice their size. Allow high density, space efficient panel mounting. Plus, special sliding contact mechanism cleans contacts with each actuation to provide exceptional reliability. Ratings of 0.1A/30V AC & DC.



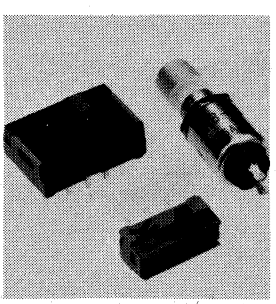
WASHABLE LOW PROFILE KEYPAD SWITCHES

Illuminated & nonilluminated models. Wide choice of cap styles & colors with legending possible on many. Extremely reliable (5 million actuations minimum). Sealed contact mechanism allows time- & money-saving automated wave soldering & washing.



LIGHTED PADDLES & ROCKERS

Snap-in 5A SPDT & DPDT MLWs & 10A DPDT LWs feature independent lamp circuits & are relampable from the front of the panel. Offered with a variety of colored rockers & paddles in all circuits. Incandescent lamps available in several voltages. Also, special LED versions.



ULTRA-SMALL, ULTRA-RELIABLE PUSHBUTTONS & SLIDES

Mighty midgets delivering big performance: SS slides with top & side actuation for maximum design flexibility; 3-on & LED models also. Tiny 500mA/125V AC FB pushbuttons with self-cleaning contacts guaranteeing 50,000 min. electrical operations, plus sealed terminals.

LIGHTED TOGGLE, ROCKER, PADDLE TIPS

The LED tips on these NKK-innovated M2100 subminiature toggle, rocker & paddle switches change color when the position of the acutator is changed. Choose 6A, 3A & dry circuit models. Solder lug, quick connect, straight PC & right angle PC terminations. SPDT, SP3T & DPDT.

NKK backs you with quick delivery and competitive prices on just about every type of switch you'd expect from a leading manufacturer, plus a lot you won't find anywhere else. The first washable super-subminiatures; the world's smallest washable toggles, rockers and pushbuttons; LED toggle tips that change color -- all are NKK "firsts." Want quality as well as innovation? Nobody builds a more reliable logic-level contact mechanism than NKK's patented, award winning STC (Sliding Twin Crossbar) system. Whether it's our tiny SS slides or our mighty 50 Amp powerhouse, you get premium quality and reliability without paying a premium price.

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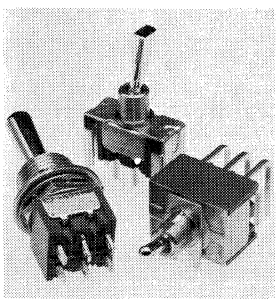
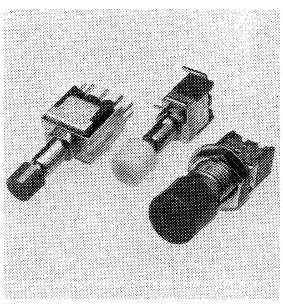


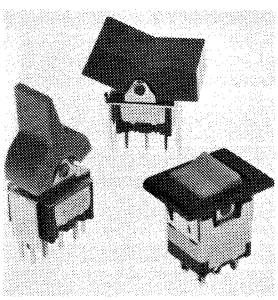
HUGE VARIETY OF SUBMINIATURE TOGGLES

One of the industry's largest & most reliable families of subminiature toggle switches. 1-4 pole, 1-3 throw & all circuits. 6A & logic-level ratings. Numerous toggle lengths. Straight, right angle, vertical PC, wirewrap & quick connect terminals, many with mounting brackets. Many options.



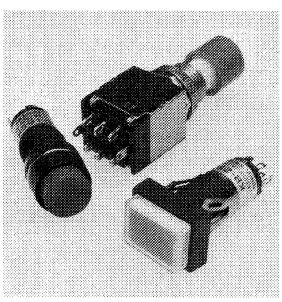
HIGH RELIABILITY SUBMINIATURE PUSHBUTTONS

Numerous poles & circuits. 6A, 3A & logic-level ratings. Solder lug, quick connect, straight PC & wire-wrap terminals. UL & CSA approvals. 100,000 mechanical operations minimum. Options include screw-on & snap-on caps, splashproof boots, mounters & colored shrouds.



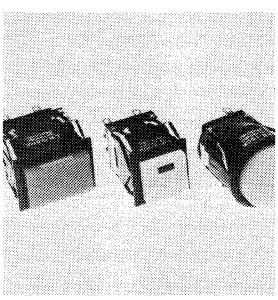
SUBMINIATURE ROCKER SWITCHES

Flat frame, snap-in or PC bracket-mounted models in all circuits & terminations. Rocker actuators available in numerous sizes, colors & configurations. 6A, 3A & logic-level rated models. SPDT, DPDT, SP3T, 4PDT & DP3T types. False illuminated switches offered, plus bezels with 1 or 2 LEDs.



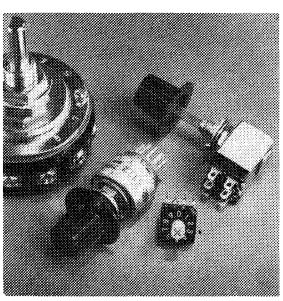
MINIATURE & POWER RATED PUSHBUTTONS

1A & logic-level rated KB switches w/round, square & rectangular actuators. Snap-in & bushing mounted models w/high reliability snap-acting mechanism for 100,000 minimum mechanical operations. 5A power rated DLBs feature high visibility, engravable round & square faces. Incandescent, neon & LED lamps.



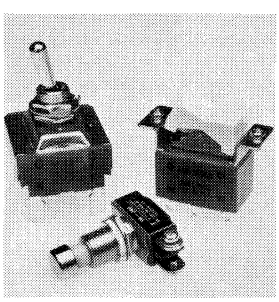
HIGH VISIBILITY LIGHTED PUSHBUTTONS

Square, round, & rectangular faced LB pushbuttons provide maximum visibility & aesthetics, yet mount compactly. SPDT & DPDT models available in momentary & alternate action (with latchdown feature) in a wide selection of lens styles, colors & light sources.



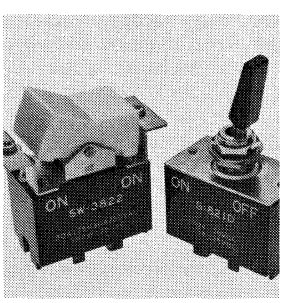
WIDE VARIETY OF ROTARY SWITCHES

Choose from a wide variety of rotaries in all sizes & ratings including MRA washable miniature models with SP 12-position, DP 6-position & 4P 3-position, plus larger rotaries from 6A to 30A. All models have adjustable stops. Logic-level binary coded DIP switches also offered.



LARGE SELECTION OF STANDARD SIZE TOGGLES, ROCKERS & PUSHBUTTONS

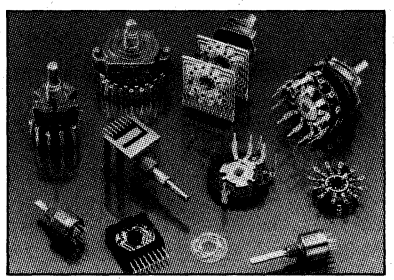
Huge variety of SPST, SPDT & DPDT toggles, rockers, & push-buttons with 3A to 25A ratings. Solder lug, quick connect, screw-on & PCB terminations. Numerous pushbutton cap, toggle & colored rocker/paddle options.



HIGH CAPACITY S SERIES TOGGLES & ROCKERS

DPDT & 3PDT, bushing mounted toggles & rockers rated at 30A 125V/250V AC (resistive load). 30A/30V DC toggles available. Special heavy duty 50A model toggle is also offered.

OAK Switches and Solenoids

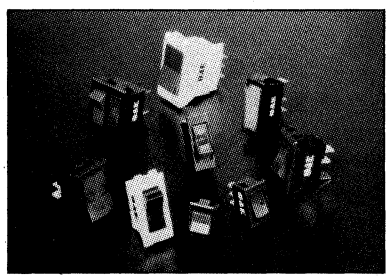


Rotary Switches

Oak rotary switches come in a variety of standard sizes and can be custom engineered to meet any design parameters. Most are qualified to MIL-S-3786 and many feature Oak's patented Unidex® detent system with dual-wiping self-cleaning contacts. Oak's complete line of rotary switches includes:

- Compact 1" "Acorn"
- Series 500 1/2" diameter single section
- Series 850 square, sealed contact programmable
- Economical 1" diameter "Monodex"
- Ultra-compact Series One-Half Inch multisection
- Economical Series 1300 plastic construction
- Economical printed circuit rotary switches
- Two, three and four position lever switches
- Power appliance switches

Request catalog F-1050.



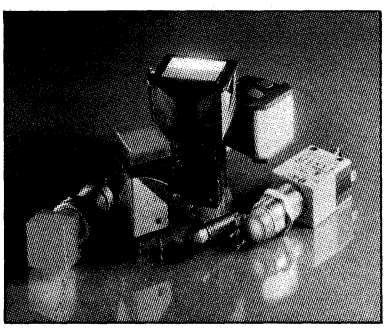
Rocker Switches

Available in an assortment of styles and colors, Oak rocker switches meet a wide range of design requirements. They are aesthetically pleasing and will complement the front panel styling of your product.

Choose from mini, single and double pole, lighted, non-lighted or LED varieties. Matching indicators are also available. Buttons come in six standard colors and nine profiles. Choose from flat, low and high "V", scalloped and contoured profile styles. Quick connect terminations are standard while PC board, solder tab, wire leads and screw terminations are also available.

Oak rockers will retrofit most existing switches and are U.L., CSA and VDE approved. All are competitively priced and many are stock items available for immediate delivery.

Request catalog F-1151.



Lighted Pushbutton Switches

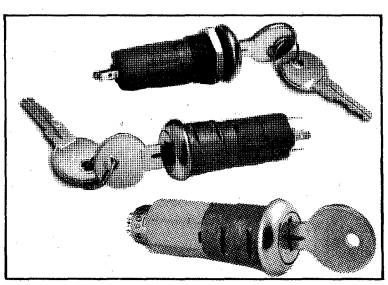
Oak Optolite™ lighted pushbutton switches and indicators come in a choice of eleven styles and nine custom colors with custom legends and various mounting options. A wide range of electrical ratings and contact configurations is available in both alternate (push-on-push-off) and momentary operation with up to 10 million duty cycles. These switches meet the military specifications for MIL-L-3661 and MIL-L-7961.

Choose from a selection of U.L. and CSA approved Optolite™ switches:

- Presslites - flexible friction cap; water tight, splashproof and E.M.I. suppressed; low profile
- Marcoflex - compact 650 series
- Indicators - subminiature, miniature, press-to-test, neon, general purpose
- Lamps - little and big QT
- Panel lights
- Series 150 - momentary pushbutton

Oak Optolite™ switches are competitively priced and many are stock items available for immediate delivery.

Request catalog IPI-1060.

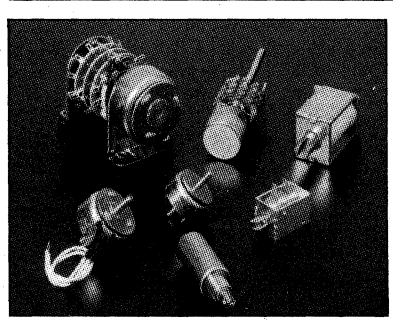


Keylock Security Switches

Oak anti-static keylock switches provide up to 20kV static protection for sensitive electronic circuitry. The compact size at 3/4" diameter is especially made for high density packaging. Available in single pole only, the keylock's operating life is tested up to 10,000 cycles.

The Series 500 keylock combines a high security switch with the versatility of the Series 500 rotary switching options. Available with up to six tumblers, it is explosion-proof and has a solid detent feel. Switching comes in one pole with up to 12 positions and two pole with up to 6 positions.

Oak Types A and F rotary keylocks are designed for applications combining maximum security with low-power switching. These tamper-proof keylocks are available in cylindrical and flat key styles with panel or durable bracket mounting. A range of standard key pull locations is available.



Solenoids

Whether rotary or linear, Oak has a solenoid for virtually any application. Rotary solenoids are available in eight basic types with 12, 18, 20 or 24 positions. They can be provided in either right or left hand with strokes from 25 degrees to 75 degrees.

Oak linear solenoids include flat pack, tubular or box frame styles. Flat pack: cover forces up to 85 lbs., push or pull strokes up to 0.400" with speeds as fast as two milliseconds. Box frame: pull ranges from 1 oz. to 4.5 lb. (AC) and 1 oz. to 20 lb. (DC). Tubular: pull, push or spring return with holding force ranges from 18 oz. to 16 lb. intermittent duty.

Also available are rotary solenoid selectors mating rotary solenoids with Oak's custom switch sections.

Request catalog F-1160 and F-1161.

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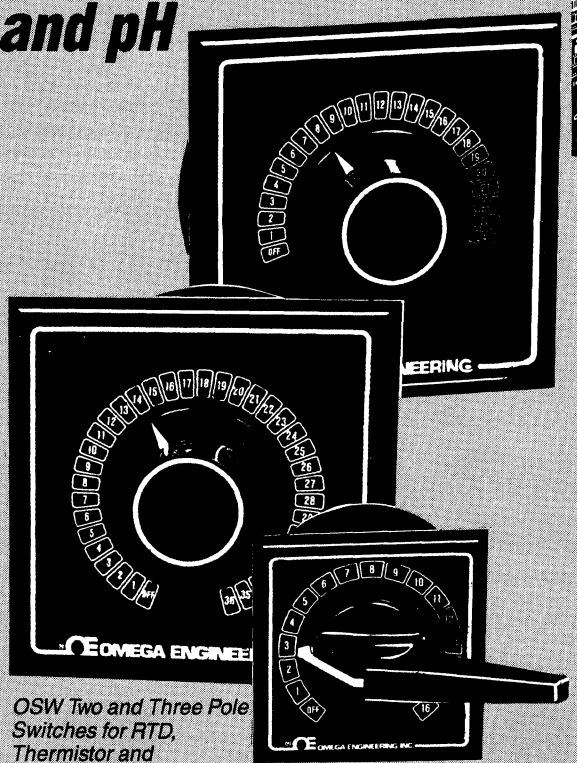

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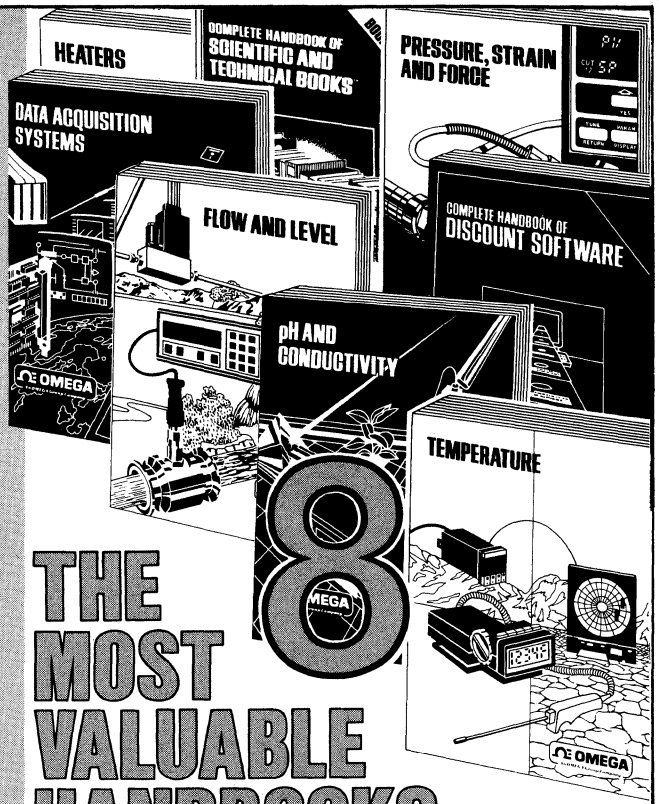

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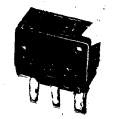
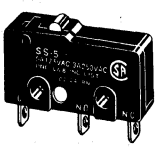
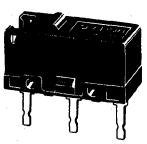
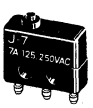
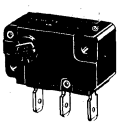
OMRON Basic Snap Action Switches

	General-Purpose Basic Switches			Miniature Basic Switches		
Model (Dimensions in Inches)	**Z**	**X**	**A**	**V**	**K**	**D2A**
						
	1.94″ L x 1.5″ H x 0.69″ W	1.94″ L x 1.95″ H x 0.69″ W	1.94″ L x 1.11″ H x 0.69″ W	1.49 L x 0.74″ H x 0.41″ W	1.70″ L x 0.63″ H x 0.41″ W	.315″ L x .236″ H x .157″ W
Features	Best selling switch offers high precision and more than 40 stock actuator styles.	Direct current switch with built-in magnetic blowout and 13 stock actuator styles.	High-capacity switch handles loads with large in-rush currents; 11 actuator styles.	General-purpose and low-force types break a wide range of loads, 7 stock actuator styles.	Economical switches with three choices of insulation barrier, 7 stock actuator styles.	Ultra-small size, linear action. Break before make and make before break contact configurations.
Rated Current	15 A (480 VAC)	10 A (125 VAC)	20 A (480 VAC)	0.1 to 21 A (125 VAC)	1 to 5 A (125 VAC)	0.1 A (30 VDC)
Operating Force (OF) Range (with pin plunger type)	8.8 to 12.3 oz.	18.0 oz.	14.1 to 22.0 oz.	0.9 to 14.1 oz.	0.42 to 1.76 oz.	1.05 to 3.53 oz.
Mechanical Service Life (operations)	20,000,000	1,000,000	5,000,000	10-50,000,000	20,000,000	50,000
Approval Standards	UL, CSA, SEV	UL, CSA, SEV	UL, CSA, SEV	UL, CSA, VDE, SEMKO	UL (TV-1, TV-2), CSA, SEV, SEMKO, VDE	—

	Subminiature Basic Switches				Low-Torque Basic Switches
Model (Dimensions in Inches)	**SS**	**D2F**	**J**	**D2MQ**	**D2MC**
					
	0.78″ L x 0.40″ H x 0.25″ W	0.50″ L x 0.26″ H x 0.22″ W	0.50″ L x 0.35″ H x 0.20″ W	0.32″ L x 0.50″ H x 0.11″ W	1.22″ L x 1.09″ H x 0.72″ W
Features	Economical, long-life basic switch offers 3 operating forces, 5 popular actuator styles.	Small, lightweight switch available in low-force and microvoltage versions.	Ultra-small size, yet capable of switching large capacity loads.	Extremely small switch ideal for equipment miniaturization.	Highly reliable rotary-action type for low torque operation; high capacity and micro-load versions.
Rated Current	0.1 to 10.1 A (125 VAC)	0.1 to 3 A (125 VAC)	7 A (125 VAC)	.05 to 0.5 A (30 VDC)	.5 to 5 A (125 VAC)
Operating Force (OF) Range (with pin plunger type)	0.9, 1.8 or 5.3 oz.	0.9 to 5.3 oz.	4.9 oz.	4.2 oz.	0.07 oz.-in.
Mechanical Service Life (operations)	30,000,000	300,000	10,000,000	30,000	10,000,000
Approval Standards	UL, CSA, SEMKO,	UL, CSA	UL, CSA	—	UL, CSA

Specifications subject to change without notice.

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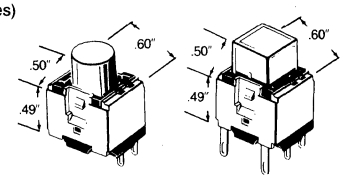
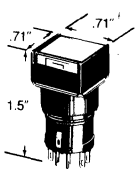
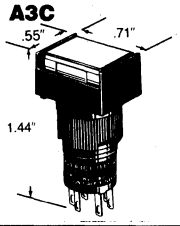
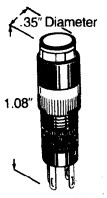
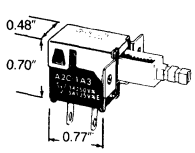
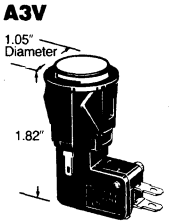
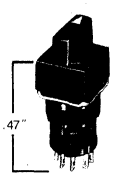
OMRON Pushbutton Switches

Model (Dimensions in Inches)		A3A	A3B	A3C	A3D
					
Features		Compact pushbutton switch covers power to signal switching.	Round, square or rectangular LPB-.63 in. dia.	Round, square or rectangular LPB-.47 in. dia.	Round, square or rectangular LPB-.35 in. dia.
Mounting		Flange mount PCB direct mount	Retainer, Snap-in	Retainer	Retainer
Action	Momentary	○	○	○	○
	Alternate	○	○	○	○
Indication Type/Screen Pattern		Non-lighted type LED Spot-illumination type. LED Surface-illumination type. Mechanical-indication type.	LED or Lamp Full surface illumination	LED or Lamp Full surface illumination	LED Full surface illumination
Control Output		High capacity type SPST-NO, 125 VAC 6A. (Resistive load). General-purpose type DPDT, 125 VAC 3A (Resistive load). Microload type SPST-NO, 30 VDC 0.1A. (Resistive load).	General Purpose SPST-NO, 125 VAC 0.5A. Mircoload SPST-NO, 125 VAC 0.1A.	General Purpose SPST-NO, 125 VAC 0.5A. Microload SPST-NO, 125 VAC 0.1A.	Microload SPST, 30 VDC 0.1A.
Indication Unit		—	○	○	○

Model (Dimensions in Inches)		A2C	A3V	A3B-S	A3B-K
					
Features		Miniature power switch with short 0.05" keystroke.	Round, pushbutton with built-in basic switch.	Selector switch in broad variety of shapes and configurations that require only 22 mm mounting depth.	Keyed switch in broad variety of shapes and configurations that require only 22 mm mounting depth.
Mounting		Flange mount	Snap-in	Nut mounting.	Nut mounting.
Action	Momentary	○	○	○	○
	Alternate	○	○	○	○
Indication Type/Screen Pattern		Non-lighted type	LED or Lamp Full surface illumination	None	None
Control Output		SPST-NO, DPST-NO; 250 VAC, 3A; 250 VAC, 5A (resistive load).	HIgh capacity SPDT, 250 VAC 15A.	SPST-NO + SPST-NO, DPST-NO + DPST-NC	SPST-NO + SPST-NC, DPST-NO + DPST-NC
Indication Unit		—	—	—	—

NOTE: ○ denotes availability.

Specifications subject to change without notice.

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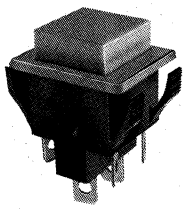
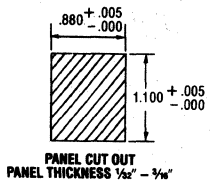
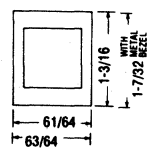
OSLO SWITCHES

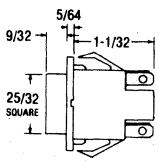
TYPE D Lighted & Non-lighted Pushbutton Switches



ALL DIMENSIONS IN INCHES

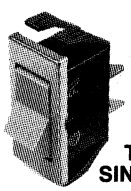






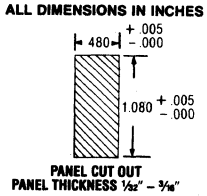
FEATURES
10 amps 125/200VAC ¼ HP 125VAC UL CSA
Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- Lamp voltages
- LED display
- Circuit arrangements
- Momentary or alternating actions
- Color combinations
- Lens markings

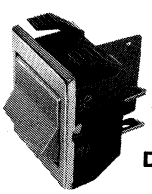
TYPE RS (Single-pole) & RT (Double-pole) Rocker Switches



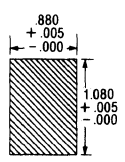
TYPE RS
SINGLE-POLE

ALL DIMENSIONS IN INCHES



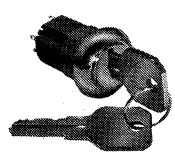


TYPE RT
DOUBLE-POLE

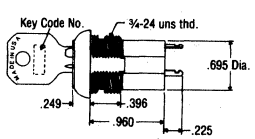


FEATURES
20 amps 125/250VAC ¾ HP, 125/250VAC UL, CSA
Snap-in panel mounting with options in:
- Lighted or non-lighted styles
- Lamp voltages
- LED display
- Circuit arrangements
- Maintained or momentary actions
- Color combinations

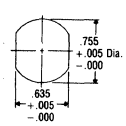
TYPE K Low-cost Keylock Switches

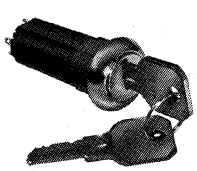


STANDARD
STYLE

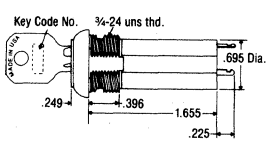


PANEL
MOUNTING





ANTISTATIC
STYLE



ALL DIMENSIONS IN INCHES

FEATURES
Key operated protection with options in:
- Standard compact style or anti-static version for static discharge protection
- Key operate & removable positions
- Circuit arrangements
- Stainless steel or chrome lock finishes
- Terminal styles

SPECIFICATIONS
4 amps @ 125VAC or 28VDC
2 amps @ 250VAC
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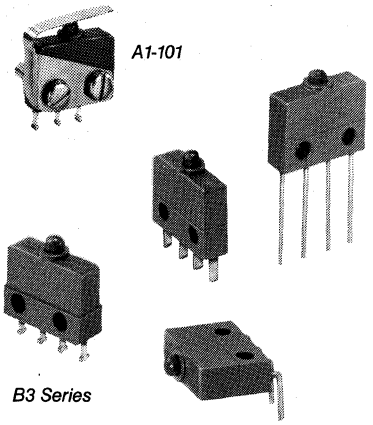
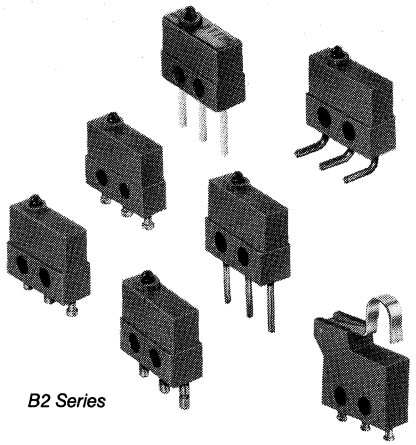
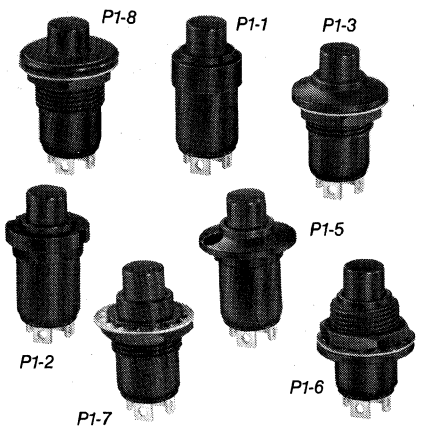






Double-break Basics

Subminiature snap-action military and commercial switches available in .200″ (MIL-S-8805/76) and .156″ (MIL-S-8805/101) wide versions. Choice of pc pins, solder turret, wire-wrap and right angle pc terminals; 5 or 6 ounce operating force; X, Y, Z, & C contact forms and gold plated or flashed silver contacts. Complete line of auxiliary actuators available and described below as P4 series.

Standard Characteristics:

Contact Rating: 7 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip Point Repeatability: Within .005″
Operating Force: 5 oz. +3, -2
Release Force: 1.5 oz. min.
Movement Differential: .018″ ± .008″
Overtravel: .006″ min.
Mechanical Life: 1 million cycles
Electrical Life: 50,000 cycles @ full load
Body Size: .510″L x .350″H x either .200″ or .156″W.
Terminals: Turret & PC, .125″L; Wire-wrap, .500″L.

Single-break Basics

Subminiature snap-action military and commercial switches available in .200″ (MIL-S-8805/4), .156″ (MIL-S-8805/109) and MIL-S-8805/106 (hi-temp) versions. Choice of 3 lengths of pc pins, single or double turret, wire-wrap and right angle pc terminals; 4, 5 or 6 ounce operating force and gold plated or flashed silver contacts. In addition to integral lever actuator models, there is a complete line of auxiliary actuators available and described below as P4 series.

Standard Characteristics:

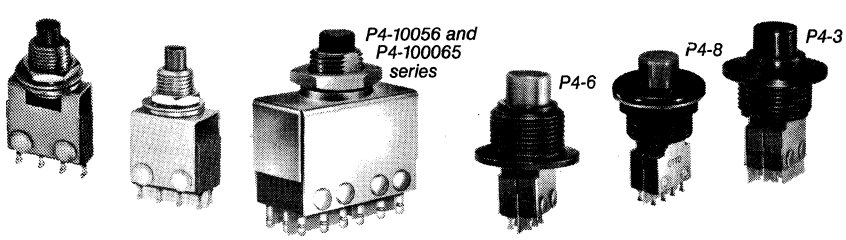
Contact Rating: 7 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .005″
Operating Force: 5 oz. +3, -2
Release Force: 1.5 oz. min.
Movement Differential: .018″ ± .008″
Overtravel: .006″ in.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Body Size: .510″L x .350″H x either .200″ or .156″W.
Terminals: Turrets, .090 & .225″L; PC, .090, .125″ & .270″L; Wire-wrap, .300″L.

Sealed Military Pushbuttons

Featuring patented rolling sleeve principle, The P1 series offers moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 7 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

Standard Characteristics:

Contact Rating: 10 amperes, resistive.
Contact Resistance: .015 ohms, max.
Tip point Repeatability: Within .001″
Operating Force: 4 lbs.
Release Force: 1 lb. min.
Overtravel: .012″ min.
Mechanical Life: 250K cycles, NO/NC; 50K NC/5-Term.
Electrical Life: 25,000 cycles @ full load
Button Size: .375″Dia. x .250″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum

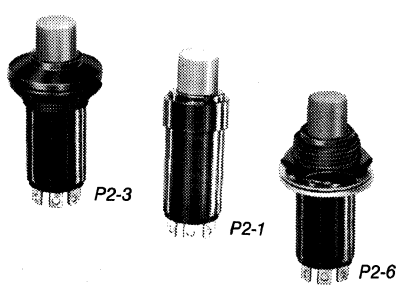


Auxiliary Actuators for B2 & B3 Basics

These actuators feature OTTO's B2 & B3 basic switches. Styles P4-1 and P4-4 are available in 1 to 4 pole arrangements.

Series P4-100056 features switches with silver contacts and P4-100065 gold contacts and are momentary actuators for 1 to 6 poles of B2 basics. Styles P4-3, P4-8 and P4-6 are moisture proof sealed at the panel and match P1, P3 and P5 in panel appearance. Also available are sealed RFI shielded, two-step and waterproof sealed constructions.

A variety of toggle actuators are also available.



twostep™ Sequential Contact Action

Ideal for "Off-High-Low", "Off-Slow-Fast", "Stop-Fine-Course" and other 3 mode applications. Each level operates an independent set of SPDT circuits rated 5 amps. Six contact arrangements are offered to satisfy most circuit requirements. Also available as DPDT single detent. Moistureproof construction. 25,000 mechanical cycle life. Make-before-break contact option available.

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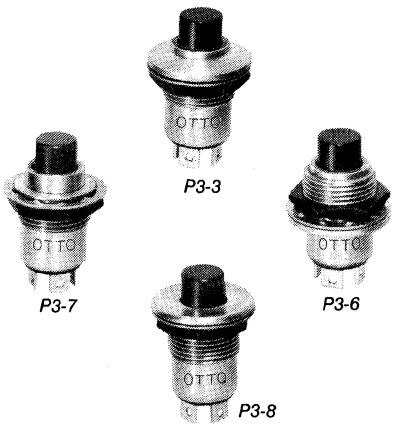
Precision Switches

OTTO CONTROLS

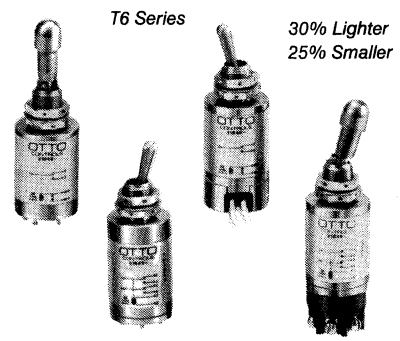


Sealed Pushbuttons

The P3 series is the commercial version of the P1 series and also features OTTO's patented rolling sleeve principle for effective moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 4 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

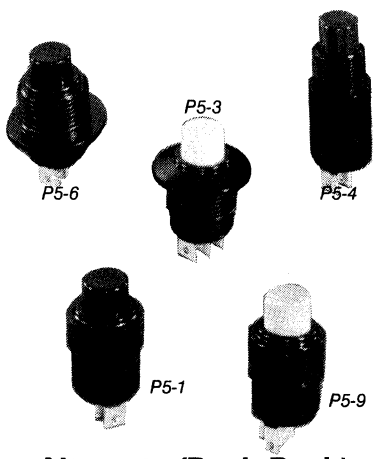
Standard Characteristics:

Contact Rating: 10 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .001″
Operating Force: 4 lbs. ± 1 lb.
Release Force: 1 lb. min.
Overtravel: .012″ min.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .375″Dia. x .250″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum, clear anodized



Environment-free Sealed Solenoid Held Toggles

Exclusive one piece, all stainless steel housing saves weight and back of panel space. Coil is self-shielding and will not emit stray magnetic fields. Positive tactile feed-back. Sealed against immersion and corrosive atmosphere. Qualified to MIL-S-5594.

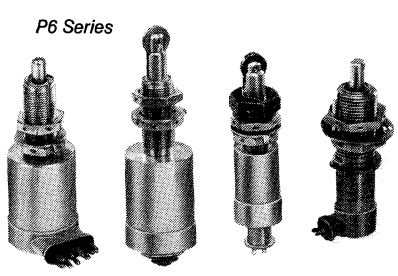


Alternate (Push Push) Action

The P5 series offers the alternate action switch function matching the panel appearance of the momentary action P1 and P3 series. Now you can design panels with both functions and still have a uniform appearance. The button returns to the original position after each actuation. Offered in moisture and dust tight sealed construction in addition to unsealed.

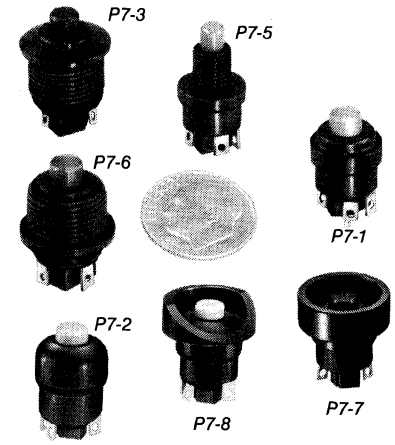
Standard Characteristics:

Contact Rating: 5 amperes, resistive.
Contact Resistance: .025 ohms, max.
Dust Tight: Per MIL-S-8805, Symbol 2.
Operating Force: 4 lbs. ± 1 lb.
Release Force: 1 lb. min.
Overtravel: .012″ in.
Total Travel: .180″ max.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .375″Dia. x .250″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: 1.1 inch max.
Case Material: Aluminum, anodized



Environment-free Sealed Plunger Switches

Sealed against immersion and corrosive atmospheres. Rugged mechanically and electrically. Employs OTTO's B2 and B3 basic switches. Complies with MIL-S-8805/104. One piece housing is sealed at the plunger with ring seals and at the base with a resilient header. Fourteen models.

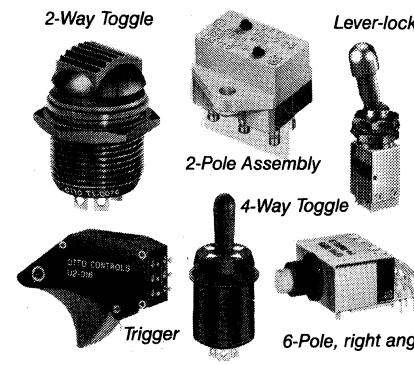


Sealed Sub-Subminiature Pushbuttons

The P7 series incorporates all of the environmental characteristics of the P1 and P3 pushbuttons but in a sub-subminiature package. It also features OTTO's patented rolling sleeve principle for effective moisture proof and dust tight sealing. Water proof to 3 feet of pressure is available on special order. There is a choice of 7 bezel/button styles with 9 button colors, all featuring positive tactile feed-back.

Standard Characteristics:

Contact Rating: 5 amperes, resistive.
Contact Resistance: .025 ohms, max.
Tip point Repeatability: Within .001″
Operating Force: 1.7 lbs ± .5 lb.
Release Force: .5 lb. min.
Overtravel: .012″ min.
Mechanical Life: 50,000 cycles
Electrical Life: 25,000 cycles @ full load
Button Size: .190″Dia. x .125″ from bezel.
Button Material: Nylon in 9 colors.
Back of panel depth: .375 inch max.
Case Material: Aluminum, anodized



Special Purpose Designs

Panel sealed, waterproof and unsealed momentary, maintained or multi-level with detent action pushbuttons, toggles with multiple positions and gangs, lever-lock action, 2-way (toggle/pushbutton) and other actions.

2 East Main Street • Carpentersville, Illinois 60110 • Phone: 312/428-7171 • FAX 312/428-1956 • TELEX: 72-2426

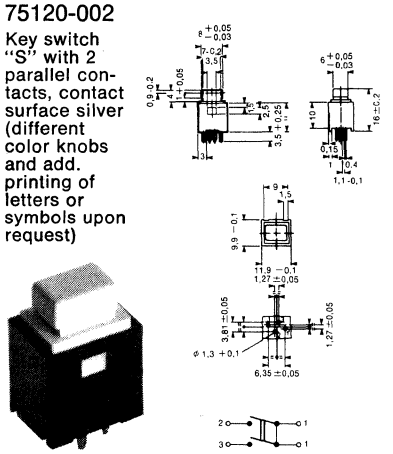
Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (312) 438-4000 • Telex 297-112 PEI UR • FAX 312-438-5522

SWITCHES

KEY SWITCHES

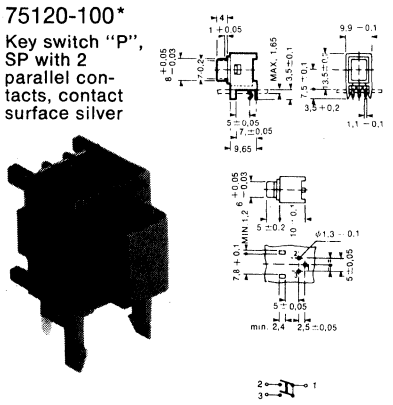
75120-002

Key switch "S" with 2 parallel contacts, contact surface silver (different color knobs and add. printing of letters or symbols upon request)



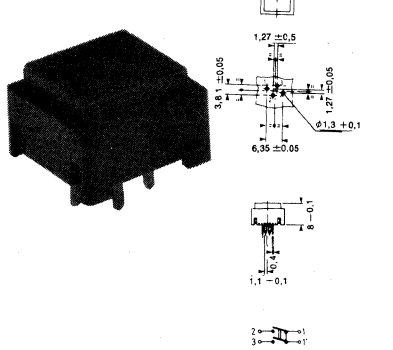
75120-100*

Key switch "P", SP with 2 parallel contacts, contact surface silver



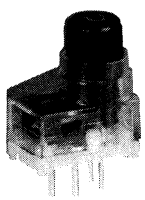
75120-008

Key switch, flat, "S" s.p. with 2 parallel contacts, contact surface silver



75121-000 (NEW)

Key switch w/LED SPST



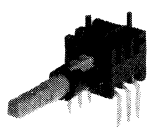
Switch Rating	0.025 A, 30 V DC or AC
Contact Resistance	≤150 mOhms contact surface silver ≤200 mOhms contact surface gold
Bounce	≤0.2 msec.
Typical Life	>200,000 switching cycles
Stroke	$0.9_{-0.2}$ mm
Actuating Force	1.4 ±0.2N
End Stop Force	>50 N
Flammability	UL 94 V −1

PUSH-PUSH SWITCHES

70052-032

MINIATURE KEY SWITCH "P"

DPDT, for p.c. mounting
Special knobs upon request



70052-034

As above, but different shaft
Knobs in different colors available

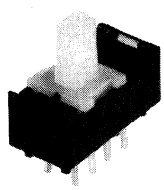
TECHNICAL DATA

Part No.	Switch rating	Contact resistance	Operational force (stroke)	Life
70052-032	0,5 A 12 V	≤20 mOhm	<4 N (3.5 mm)	10.000
70052-034	0,05A 250 V			

4-POSITION SLIDE SWITCH

74650-013*

Slide switch SP, 4 switching positions, "S"



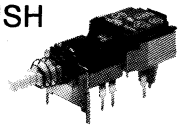
SPECIFICATIONS

Switch Rating	100 mA 30 V DC
Dielectric Strength	500 V AC
Insulation Resistance	>100 MΩ
Contact Resistance	≤100 mΩ
Life	≥1,000 cycles
Operational Force	1 N to 5 N
Contact Force	ca. 0.4 N

(different colors of knobs and add. printing of letters or symbols upon request)
Contact surface gold upon request

ME-5 SERIES POWER SWITCHES "SOFT TOUCH" PUSH-PUSH

70060-003
70060-014
70060-200
70060-208



Preh combines superior quality & wide flexibility in offering the ME-5 series power switches (DPST). This complete line is available in printed circuit or solder terminals. Optional SPST auxiliary switches (1A/24V, AC/DC) available. Accessories such as a dust cover, fuse holder, etc. also available on request.

Approvals:

VDE, UL, CSA, N,

D, S, SEV, BSI

TECHNICAL DATA

Part No.	Power rating	Contact resistance	Operational force (stroke)
70060-003	2,5/100 A 250 V (IEC 65)	<50 mOhm (<30)	≤6 N (3,5/5.7 mm)
70060-014	2,5/100 A 250 V (IEC 65)	<50 mOhm (<30)	≤6 N
70060-200	4/100 A 250 V (IEC) 65)	<50 mOhm (<30)	≤6 N
70060-208	4/100 A 250 V (IEC) 65)	<50 mOhm (<30)	≤6 N

70053-006

Minature push-push switch DPDT. Available in optional 90° degree P.C. mount.

TECHNICAL DATA

Part No.	Switch rating	Contact resistance	Operational force (stroke)	Life
70053-006	2,4 A 10 V	≤40 mOhm	<5 N (4,0/2,5)	10.000

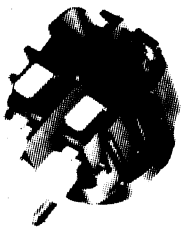
***DETAILED CATALOG AVAILABLE UPON REQUEST**

PRES:AIR:TROL CORP
PRES:AIR:TROL
1009 W. Boston Post Road, Mamaroneck, NY 10543
FAX (914) 698-9456
(914) 698-2026 • 800-431-2625 (OUTSIDE NY)

PRESSURE AND VACUUM SWITCHES
• AND •
SAFE SWITCHING SYSTEMS
(Shock-Proof • Water-Proof • Explosion-Proof)

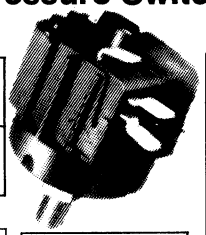
Low Cost Pressure Switches

File Number E80254



Low Pressure

SPDT	Range Inches Water	Electrical Rating
6731/03	1.5 - 7	3A 125 VAC
6731/06	5 - 45	10A @ 250 VAC
6731/10	20 - 55	15A



Vacuum Switches

6721/06	6721/20	6721/30	6721/40
7" · 15" water	13" · 38" water	28" · 80" water	75" · 270" water
SPDT 10A 125/250 VAC	SPDT 16A 125/250 VAC	SPDT 16A 125/250 VAC	SPDT 16A 125/250 VAC

Field pressure adjustment is Phillips Head Screw.

Approx. Overall Size
2¼" x 2" O.D.

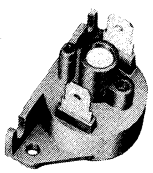
Medium Pressure

SPDT	DPDT	P.S.I.	Electrical Rating
6741/20	6742/20	1.5 - 3.5	
6741/30	6742/30	3.0 - 5.5	
6741/40	6742/40	5 - 10	
6741/50	6742/50	8 - 18	16AMP 125/250 VAC • 21 AMP 1 HP Avail
6741/60	6742/60	16 - 30	
*6741/70	6742/70	25 - 55	
*6741/80	6742/80	45 - 75	
*6741/90	6742/90	60 - 120	
——	6702	20 - 200	

Pressure Connector 1/8" NPT

* Consult Factory For Repeat Accuracy

See main catalog for detailed specs.

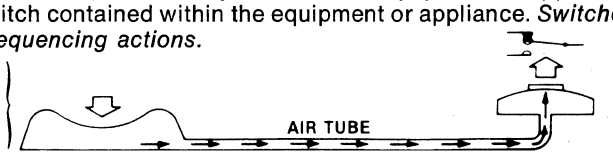


Sensitive Pressure, Vacuum and Differential Pressure Switching
(Your Choice)

Part No.	Rating	Adjustable Pressure Range Inches W.G.	Adjustable Vacuum Range	Adjustable Max. Diff. Pressure
6753	.5 Amp	.5 to 16 Inches W.G.	.5 to 16 Inches W.G.	16 Inches W.G.

• WATER, SHOCK AND EXPLOSION PROOF SWITCH SYSTEMS •

Instead of a switch connected by cable to the equipment or appliance, an air bellows is joined by tubing to a pressure switch contained within the equipment or appliance. *Switches are available in momentary, alternate action, or sequencing actions.*

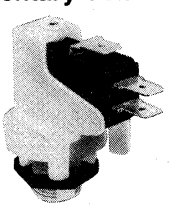


Air Switches

1. 2HP @ 240VAC
   1HP @ 120VAC
   21 AMP
2. Variety of mounting choices
3. Acetel plastic body which ensures high mechanical stability and minimum absorption.

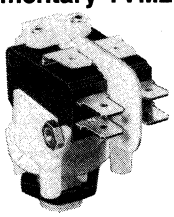
FILE #E80254
FILE #LR69099-1

ON/OFF TVA211A Momentary TVM211A



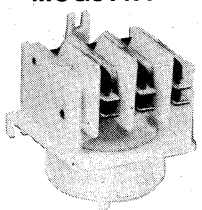
"Tinytrol"™ Single SPDT

ON/OFF TVA211A Momentary TVM211A



"Tinytrol" Double DPDT

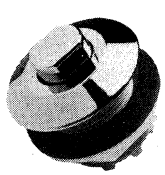
4-Function MCG311A



"Magictrol"™ Sequencing

Air Actuators

The air bellows actuators in any of the various forms, are not affected by water, dirt, dust or flammable gases. Only a few of the many actuators available are shown here. Standard electrical footswitches also available.



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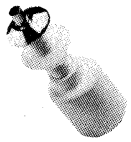
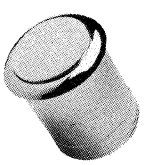
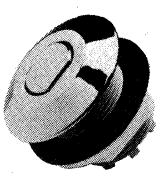


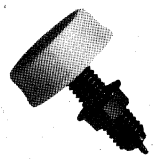
B513A



B318A

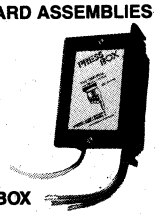


B225F



6433

STANDARD ASSEMBLIES



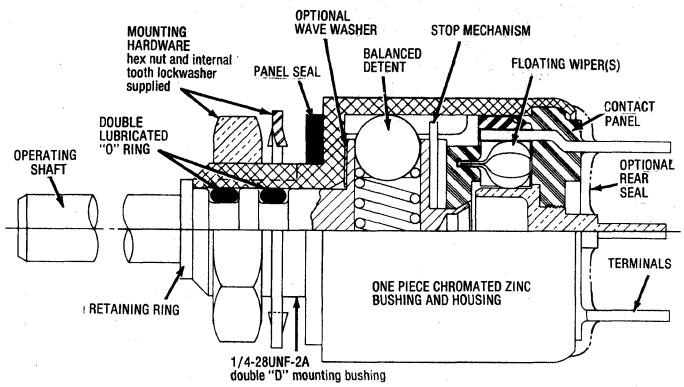
PRESS BOX

Shallco

SHALLCO, INC.
PRECISION ELECTRONIC COMPONENTS
SMITHFIELD INDUSTRIAL PARK • P.O. BOX 1089 • SMITHFIELD, N.C. 27577 • 919/934-3135

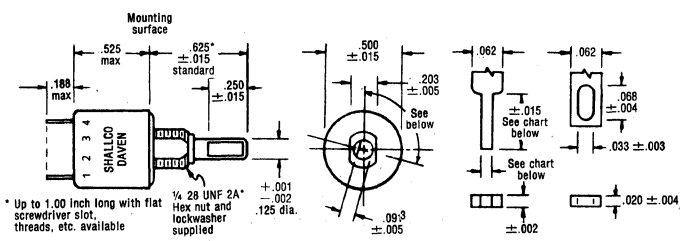
½ INCH SUBMINIATURE ROTARY "C" SWITCH

The Shallco subminiature ½ in. diameter "C" Series combines time proven (over 30 years) internal construction i.e., rotor, stator, wiper, with a cost effective die cast operating shaft and housing.
The Shallco "C" Series switches are designed to satisfy the most demanding industrial and commercial instrumentation requirements.
Shallco offers a unique ½ inch, 3 pole, 4 position, 30° switch and a greater selection of 36°, 45° and 60° switches than any other manufacturer.
The most cost effective switch combines the die cast shaft and housing. However, brass and stainless steel shafts are available and provide the flexibility needed to meet your exact requirements without over specifying. No other manufacturers offers this service.
Our nationwide network of representatives (see EEM yellow pages) is ready to respond to your requirements in an expeditious manner.



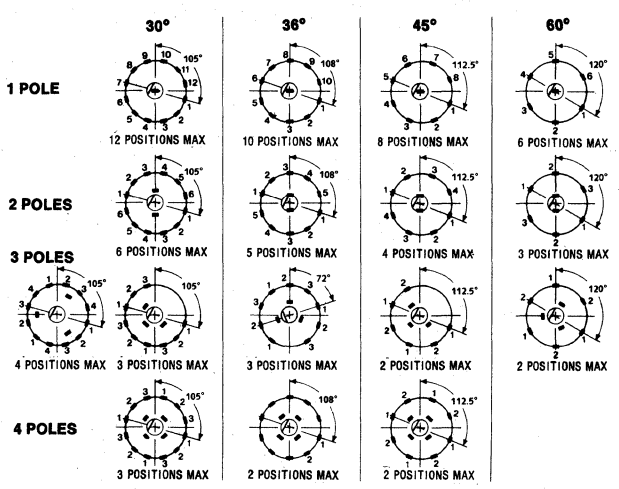
Daven Internal Construction Design — Proven Reliability Since 1951

DIMENSIONS



SCHEMATICS

All one pole commons are either .028 dia. pin for P/C terminals or .065 dia. turret for solder lug terminals. All switches are supplied with the maximum complement of terminals.



SPECIFICATIONS

MATERIALS:

Bushing and housing (1 pc.): Chromate coated zinc die cast

Operating shaft: Chromate coated zinc die cast; optional brass or stainless steel

Contacts/Terminals: Gold-plated

Contact panel: Molded Thermoset plastic

Detent: Balanced system with two balls and spring

Wiper: Floating (rosebud) beryllium copper, gold plated

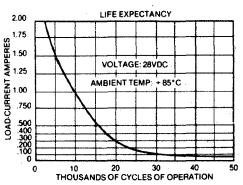
Seals: Shaft and bushing: double lubricated "O" ring. Panel: flat gasket - standard "O" ring - optional. Rear terminal seal: optional (see above)

Rotational torque: 10 inch ounces min.

Stop torque: 7.5 inch lb. min.

ELECTRICAL:

Contact Resistance: 20 milliohms max. thru life; 10 milliohms max. initial; see life curve



Insulation Resistance: 10,000 megohms minimum thru life; 50,000 megohms initial (as measured between mutually insulated parts)

Voltage breakdown (DWV): 600 Vac between mutually insulated parts

Life: 25,000 cycles minimum at .200 amp, 28 Vdc (resistive load) at +85°C

ENVIRONMENTAL:

Shock: MIL-STD-202 type "M" and "H" (medium and high shock)

Vibration: MIL-STD-202, method 204, test condition 3, grade 3 and also MIL-STD-810, method 514 procedure II, part 3, curve AF for X, Y and Z axis

Operating temperature range: −65°C to +85°C

Storage temperature range: (Non-operating exposure) −65°C to +125°C

General: Switches will meet or exceed the requirements of MIL-S-3786/20, thermal shock (−65°C to +125°C), salt spray, explosion, construction "E" and "F", stop strength, bushing strength (15 lb.), terminal strength, shaft and panel seals, sand and dust.

HOW TO SPECIFY

*Poles	Terminals	Indexing	Series	Contacts
1	P=PC	30°	"C"	"M" Shorting
2	S=Solder Lug	36°	Zinc	"B"
3		45°	Housing	Non-shorting
4		60°		

†Positions	Stops	Shaft Length, fms	Flat Length	Shaft Material
02	"F" Fixed	16ths of inch	16ths of inch	Z=Zinc
to		10=.625 Standard	04=.250 Standard	B=Brass
12	"R" Continuous Rotation	16=1.000 max.		S=Steel

† See schematics

fms = from mounting surface
1004 is standard. Shaft lengths up to 1.00" max. and various flat locations are optional.

Example: 1P36CB10R1004Z
1 pole, PC, 36°, C series, Non-shorting, 10 positions, continuous rotation, .625 long shaft (includes bushing), .250 long flat opposite position #1, chromate coated zinc operating shaft

Shallco

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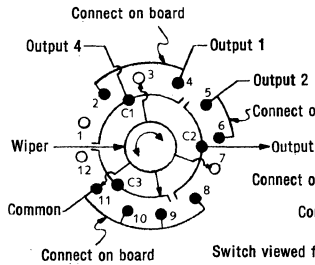
PRECISION ELECTRONIC COMPONENTS
SMITHFIELD INDUSTRIAL PARK • P.O. BOX 1089 • SMITHFIELD, N.C. 27577 • 919 934-3135

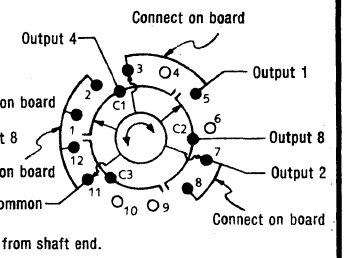
½ INCH BINARY CODED ROTARY SWITCHES

Schematics

Binary Coded Decimal Series 126



Complement Binary Coded Decimal Series 127



Switch viewed from shaft end.

• = terminals provided
o = terminals removed

Wiper shown with switch in position #1. Shaft flat diametrically opposite position #1.

Factory fixed stops available to limit rotation.
All switching is non-shorting.

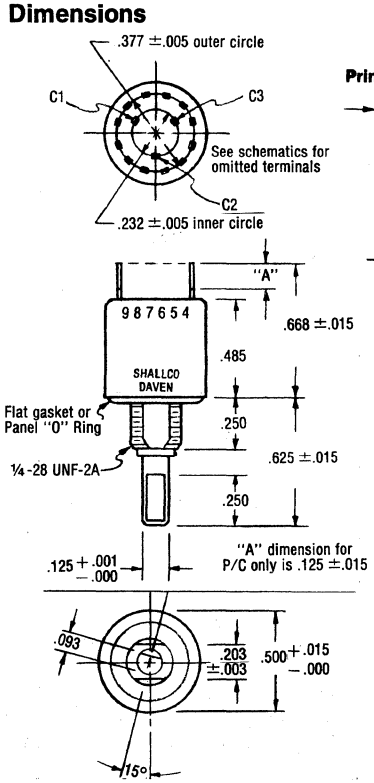
BCD

Switch Position	Common made to output: 1	2	4	8	BCD Output
1					0
2	•				1
3		•			2
4	•	•			3
5			•		4
6	•		•		5
7		•	•		6
8	•	•	•		7
9				•	8
10	•			•	9
11		•		•	10
12	•	•		•	11

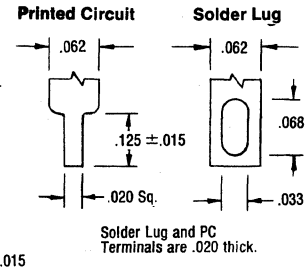
Complement BCD

Switch Position	Common made to output: 1	2	4	8	BCD Output
1	•	•	•	•	0
2		•	•	•	1
3	•		•	•	2
4			•	•	3
5	•	•		•	4
6		•		•	5
7	•			•	6
8				•	7
9	•	•	•		8
10		•	•		9
11	•		•		10
12			•		11

Dimensions



Terminals



Solder Lug and PC Terminals are .020 thick.

SPECIFICATIONS

MATERIALS:

Bushing and housing (1 pc.): Stainless steel, nickel plated brass or chromate coated zinc die cast

Operating shaft: Stainless steel, brass or chromate coated zinc die cast

Contacts: Copper alloy with plated gold over nickel

Detent: Balance double balls of brass. Spring is steel

Shaft & panel seals: Double "O" ring shaft seal is standard. Flat gasket panel seal is standard. "O" ring panel seal is optional

Contact panel: Diallyl phthalate per MIL-M-14

ELECTRICAL:

Life: Up to 25,000 cycles with a resistive load of .200 Amps, 28 volts DC max.

Contact Resistance: 20 milliohms initial; 100 milliohms after life

Insulation Resistance: 50,000 megohms initial; 10,000 megohms after life

Voltage breakdown (DMV): 500 VAC between mutually insulated parts

MECHANICAL:

Stop torque: 7.5 pound inches minimum

Rotation torque: 8 to 24 ounce inches at room temperature

Optional seal: Can be sealed to withstand total immersion in FC 40/43 for 30 seconds @ +85°C

Long Life: To insure prolonged use or storage life, the contacts of the ½" binary coded switch are constructed with gold plating over silver. Shafts are available in lengths up to 1.00 inch (fms) in brass, stainless steel or zinc die cast to meet your specific requirements. Dougle "O" ring shaft seals are standard.

Compatible: Series 126 is available with up to 12 positions fixed stop, or continuous rotation, binary coded decimal (BCD) with 30° indexing. Its complement, the Series 127, is also furnished with up to 12 positions BCD. Both P/C and standard solder terminals are available.

PART NUMBER CODING

PART NUMBERING SYSTEM

126 or 127 ■ ■ - ■ ■ - ■ - ■ ■ - ■

- Flat length 0 through 8 in 1/16" increments
- Shaft length from mounting surface 5 through 16 in 1/16" increments
- Type of terminals P = P.C. S = Solder lug
- Number of positions 2 through 12 Add "CR" for continuous rotation
- Shaft material S = Stainless steel B = Brass Z = Die cast zinc
- Case material S = Stainless steel B = Brass Z = Die cast zinc
- Series

Shallco

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PRECISION ELECTRONIC COMPONENTS
SMITHFIELD INDUSTRIAL PARK • P.O. BOX 1089 • SMITHFIELD, N.C. 27577 • 919/934-3135

8, 14 AND 16 PIN DIPSWITCHES

SPECIFICATIONS

MECHANICAL:

Case and Cover: Molded plastic with a min oxygen index of 28%
Contacts: Beryllium copper or CA 725 with gold over nickel, plated or clad. Have wiping action
Detented positions: 6, 8 and 10
Life: 10,000 cycles min.
Shaft operating torque: 1 to 2 inch ounces
Stop torque: 30 inch oz. min w/ext. stop. See external stop arrangement

ELECTRICAL:

Contact resistance: .050 ohms max.
DC insulation resistance: 10,000 megohms
Dielectric strength: 1000 Vac
Rated loads: 115 Vac or 28 Vdc at .125 amp

ENVIRONMENTAL:

Moisture resistance: Per MIL-STD-202, method 106
Operating temperature: −40 to +85°C (−40 to +185°F)
Resistance to solvents: Per MIL-STD-202, method 215
Shock: 10 g's per MIL-STD-202
Solderability: Per MIL-STD-202, method 208
Thermal shock: Per MIL-STD-202, condition A, −55 to +85°C, 5 cycles (−67 to +185°F)
Vibration: 15 g's up to 500 Hz Per MIL-STD-202

TRUTH TABLE PROGRAMMING

Shorting	Available on 60° only.
Non-shorting	Available on 60° only.
Contact closure only	Available on 36° and 45°.

Use sample program below as a guide to developing truth tables for your application.

ADDITIONAL FEATURES

1. An internal "O" ring is in every switch.
2. All contacts are sealed on the base.
3. Cover and base are ultrasonically bonded.
4. Compatible with most PC board washes such as freons, chlorethanes and alcohols.

SAMPLE PROGRAMS

Truth Tables are examples only

	POLES			
	A	B	C	D
1				
2	•			
3		•		
4	•	•		
5			•	
6	•		•	
7		•	•	
8	•	•	•	
9				•
10	•			•

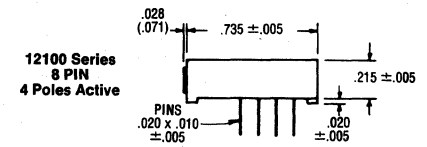
8 PIN
12100 Series
Example above is BCD, 10 position, 36° indexing

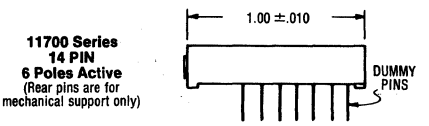
	POLES					
	A	B	C	D	E	F
1	•					
2		•				
3			•			
4				•		
5					•	
6						•
7						
8						
9						
10						

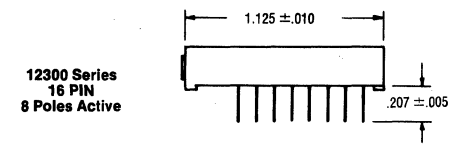
14 PIN
11700 Series
Example above is single pole, 6 position, 60° indexing

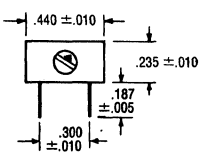
ANY combination of contact closures in ANY position is achievable within the truth table constraints.

DIMENSIONS



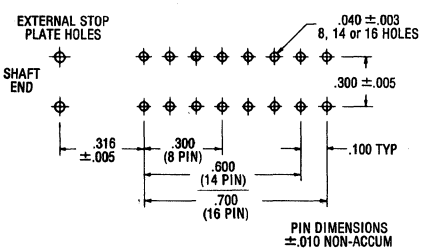






Switches above shown with standard plastic operating shaft, screwdriver slot and index mark.

BOARD LAYOUT



ALL SWITCHES AVAILABLE WITH 36°, 45° and 60° INDEXING.

PANEL MOUNTING—CONTINUOUS ROTATION ONLY—

SHAFT OPTIONS UP TO 1.00 INCH—LONG BRASS

External Stop Option
1. Requires .125" min. length brass shaft.
2. No loss of positions on 60° switch.
3. Loss of (1) position on 45° and 36° switches.

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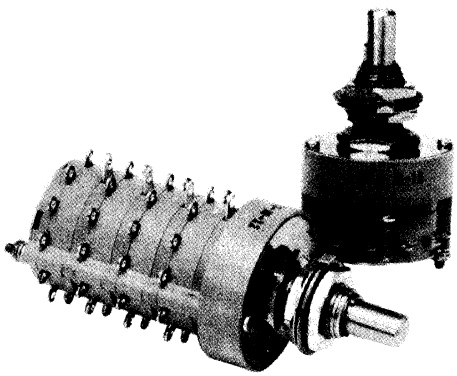
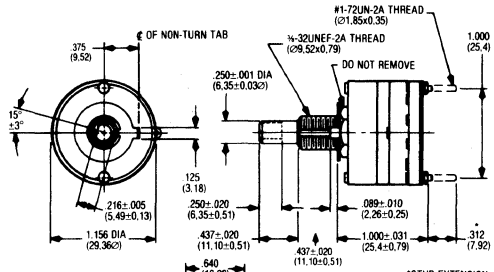
series **J**

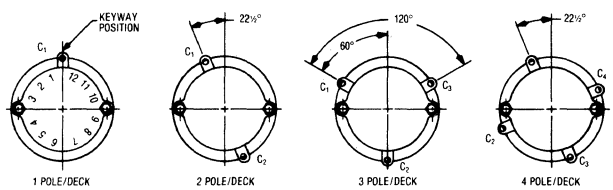
ROTARY SELECTOR SWITCHES



FEATURES OF SHALLCO ONE INCH SERIES J SINGLE OR MULTIDECK SWITCH

- Designed to meet requirements of MIL-S-3786
- Closed construction
- Smooth, positive detent
- Low, stable contact resistance





SPECIFICATIONS

GENERAL:

Designed to meet the requirements of MIL-S-3786/SR04

ELECTRICAL:

Current carrying capacity - 10 amperes
Current switching capacity - 1 ampere (28 VDC, Resistive)
Contact resistance - Initial - 5 milliohms maximum
Contact resistance - After Life - 20 milliohms maximum
Insulation resistance - 50,000 megohms
Voltage breakdown - 1000 VAC
Voltage breakdown - After Life - 500 VAC minimum

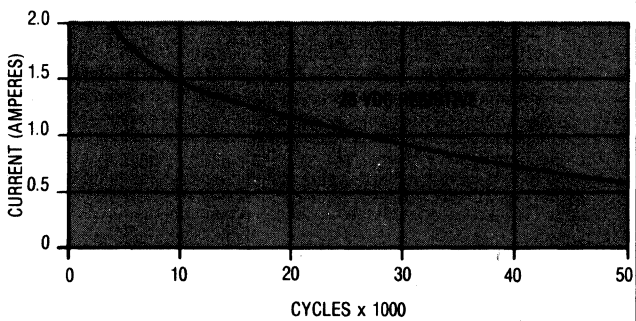
MECHANICAL:

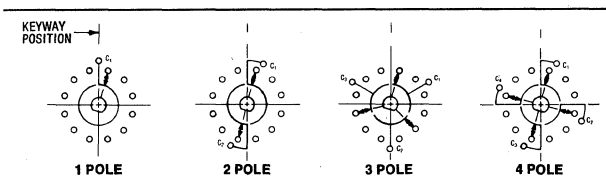
Rotational life - 50,000 cycles
Stop torque - 15 pound-inches minimum
Construction - Enclosed
Stops - Factory set
Torque - 8 to 120 ounce-inches (dependent on decks, poles/deck)
Shaft flat - Opposite moving contact, see diagrams

SHORTING				NON-SHORTING		
CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	CODE	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
1130-JM	30°	12	ONE	1130-JB	30°	12
1230-JM		6	TWO	1230-JB		6
1330-JM		4	THREE	1330-JB		4
1430-JM		3	FOUR	1430-JB		3

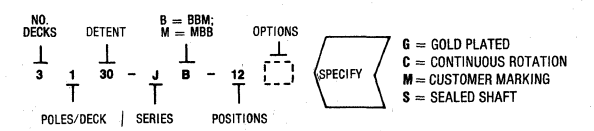
SINGLE DECK SHOWN. FOR MULTI-DECK, INCREASE FIRST DIGIT OF ABOVE CODES.

LOAD vs. LIFE

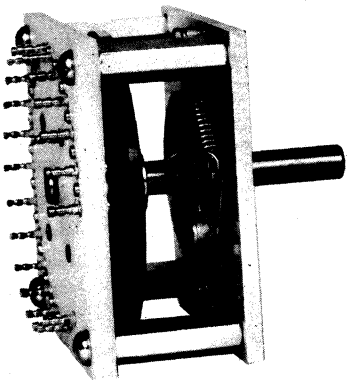




(VIEWED FROM SHAFT END AND SHOWN IN POSITION 1, EXTREME CCW POS.)



Shallco ROTARY SWITCHES SERIES C, D, AND E

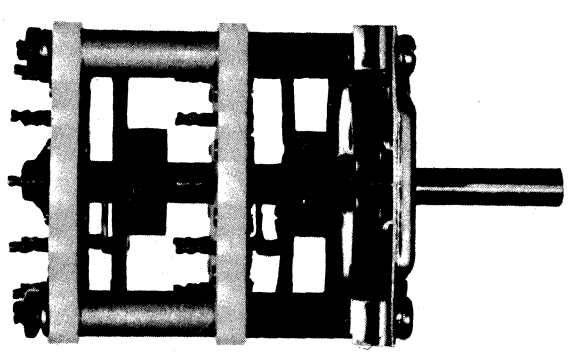


SPECIFICATIONS

GENERAL:
Meets or surpasses requirements of MIL-S-3786

ELECTRICAL:
Current carrying capacity—10 amps.
Current switching capacity—up to 2 amps.
Contact resistance—Initial—.005 ohms max.
Contact resistance—After Life—.010 ohms max.
Insulation resistance—50,000 megohms
Dielectric withstanding voltage—1500V rms
Dielectric withstanding voltage after life—1000V rms

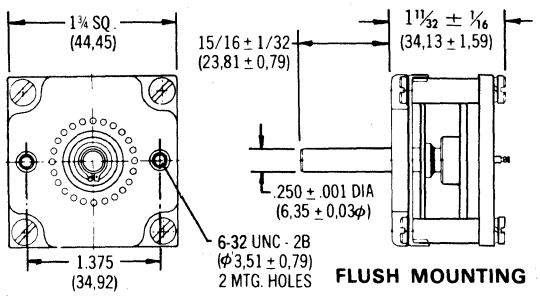
MECHANICAL:
Rotational life—50,000 cycles* min.@.250 amps.@85° C
Stop torque—50 In. Lbs.
Type construction—Open frame
Stops—Factory set to desired position.
Optional features—⅜-32 UNEF-2A bushing mount with anti-rotation pin. Shaft and front panel "O" ring seals. Spring return feature.
Concentric shafts available
Progressive shorting available
*One cycle = one full cw plus one full ccw rotation.



FEATURES OF SHALLCO 1¾, 2¼, 2¾ SQUARE SERIES C, D, E SINGLE DECK SWITCH MULTI DECKS AVAILABLE

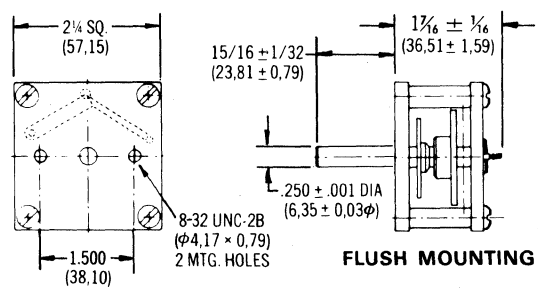
- Meets or surpasses requirements of MIL-S-3786
- Available in one pole 2-48 position through four pole 2-15 position. See ordering information
- High current carrying capacity
- Low contact resistance

SERIES C



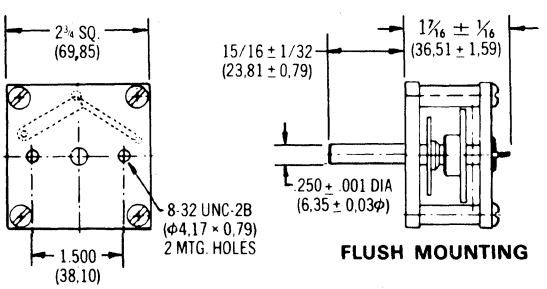
FOR ADDITIONAL DECKS ADD. 29/32 (23,02) PER DECK

SERIES D



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK

SERIES E



FOR ADDITIONAL DECKS ADD 1 1/16 (26,99) PER DECK.

REQUEST CATALOG IO FOR COMPLETE INFORMATION

NUMBERS IN ( ) ARE METRIC EQUIVALENT (MILLIMETERS)

USE ORDER FORM

SHALLCO INC. / SMITHFIELD IND. PARK / P.O. BOX 1089 / SMITHFIELD, N.C. 27577 / (919) 934-3135

SHALLCO ORDERING INFORMATION

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-CM	15°	24*	one	111-CB	30°	12**
112-CM	11¼°	32*		112-CB	22½°	16**
121-CM	15°	11	two	121-CB	30°	6
122-CM	11¼°	15		122-CB	22½°	8
131-CM	15°	5	three	131-CB	30°	3
132-CM	11¼°	7		132-CB	22½°	4
141-CM	15°	5	four	141-CB	30°	3
142-CM	11¼°	7		142-CB	22½°	4

*Maximum number of positions may be used with continuous rotation only.
**Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-DM	15°	24*	one	111-DB	30°	12*
112-DM	11¼°	32		112-DB	22½°	16*
113-DM	7½°	48		113-DB	15°	24*
121-DM	15°	24*	two	121-DB	30°	12*
122-DM	11¼°	32		122-DB	22½°	16*
123-DM	7½°	23		123-DB	15°	12
141-DM	15°	11	four	141-DB	30°	6
142-DM	11¼°	15		142-DB	22½°	8
143-DM	7½°	11		143-DB	15°	6

*Normally supplied as continuous rotation; stops available on request.

SHORTING				NON-SHORTING		
SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE	NUMBER OF POLES	SERIES	SPACING BETWEEN POSITIONS	MAXIMUM POSITIONS PER POLE
111-EM	15°	24*	one	111-EB	30°	12*
112-EM	11¼°	32		112-EB	22½°	16*
113-EM	7½°	48		113-EB	15°	24*
121-EM	15°	24*	two	121-EB	30°	12*
122-EM	11¼°	32		122-EB	22½°	16*
123-EM	7½°	48		123-EB	15°	24*
141-EM	15°	11	four	141-EB	30°	6
142-EM	11¼°	15		142-EB	22½°	8
143-EM	7½°	23		143-EB	15°	12
161-EM	15°	7	six	161-EB	30°	4
162-EM	11¼°	9		162-EB	22½°	5
163-EM	7½°	15		163-EB	15°	8
181-EM	15°	5	eight	181-EB	30°	3
182-EM	11¼°	7		182-EB	22½°	4
183-EM	7½°	11		183-EB	15°	6

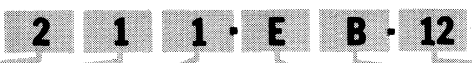
*Normally supplied as continuous rotation; stops available on request.

(Order Form to order Series C, D, E)

Order by using a six-place "shorthand" description

Example: 211—EB—12

Rotary Selector Switch, two decks, 1 pole per deck, 30° of spacing between positions, E series, non-shorting, 12 positions.



PLACE 1	PLACE 2	PLACE 3	PLACE 4	PLACE 5	PLACE 6
indicates number of decks:* 1 = One Deck 2 = Two Decks 3 = Three Decks, etc.	indicates number of poles per deck: 1 = One Pole 2 = Two Poles 3 = Three Poles 4 = Four Poles	indicates degrees of spacing between positions: Shorting 1 = 15° 2 = 11¼° 3 = 7½° Non-Shorting 1 = 30° 2 = 22½° 3 = 15°	indicates series of switch: C = C Series D = D Series E = E Series	indicates Shorting or Non-Shorting: M = Shorting (make before break) B = Non-Shorting (break before make)	indicates number of positions per pole: 2 = Two positions 3 = Three positions 4 = Four Positions, etc.

Request catalog 10 for more detailed information and additional switch types.

SHOGYO SWITCHES

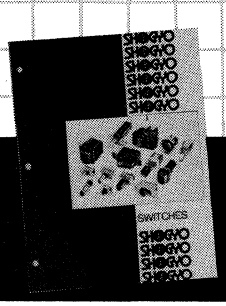
Your design deserves Shogyo quality and reliability. You deserve...

Shogyo Service... comprehensive, responsive and fast

Shogyo Professionalism... the helpful experience you need

Shogyo Prices... always competitive, usually better

and...



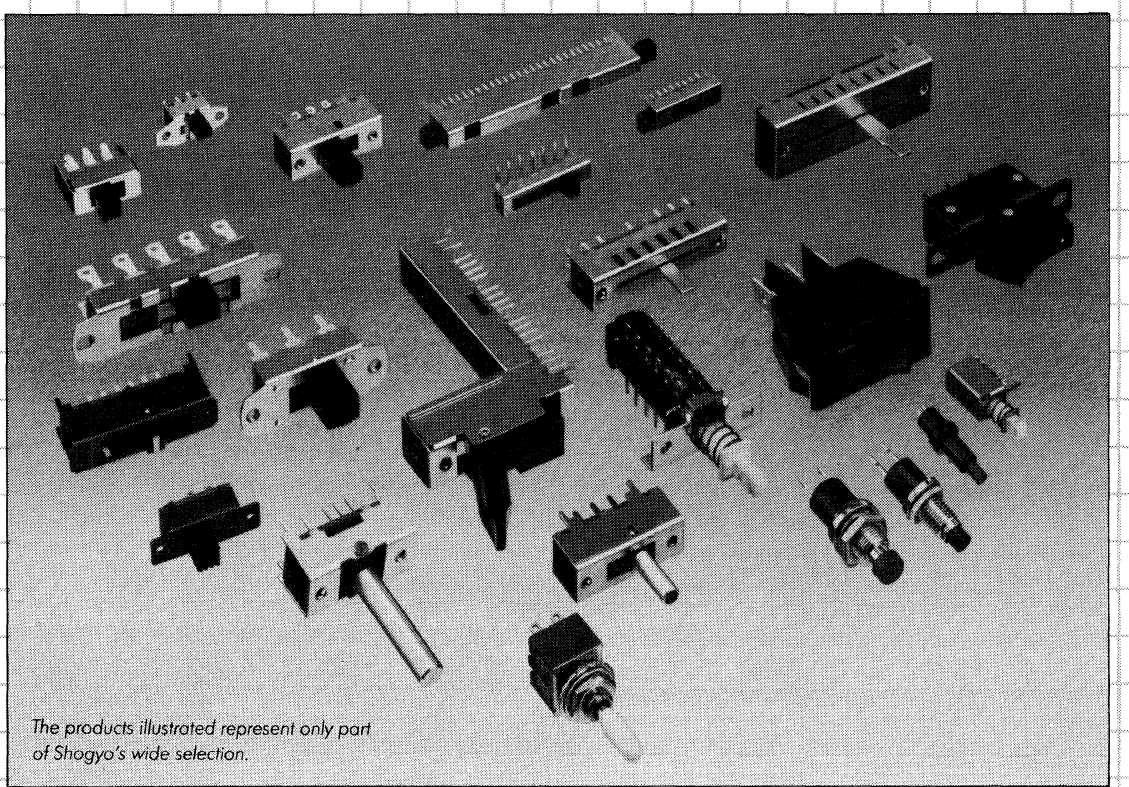
For complete product listings and specifications, request our free catalog.

SHOGYO

Shogyo Selection... with complete custom design capabilities

Including a diverse offering of:
- *Slide switches*
- *Toggle switches*
- *Power switches*
- *Push button switches*
- *Lever action switches*
- *Push-slide switches*
- *Leaf switches*
- *Rotary-slide switches*

And featuring:
- *PC or solder mount*
- *An extensive variety of sizes, pin types, pole and position quantities, ratings, contact and insulation resistances, and withstand voltages*
- *Electrical/mechanical endurances up to 30,000 cycles*
- *Silver plated contacts*



The products illustrated represent only part of Shogyo's wide selection.

For immediate assistance and specific information on the product(s) you require:

Dial 516-466-0911 or FAX 516-466-0922

SPECIFY SHOGYO. ELECTRONIC COMPONENTS AS GOOD AS YOUR DESIGN.
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Great Neck, New York 11021-4799
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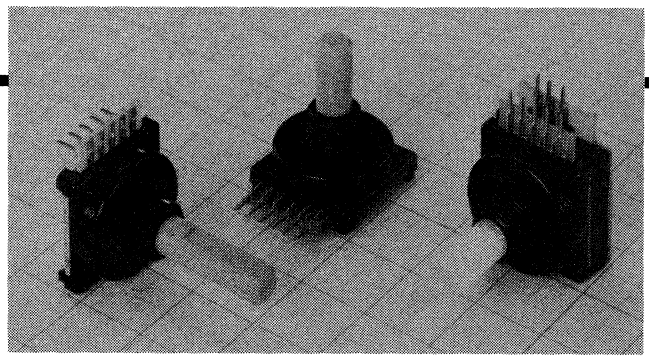
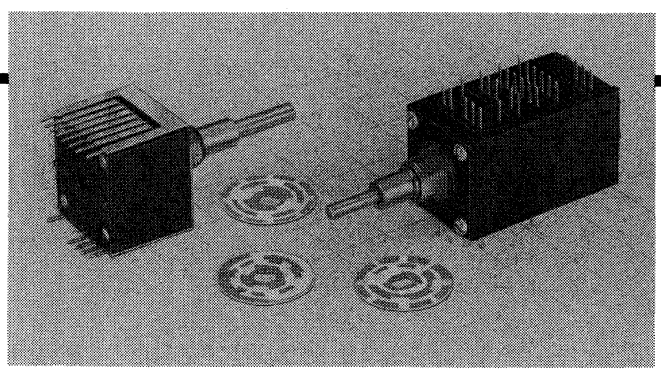
SHOGYO

We Switch The World

- For cursor, scan, position sensing, and robotics applications
- Up to 400,000 operations
- Detented or non-detented versions
- All quadrature two bit codes



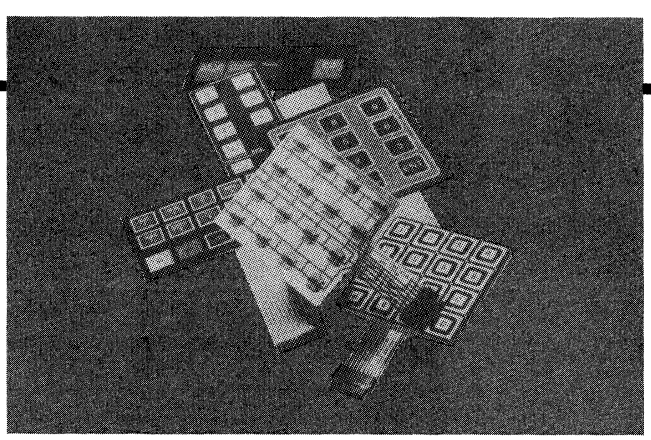
Encoder
LCE



MM P/REL
Rotary Switches

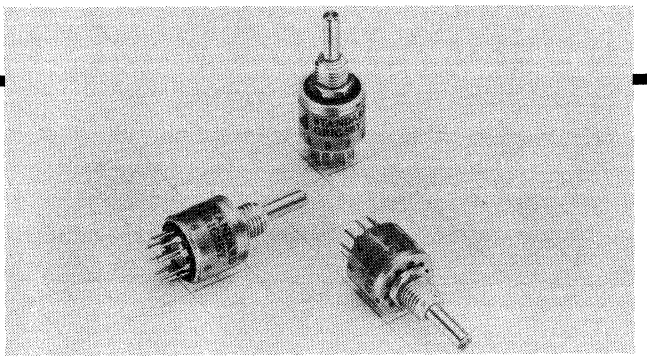
- Just .865" square
- Indexing angles: 60°, 45°, 36°, 30°, 22.5°, 20°, 18°, 15°, 12.8°, 11.25°, 10°
- Programmable to customer truth table
- Enclosed, wave solderable construction
- 50,000 cycles

- Flexible or PC board construction
- X-Y or Common Bus configuration
- ESD, EMI, RFI shielding
- Non-tactile or tactile feedback
- Embossed overlays available
- New! Shorting contact feature



STANDARD GRIGSBY

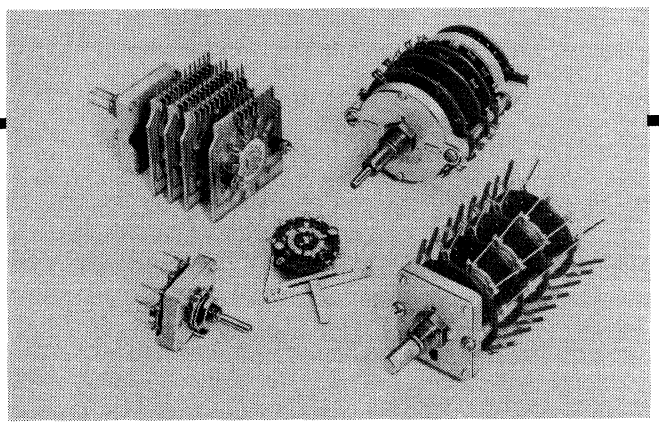
Membrane Switches
Custom Assembly



Now at an affordable price!

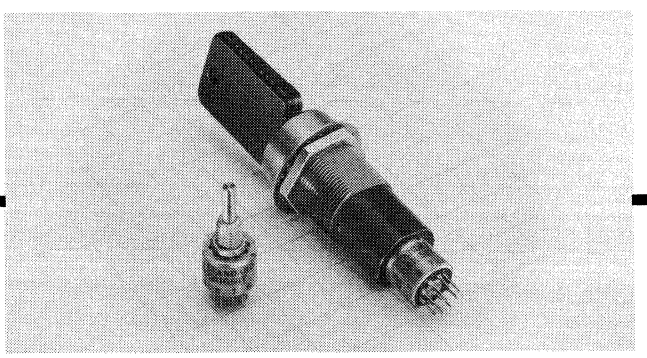
- Just .500" diameter
- Constructed to meet rigid military specs
- Sealed or unsealed versions
- Fixed or adjustable stops available
- 4 indexing angles available

SG Series SD
Rotary Switches



- Multiplicity of circuits
- Subminiature sizes
- Military finishes available
- Selection of lever switches
- Various indexing angles
- Horizontal and vertical PC mounting
- Wire wrap available

Open Frame
Rotary Switches



- Utilizes new 1/2" SD rotary switch
- Anti-static discharge protection available
- Number of security levels offered
- Various circuits variations available
- Choice of angles of throw

SG Series SDL
Rotary Switches

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Aurora, Illinois 60507-9990 USA
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Call or write for applications assistance.

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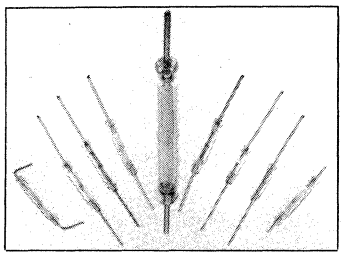
STANDEX REED SWITCHES

Setting Performance Standards Throughout the World . . .



- ☐ Tested to 1 billion operations
- ☐ Totally automated production
- ☐ Highest quality, based on computerized SPC, yielding unmatched uniformity.
- ☐ Custom cutting and forming for difficult applications
- ☐ Several standard contact materials for a broad range of applications

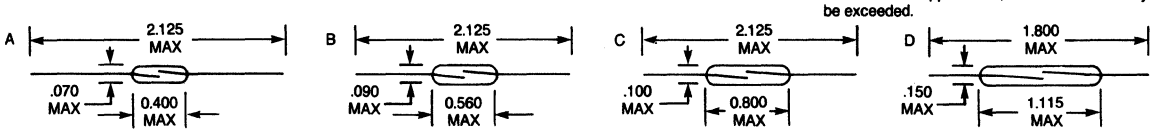
Switch Specifications:

Switch Type	Switch Size	Lead Dia. (inches typ.)	Contact Material	Power Rating (VA max.) Sec 1608.3	Switching Current (amps max.)	Carry Current (amps max.)	Switching Voltage (volts DC max.)	Switching Voltage (volts AC rms max.)	Breakdown Voltage (volts DC min.)	Contact Resistance (milliohms max.)	Insulation Resistance (ohms min.)	Operate Time Including Bounce (ms. typ.)	Resonant Freq. (kHz. min.)	Pull-in Range (ampere-turns)	Typical Drop-Out for 20 AT Pull-in	Typical Drop-Out for 40AT Pull-in	Vibration 10-2000 Hz (G's max.)
GR400	A	0.018	Rhodium	5	0.5	1.0	50	50	150	150	10^{12}	0.5	4.5	10-40	14	22	50
GR560	B	0.022	Rhodium	10	0.5	1.0	100	125	250	100	10^{12}	0.6	3.0	9-50	14	28	50
GK560	B	0.022	Gold-Nickel Alloy	10	0.5	1.0	100	125	250	150	10^{12}	0.6	3.0	9-70	10	15	50
GHG560	B	0.022	Amalgam	10	0.5	1.0	100	125	250	75	10^{12}	0.4	3.0	10-40	10	17	50
PR560	B	0.022	Rhodium	10	0.5	1.0	200	250	600	100	10^{12}	0.6	3.0	15-60	14	28	50
TS560	B	0.022	Noble Metal	5	0.5	1.0	50	125	200	250	10^{9}	1.0	3.0	10-100	N/A	N/A	30
GR100	C	0.022	Rhodium	10	1.0	2.0	200	250	350	100	10^{12}	0.8	2.2	9-60	12	22	40
PR100	C	0.022	Rhodium	10	1.0	2.0	250	350	1000	100	10^{12}	0.8	2.2	20-60	12	22	40
GR100F	C	0.022	Rhodium/ Copper	10	1.0	2.0	200	250	350	75	10^{12}	0.8	2.2	15-50	17	32	40
TS100	C	0.022	Noble Metal	5	1.0	2.0	100	125	300	250	10^{9}	1.0	2.2	10-100	N/A	N/A	40
GK126	C	0.026	Gold-Nickel Alloy	25	1.5	2.5	200	250	350	150	10^{12}	1.0	2.5	15-80	10	20	30
GHG126	C	0.026	Amalgam	15	1.5	2.5	200	250	350	75	10^{12}	0.8	2.5	20-60	10	20	30
PR150	D	0.026	Rhodium	30	1.5	3.0	250	400	1000	100	10^{12}	1.5	1.2	20-60	10	20	30

1) Contact resistance measurements are made at 10mA from a 1 volt source with 50% overdrive.

2) Storage temperature - 50°C to +155°C
Operate temperature - 40°C to +125°C

3) Consult factory for specific application assistance when using switches at or near maximum rated load. In some applications, maximum loads may be exceeded.



Contact Materials — Dry Circuit & Power Switching

Rhodium

Industry standard — recommended for general purpose applications. Low resistance, high melting point metal provides millions of trouble-free operations at low and medium loads.

Gold-Nickel Alloy

Specially developed plating and post assembly conditioning makes this alloy particularly resistant to hostile transients encountered in telecommunication circuits. Suitable for medium and high power loads.

Mercury Amalgam

Precision controlled mercury amalgam ensures contact resistance stability at low level switching over hundreds of millions of operations as required in automatic test equipment and instrumentation applications.

Detail application assistance for custom forming and proximity applications.

Call or write for complete Switch and Application catalog.

Standex Electronics
4538 Camberwell Road Cincinnati, OH 45209 (513) 871-3777

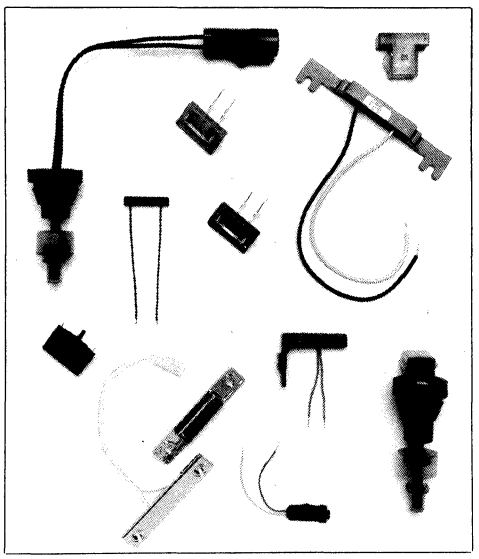
a Standex company
Morley Road, Tonbridge, Kent, England (732) 771023

EEM 1988

For Manufacturers' sales office, see yellow pages

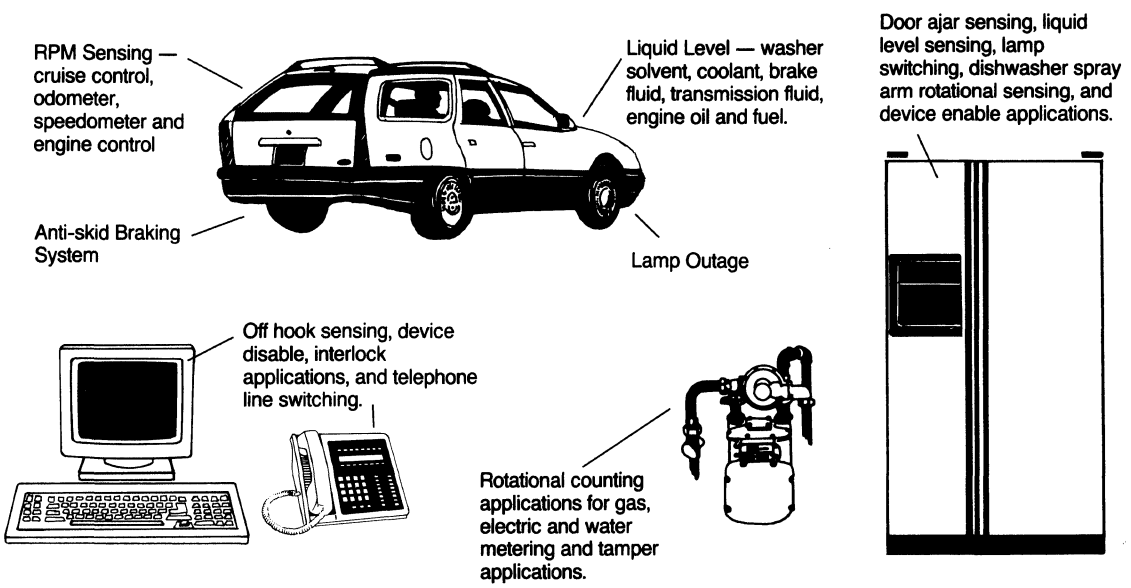
Standex Electronics

CUSTOM MAGNETIC SENSORS



Standex Electronics designs and builds magnetic proximity sensors for a wide range of markets and applications. The basic sensing element for most applications is the hermetically sealed reed switch. Other technologies are used as the application dictates.

- ☐ Hi-Rel Switching — hermetically sealed contacts — billions of operations switching low level loads
- ☐ No External Power Required
- ☐ Power Switching — direct switching of power loads with up to 2.5 amp DC inrush
- ☐ Wide Actuation Distance — reliable actuation at up to one inch for certain applications
- ☐ Low Cost — very competitive with other technologies



Standex Electronics

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Phone (513) 871-3777
Fax (513) 871-3779
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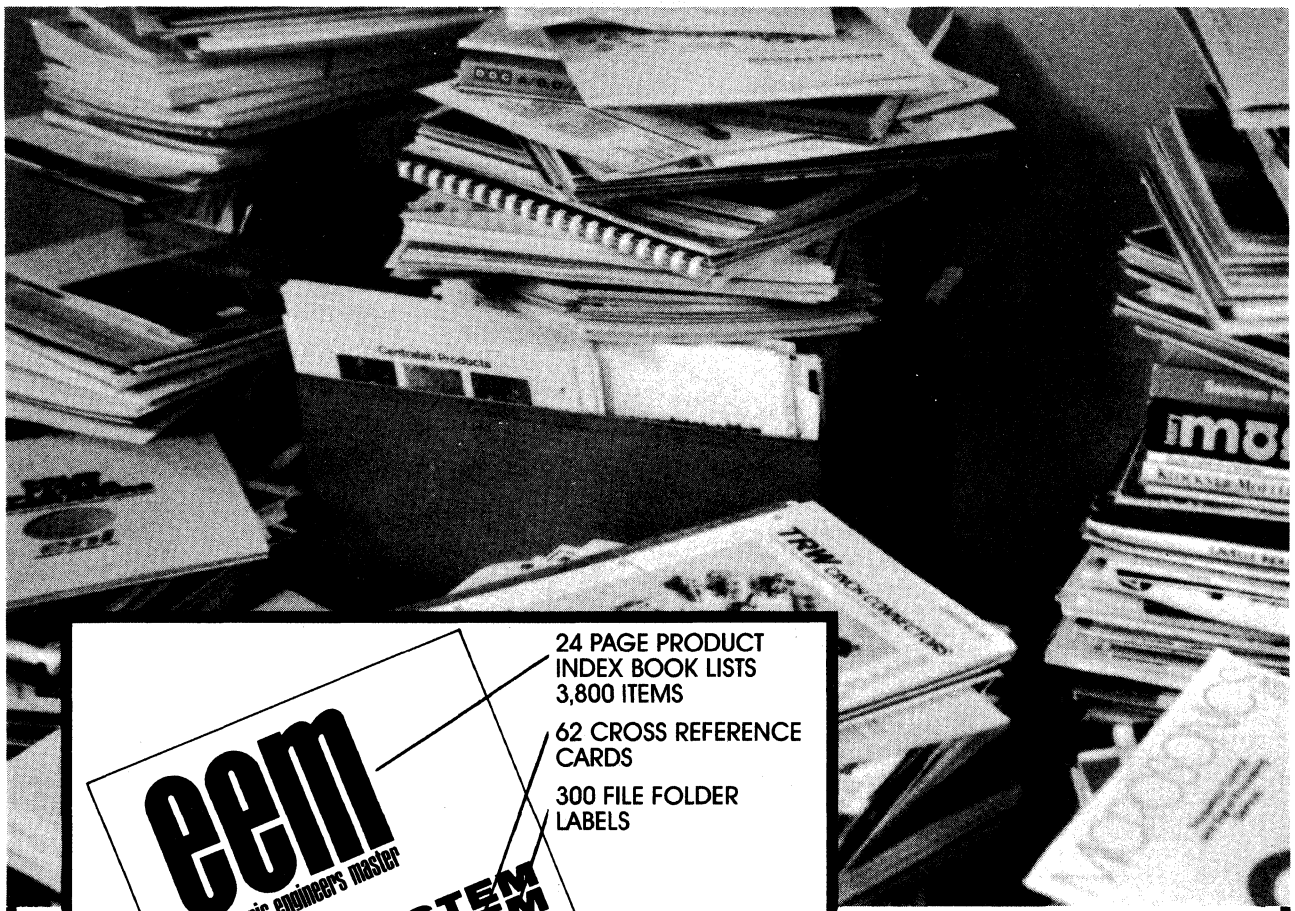
a Standex company

The world's best known companies are turning to Standex Electronics for magnetic proximity sensors.

Standex magnetic proximity sensors are used by companies such as General Electric, Ford, Digital Equipment Corp., IBM, and Northern Telecom. Call us and find out why.



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Switchcraft
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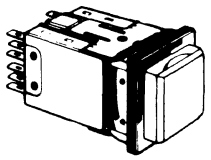
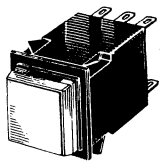
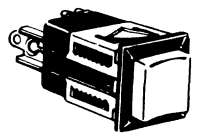
EXTENSIVE SELECTION OF PUSHBUTTON SWITCHES



SERIES PL —
"Push-Lite" SWITCH



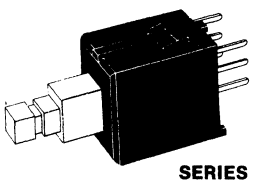
SERIES BXL —
"Box Switch" SWITCH



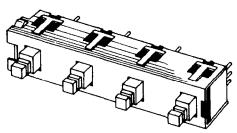
SERIES US & LUS —
"Uniswitch" SWITCHES

Standard and miniature non-illuminated or illuminated switches offer broad switching capabilities in minimal mounting space. All switches are easy to mount and are available with a variety of actuator colors, circuitry, terminal styles and mechanical functions. Current ranges from 250 mA to 8 A.

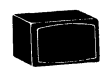
IBS MINIATURE PUSHBUTTON SWITCHES



SERIES 98000R



Type I



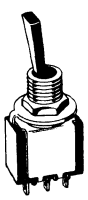
Type II

Series 98000R IBS miniature pushbutton switches can be gang mounted on common frames, up to 12 stations long with center-to-center spacing of 10 mm, 15 mm or 20 mm. Available with interlock, non-lock, momentary or push-lock/push-release mechanical functions. .130 in. (3.30 mm) x .130 in. (3.30 mm) square plungers accept a full line of industry standard pushbuttons. Switches are stocked without pushbuttons due to wide variety that can be used. Order pushbuttons separately. Switches have .157 in. (4 mm) long PC terminals for mtg. single- or double-sided PC boards up to .094 in. (2.39 mm) thick. Close stacking (centers) permit high density within minimum front panel space. Plunger travel: .144 in. (3.66 mm).

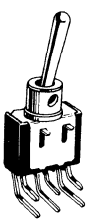
IBS PUSHBUTTONS

IBS pushbutton faces are concave for operator convenience with full legend capability. Can be mounted horizontally or vertically. Pushbutton dimensions: Type I — .388 in. (9.86 mm) W x .216 in. (5.49 mm) H x .425 in. (10.80 mm) D. Type II — .464 in. (11.79 mm) W x .288 in. (7.32 mm) H x .432 in. (10.97 mm) D. Pushbuttons must be ordered separately.

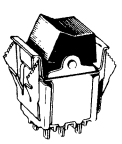
MULTI-SPEC® INTERNATIONALLY APPROVED SWITCHES



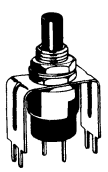
Series A
Miniature
Flat Toggle



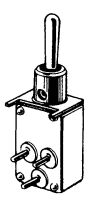
Series A
Miniature Toggle
Right Angle PC,
Horizontal Lever
Action



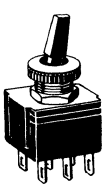
Series B
Miniature
Rocker



Series F
Subminiature
Pushbutton,
Straight PC

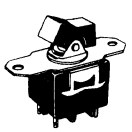


Series J
Miniature
Low Profile
Toggle

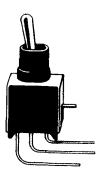


Series UL4600
High Current
Toggle

Series UL4700
Pushbutton



Series P
Rocket Power
Switch



Series M
Microminiature
Toggle

1-4 pole rocker, toggle and pushbutton switches offer a wide selection of standard and special features. In miniature, subminiature and microminiature sizes, they are designed for bushing, snap-in or PC board mounting. Terminal choices include solder lug, PC, wire-wrapping, quick-connect and sealed or unsealed. They have most European approvals. There's a selection of gold and silver contacts with ratings from 100 mA to 20 A.

Switchcraft, Inc., 5555 N. Elston Ave., Chicago, IL 60630 Tel. (312) 792-2700 TWX 910 221 5199 FAX (312) 792-2129

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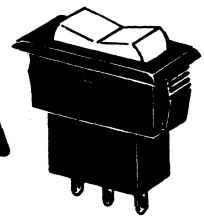
SERIES 50 MINIATURE ROCKER SWITCHES



(applied for) **(actual size)**

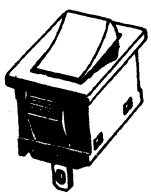
Rocker Color				Function[1]			
Black	Red	Gray	Blue	III	II	I	Circuit
503B2NN	503B2NR	503B2NG	503B2NBL	On	—	(On)	SPST
502B2NN	502B2NR	502B2NG	502B2NBL	On	—	On	SPST
506B2NN	506B2NR	506B2NG	506B2NBL	(On)	Off	(On)	SPDT
507B2NN	507B2NR	507B2NG	507B2NBL	On	Off	(On)	SPDT
504B2NN	504B2NR	504B2NG	504B2NBL	On	Off	ON	SPDT

[1]Parentheses = momentary function;
no parentheses = locking function.

Single pole miniature, instrument-grade rocker switches provide up to 4 A, 125 V switching and snap-in mounting for car phones, mobile radios, hand held instruments, and other applications. Switches have epoxy sealed solder lug terminals and offer a choice of 2- or 3-position (momentary and/or locking combinations) and four rocker colors. Dim.: .41 in. (10.3 mm) w. x .913 in. (23.2 mm) h. x .772 in. (19.6 mm) lg. Mounts in .35 in. (8.9 mm) x .734 in. (18.65 mm) in panels up to .118 in. (3 mm) thick max.

SERIES 100 — SINGLE POLE, 2- & 3-POSITION NON-ILLUMINATED ROCKER SWITCHES

UL, CSA and VDE approved switches have up to 8 A switching; 1A, 1C or 1K circuitry; solder or .187 in. quick connect terminals; locking action; and black or white housings and rockers. Additional approvals include: SEMKO (Sweden), DEMKO (Denmark), and NEMKO (Norway). Snaps into .75 in. (19 mm) x .51 in. (13 mm) panel openings from front. Matching indicator lights available; contact Switchcraft. Dim.: .744 in. long x .508 in. wide x .492 in. behind panel (excluding terminals).



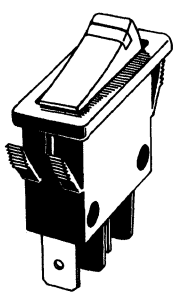
(Other European Approvals available)

Part No.	Circuitry	Terminals	Housing Color	Rocker Color	Current Rating
100B2NN	1A, ON-OFF	Solder Lug	Black	Black	1
100B2BB	1A, ON-OFF		White	White	1
102B2NN	1C, ON-ON		Black	Black	1
102B2BB	1C, ON-ON		White	White	1
104B2NN	1K, ON-OFF-ON		Black	Black	2
104B2BB	1K, ON-OFF-ON		White	White	2
100B98NN	1A, ON-OFF	Quick Connect	Black	Black	1
100B98BB	1A, ON-OFF		White	White	1
102B98NN	1C, ON-ON		Black	Black	1
102B98BB	1C, ON-ON		White	White	1
104B98NN	1K, ON-OFF-ON		Black	Black	2
104B98BB	1K, ON-OFF-ON		White	White	2

NOTES: [1] UL & CSA — 8 A, ¼ hp, 250 V AC; 8 A, 12 V DC non-inductive load.
[2] UL & CSA — 5 A, ⅓ hp, 250 V AC; 5 A, 12 V DC non-inductive load. VDE — 6 (4) A, 250 V AC.

SERIES 200 — SINGLE POLE, 2-POSITION, HIGH CURRENT, ILLUMINATED & NON-ILLUMINATED ROCKER SWITCHES

UL & VDE approved (CSA applied for) switches have up to 16 A switching; 1A or 1C circuitry; solder or .25 in. quick-connect terminals; locking action; matte black or white housings; red, amber, matte white, matte black & matte black/red rockers. Snaps into 1.181 (30 mm) x .433 in. (11 mm) panel openings from front. Inrush current: 200 A, 250 V AC, 10 ms. Matching indicator lights available; contact Switchcraft. Dim.: 1.17 in. long x .551 in. wide x 1.118 in. (quick connects) behind panels.



(Other European Approvals available)

NOTES: [1]UL, CSA & VDE approved — 16 A, 3/4 hp; 250 V AC; 12 A, 28 V DC non-inductive load. VDE approved — 16 (6) A, 250 V AC.

[2]UL & CSA approved — 16 A, 250 V AC.

SERIES 200—Locking Action

Part Number	Circuitry	Terminals	Housing Color	Rocker Color	Illum.	Current Ratings
200B2NN	1A, ON-OFF	Solder Lug	Matte Black	Matte Black	No	1
200B2NNR	1A, ON-OFF		Matte Black	Matte Black/Red		
200B5NN	1A, ON-OFF	Quick Connect	Matte Black	Matte Black		
200B5NNR	1A, ON-OFF		Matte Black	Matte Black/Red		
202B2NN	1C, ON-ON	Solder Lug	Matte Black	Matte Black		
202B2NB	1C, ON-ON		Matte White	Matte White		
202B5NN	1C, ON-ON	Quick Connect	Matte Black	Matte Black		
202B5NB	1C, ON-ON		Matte White	Matte White		
200NB2ANKR	1A, ON-OFF	Solder Lug	Matte Black	Red	Yes	2
200NB2ANKA	1A, ON-OFF		Matte Black	Amber		
200NB2ABKR	1A, ON-OFF		Matte White	Red		
200NB2ABKA	1A, ON-OFF		Matte White	Amber		
200NB5ANKR	1A, ON-OFF	Quick Connect	Matte Black	Red		
200NB5ANKA	1A, ON-OFF		Matte Black	Amber		
200NB5ABKR	1A, ON-OFF		Matte White	Red		
200NB5ABKA	1A, ON-OFF		Matte White	Amber		

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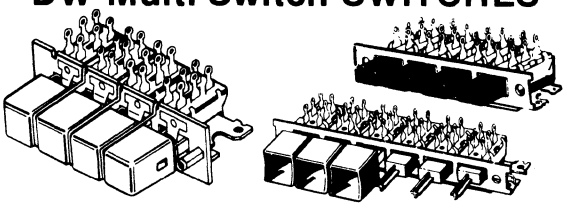
DW Multi-Switch SWITCHES



The DW (double-wipe) Multi-Switch switch is available up to 18 stations in a single row & ganged assemblies with interaction between rows. Max. switching per station is 4-C (4PDT). Each station utilizes specially designed switching modules with U-shaped, high reliable bifurcated contactors rated at 3 amps, A.C.; 0.5 amp, D.C., 125 V, non-inductive load. DW Multi-Switch switches are available in 5 series: 65000, 66000, 67000, 70000, and 71000. All provide four standard functions: **Interlock** — actuating a pushbutton automatically restores to normal the pushbutton previously actuated. **Lock-Out** — prevents operation of more than one pushbutton at a time. This feature is included on all interlock switches. **Non-Lock** — each pushbutton has momentary action. **All-Lock** — all pushbuttons, except release, lock when depressed. All pushbuttons restored to normal by actuating (momentary) release pushbutton. **Push-Lock/Push-Release** — pushbuttons lock when depressed and release when again depressed. **All Series** — pushbuttons on $^{3}/_{8}$" centers. DW Multi-Switch switches are available in single row assemblies with interlock and all-lock functions from one to twelve stations; with non-lock and push-lock/push-release functions up to 18 stations.

Series 65000—Non-illuminated, integral pushbutton.
Series 66000—Non-illuminated version of Series 67000.
Series 67000—Illuminated pushbuttons.
Series 70000, 71000—Non-illuminated, cross-rib plungers, accept up to 12 different styles of pushbuttons.

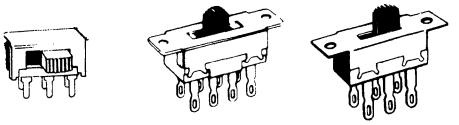
MOMENTARY Button Switch SWITCHES

Miniature pushbutton switches are enclosed in metal housing. Terminals: solder lug. Contacts: internal nickel silver, 250 mA, 30 W max., AC, non-inductive. **Series 903, 913:** behind panel mtg. **Series 923, 933:** front mount. All switches: bushing mount.

903 & 913

923 & 933

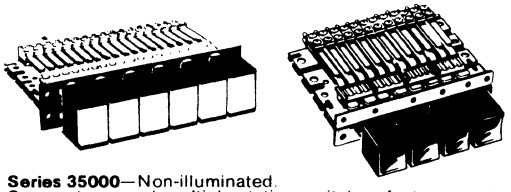
"Tini-Slide" SWITCHES



Miniature "**Tini-Slide**" switches are precision locking switches with unique lift/wipe/slide action and silver contacts. Ratings: 0.5 A, 125 V AC or DC, non-inductive. 2- and 3-position types. U.L. listed. Solder lugs or PC terminals. Crowned knobs.

Series 56000 — DPDT & DPTT **Series C63000 — 4PDT**
Series C62000 — Side Knobs

littel Multi-Switch SWITCHES



Series 35000—Non-illuminated.
Compact, rugged multiple-station switches feature up to 6PDT per station in .6 square inch space. Excellent selection of contacts for low or high current switching. Plungers accept nine different Switchcraft pushbuttons. Mechanical functions are: interlock, all-lock, non-lock and push-lock/push-release. One to 12 stations; many legends are possible.

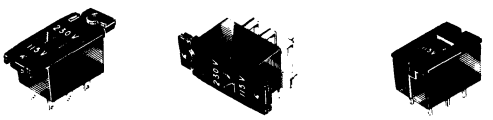
Series 36000—Non-illuminated companion series to Series 37000. All other basic functions and features are same as Series 35000.

Series 37000—Single lamp illumination at each station. All other basic functions and features are same as Series 35000.

Series 38000—Twin lamp illumination using low power, low heat lamps. All other basic functions and features same as Series 35000.

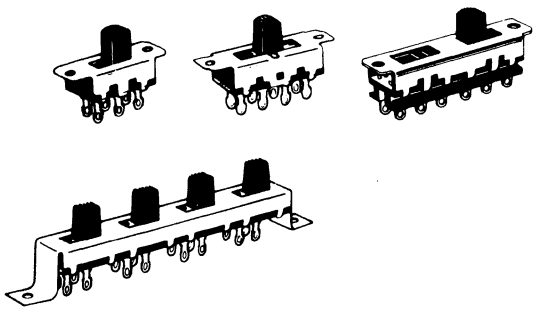
EUROPEAN LINE VOLTAGE SELECTOR SWITCHES

NEW! 10 A SWITCH



Durable slide switches provide quick and easy programming/ selection of 115 V or 230 V primary power in electrical/electronic equipment for international marketplace. UL. CSA and VDE (Verband Deutscher Elecktrotechniker) approved. Mountings are flange or PC (straight or right angle). DPDT, locking. Ratings: UL & CSA: 2A, 250 V AC & 4A. 125 V AC. VDE: 2 A, 250 V AC. Switches also designed to comply with CEE and IEC requirements Legends: 115 V-230 V. New 10 A switch rated: 10.1 A, 125 V AC; 5 A, 250 V AC. Submitted to UL & CSA for listing.

SLIDE SWITCHES



Instrument quality Switchcraft slide switches have low cost, precision "double-wipe" contacts with "U"-shaped bifurcated contacts rated at 0.5 A DC, 3 A AC, 125 V, non-inductive. Solder lugs have $^{5}/_{64}$" dia. center holes and wrap-around notch. Various knob styles: crowned, rocker, flush. U.L. & C.S.A. listed types and heights. Up to 4 poles of switching with locking or momentary action.

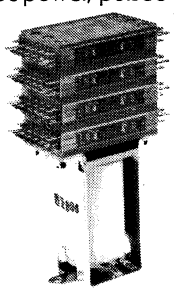
Series 46000 — General purpose slide switches
Series 47000 — Tandem switches
Series 48000 — 4-gang slide switches

Switchcraft, Inc., 5555 N. Elston Ave., Chicago, IL 60630 Tel. (312) 792-2700 TWX 910 221 5199 FAX (312) 792-2129

T-bar® THE SOURCE FOR MULTI-CONTACT RELAYS AND SWITCHES

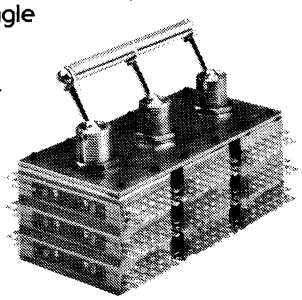
RELAYS

General purpose 800-series, with contact ratings to 5A, and 900-series with low-level to 1A ratings. Both available with 12, 24, 36, 48, and 52 poles in form A (N.O.), form B (N.C.), and form C (D.T.) and 60 poles, form A. Operation from continuous ac or dc power, pulsed power (latching), or solid-state logic. Environmentally sealed and hermetically sealed relays for aerospace, shipboard and ground support hostile environments are available.



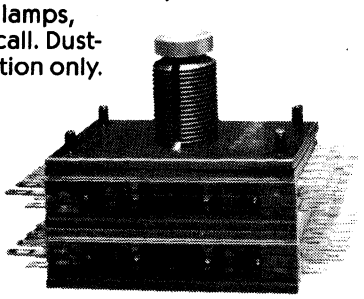
TOGGLE SWITCHES

Same 800-series and 900-series as relays. Available with 12 to 144 poles in form C, maintained action. Typical life in excess of 50,000 operations. Normally dust-tight, T-Bar toggle switches are also available in an environmentally sealed version.



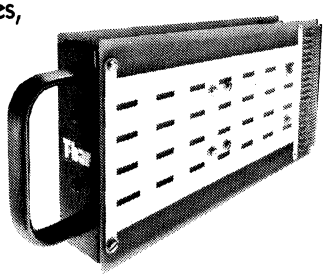
PUSHBUTTON SWITCHES

Momentary pushbutton switches, 800-series only are available with 12 to 36 poles, form C. Typical applications include press-to-test for control panel lamps, reset, and all-call. Dust-tight construction only.



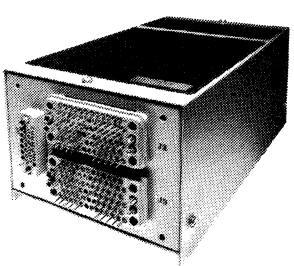
PLUGGABLE MODULES

Pluggable modules use standard T-Bar multi-contact relays in either a one relay configuration or two relays independently controlled with no common failure mode. Plugged into T-Bar printed circuit card cages, any desired switching configuration can be established by backplane wiring.



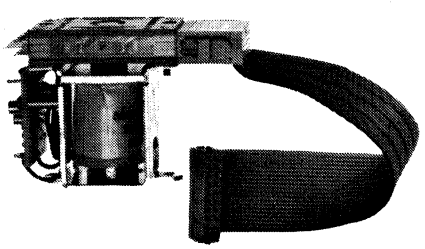
SELECTOR UNITS

Standard T-Bar relays, 800 or 900-series, are packaged as an automatic selector unit to random or sequential circuit selection and addressed through binary weighted coils. Available as Treeselect (all unaddressed lines remain open) or Norselect (all unaddressed lines connected to a bus), selector units can be provided with 16 to 128 positions.



CONNECTORS

T-Bar plug-on connectors are available for all relays and switches. Each connector provides wiring to one-half of a wafer deck (6 poles; A, B, or C). A 36-pole device, for example, requires 6 connectors. Two connector versions are available. One accommodates individual wiring with crimp-on connectors; the other is used to mass-terminate ribbon cable.



T-bar INCORPORATED
a DATA SWITCH company

One Enterprise Drive, Shelton, CT 06484
Telephone: (203) 926-1801, TWX: 710 468-3210

Dept. EM, 500 Tenth Street, Palisades Park, NJ 07650 • (201) 944-2221

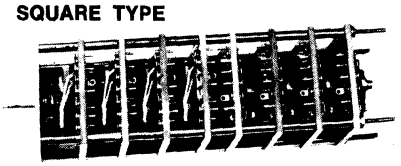
Tech Labs will undertake special prototype design and manufacturing of your switch and attenuator requirements. We can also customize and supply completely pre-wired units. Contact our factory for competitive quotations.

Tech labs SINCE 1935 SWITCHES & ATTENUATORS

FEATURES COMMON TO ALL SWITCHES

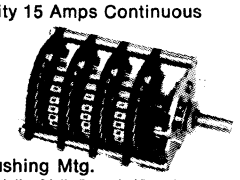
- Precious Alloy Contacts
- Insulation Res. 10,000 M-Ohms Min.
- Hi-Pot 1500 V RMS Min.
- Contact Resistance less than .01 Ohm
- Low Thermal EMF
- Low Capacitance between Contacts
- Low Electrical Losses at HF
- Fixed or External Adj. Stops
- Exceptionally Long Life
- Adaptability for Remote Drives and Controls
- Customized Features to your Requirements
- Pre-Wired Availability

ROTARY SWITCHES
SQUARE TYPE



- 13 Styles Available
- Sizes: 1⅝" x 1⅝" up to 8" x 8" sq; 15 Decks max.
- 1 to 12 Poles/Deck
- Up to 150 Positions/Pole
- Current Capacity 15 Amps Continuous

TYPE 2
LOW COST

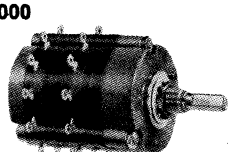


- Single Hole Bushing Mtg.
- Size: 1¾" x 2¼"; ¾" Depth/Deck
- 1 to 4 Poles/Deck
- Up to 24 Positions/Pole MBB
- Up to 12 Positions/Pole BBM
- Indexing: 15°, 30°, 45°, or 60°
- Current Capacity: 5 Amps Continuous

TYPE 3
LOW COST **UL LISTED**

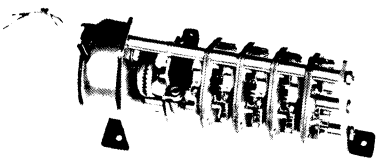
- Enclosed Molded Construction
- Size: 1¼" Dia. x ½" Depth/Deck
- SP or DP/Deck
- Up to 12 Pos./Pole BBM or MBB
- Indexing: 30° or 60° and 90°
- UL Listed: 3 Amp Resistive 120 VAC
  3 Amp Resistive 28 VDC

TYPE 2000



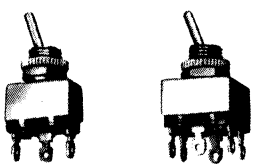
- Low Contact Resistance <1 Mili-Ohm
- Insulation Resistance. >1 Million Meg-Ohms
- Sizes: 2⅝2" Dia. x 1⅛" Depth/Deck
- SP or DP/Deck
- 6, or 12 Pos./Pole MBB
- Indexing: 30° or 60°
- Current Capacity: 5 Amps Continuous

ROTARY SWITCHES
REMOTELY CONTROLLED



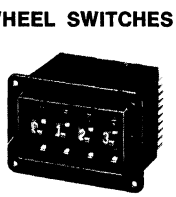
- Available as Stepping Switch or
- Motor Driven Solenoid Drives,
- Motor and Geneva Drives,
- Enercon AC Incremental Motor Drive,
- Interrupters or Homing Decks Available.
- May be Remotely Controlled by Master-Slave Arrangement: Computer, External Pulse or Other AC or DC Operation.

TOGGLE SWITCHES



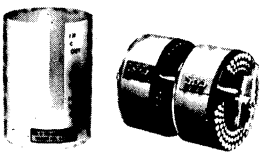
- Meets or Exceeds MIL-S3950, MS75028 & 029
- Size: ¼" x ½" x 5⁄16" for SP.ST or DT
- Size: ½" x ½" x 5⁄16" for DP.ST or DT
- Contact Resistance: 10 Milli-Ohms
- ¼–40 Mtg. Bushing, ¼ or ⅜ lg.
- Various Combinations of Bushings, Terminals, Handles and Housings Available.
- Contact Rating: 5 Amps @ 28 VDC and/or 5 Amps @ 125 VAC Inductive Load

THUMBWHEEL SWITCHES



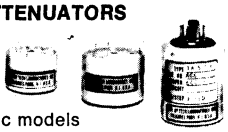
- Compact Modular Construction
- Size: ½" Wide Modules
- Positive Detent 10, 11, 12 Positions
- Wide Range of Codes
- Various Terminations
- Kelvin Vally Voltage Divider
- Decade Transfer Drive Between Digits
- Capacitance Decades
- Precision Resistance Decades
- Current Capacity: 1 Amp. Continuous

ATTENUATORS
ROTARY/VARIABLE



- Five basic models — 1⅞" to 3" dia.
- All circuit configurations
- Wide range of impedance
- Available with detents, tapers and cueing
- Aluminum anodized can
- Precious metal contacts
- Up to 45 steps
- Audio, video and RF

FIXED ATTENUATORS

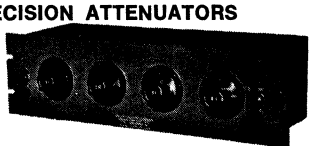


- Two basic models
- Standard circuits "T" and Bridged "H" — others available
- Octal plug-in base available
- Up to 80 db loss
- Many impedance available

VERTICAL/VARIABLE

- Two basic models — 1" and 1½" wide
- Many circuit configurations available
- Wide range of impedance
- Available with detents, tapers and cueing
- Black anodized escutcheon plate
- Precious metal contacts
- Up to 30 steps

PRECISION ATTENUATORS



TYPE 11T AND 11H PRECISION ATTENUATORS — DC to 10 MHz*

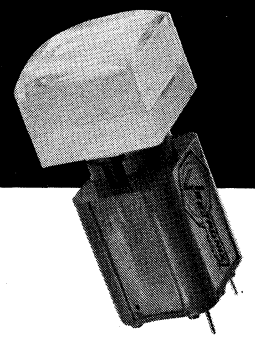
- Circuit: "T" or Balanced "H"
- Impedance: 50 to 600 ohms, as specified
- Resistor Accuracy: ±0.1% or better
- Accuracy: ±0.1 db to 200 KHz (overall) ±0.6 db to 2 MHz. Lower values of loss, essentially flat to 10 MHz

Type No.	Circuit	db Range	db/ Step	Dimensions
11-T	"T"	111	0.1	5¼"x19"5"
11-H	Bal. "H"	111	0.1	5¼"x19"x10"

* On Low Impedance Units, Lower Losses Usable to 100 MHz.

TYPE 850T AND 850H FOR THE AUDIO RANGE

- Circuit: "T" or Balanced "H"
- Impedance: 600/600 ohms unless specified —Other values to order
- Range: 2 dial unit gives 93 db in 0.1 db steps: 3 dial unit gives 111 db in 0.1 db steps
- Terminals: Telephone type jacks for input and output — Solder terminals provided on rear for permanent connections: Insertion of plugs into jacks lifts rear connections
- Accuracy: Resistors adjusted to ±0.1% excepting low values of loss are ±.25%



the SWITCH you'll LOVE to touch!

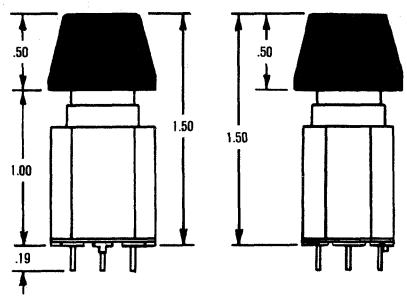
VEETRONIX™ KEYBOARD SWITCHES

a Touch Above the Rest!

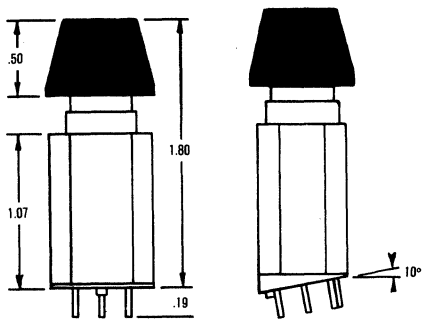
Hardly a day passes without someone calling to say,
"I Like The Touch of Your Switches."

Widely used by manufacturers of computer and video switching equipment, because of ***VEETRONIX'*** patented design, which combines POSITIVE ACTION with just the right touch. Not loose. Not stiff. Just right!

SHORT SERIES



LONG SERIES



SWITCH FORM	CIRCUIT DIAGRAM	SWITCHING
A	1 — 6	Single Pole Single Throw Normally Open
B	1 — 6	Single Pole Single Throw Normally Closed
AA	1 — 6, 4 — 3	Double Pole Single Throw Normally Open
BB	1 — 6, 4 — 3	Double Pole Single Throw Normally Closed
AB	1 — 6, 4 — 3	Double Pole Single Throw 1 Open/1 Closed (Break Before Make)
LAMP	L2 — L5	Voltage And Amperage At Option

SPECIFICATIONS:

Max.Current (except special order)
Form A or AA: 500 milliamps (resistive)
others: 250 milliamps (resistive)

Max. Voltage
Form A or AA: 200 VDC (resistive)
others: 100 VDC (resistive)

Max. Power Loading
Form A or AA: 10 watts (resistive)
others: 7 watts (resistive)

Max. Initial Contact Resistance
100 milliohms

Min. Breakdown Voltage
250 VDC

Min. Insulation
100 milliohms

Min. Life (reed)
50 million cycles

Lamp
T-1 ¾ bi-pin; optional voltage 3-28

All Plastic Parts
premium engineering plastic

Contact Surfaces
Noble metal

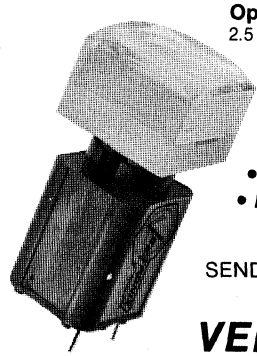
Terminals
0.025 Dia. nickel plated

Key Travel
.187" plus or minus .007"

Pre-Travel
Min. .050"

Min. Overtravel
.020"

Operating Force
2.5 oz. to 20 oz. = 0.7 oz.



- ***OPTIONAL ILLUMINATION!***
- ***HERMETICALLY SEALED CONTACTS!***
- ***CHOICE OF SWITCH FORMS!***
- ***BI-LEVEL & ALTERNATE ACTION!***
- ***REGULAR & LOW PROFILE UNITS!***

SEND YOUR SPECS FOR QUOTE
WRITE OR PHOHE

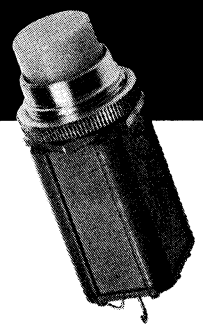
THE KEY TO QUALITY

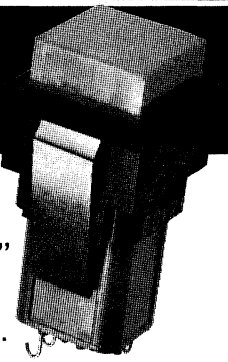
VEETRONIX, INC.

BOX 480 Lexington, NE 68850 (308) 324-4600
TWX: 910-960-4741 FAX: (308) 324-4985
Ask for Eddie Howerter

MADE IN U.S.A.

VEETRONIX™ PANEL SWITCHES





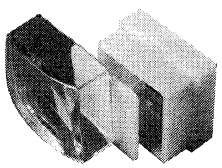
Available in a variety of configurations, these panel switches have the same "JUST-RIGHT-TOUCH" as our line of keyboard switches. In addition, we will build to your specifications at very competitive prices.

See specifications and table of contact forms on facing page.

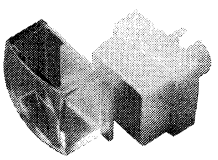
VEETRONIX™ KEYCAPS

VEETRONIX will provide just the right cap for your requirements, either from standard styles, or custom-made to your exact specifications. Our in-house tool and die shop permits the flexibility to meet your individual needs. We offer a wide choice of colors. Cap adapters permit use on either an illuminated or unilluminated switch. Relegendable styles available for 1-space and 2-space caps.

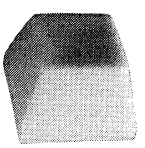
SOME REPRESENTATIVE CAPS AND ADAPTERS:



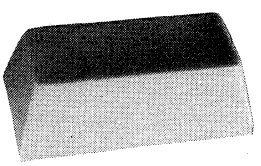
.720" SQUARE CONCAVE RELEGENDABLE CAP



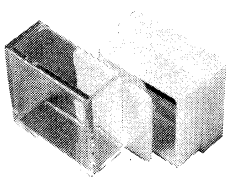
.600" SQUARE RELEGENDABLE CAP



V7001 1-SPACE CAP

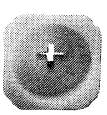


V7001 2-SPACE CAP



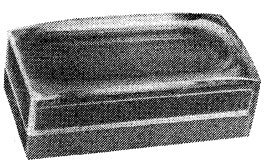
.720" SQUARE, FLAT-TOP RELEGENDABLE CAP

ADAPTER FOR ILLUMINATED SWITCHES



ADAPTER FOR NONILLUMINATED SWITCHES

V7002 1-SPACE CAP



V7002 2-SPACE CAP

CUSTOM MANUFACTURING:

VEETRONIX **can mold special plastic parts to meet your most exacting requirements, either from your mold or from one we design and build for you in our tool and die shop.** ***VEETRONIX*** **can also do custom assembly of electronic and electro-mechanical devices. Send specs for quote.**

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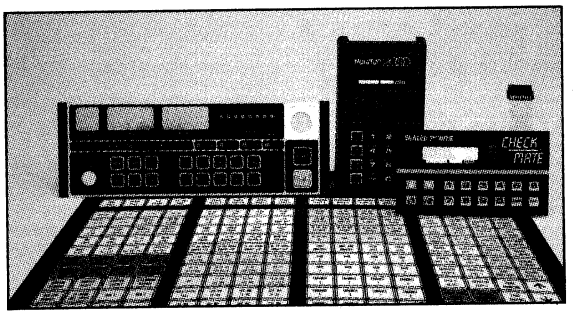
MADE IN U.S.A.

KEYBOARDS/KEYPADS

Manufacturer	Starting EEM Page No.	Type						Features								
		Key Switch	Mechanical (Hard Contact)	Capacitive	Hall Effect	Membrane: Full Travel	Membrane: Not Full Travel	Conductive Elastomers	Low Profile	Sealed Keyboard	Back Lighted	Illuminated Switch	Modular	Custom Legends & Symbols	Capabilities	Custom Keypads
Amkey	B•1810	¤		¤					¤	¤	¤			¤	¤	¤
Berquist	B•1809					¤	¤			¤	¤	¤		¤	¤	¤
Cherry	B•1812	¤	¤			¤			¤	¤	¤	¤	¤	¤	¤	¤
Control Displays	B•1813		¤							¤	¤	¤		¤	¤	¤
Digitran	B•1814		¤	¤				¤	¤	¤			¤	¤	¤	¤
EECO	B•1815		¤			¤		¤	¤	¤	¤		¤	¤	¤	
ERA/Refac	B•1816	¤				¤		¤			¤		¤	¤	¤	¤
Flex-Key	B•1817		¤					¤*	¤	¤*	¤	¤		¤	¤	¤
GM Nameplate	B•1819					¤		¤		¤	¤		¤	¤	¤	¤
Grayhill	B•1820								¤				¤	¤		¤
Hall	B•1822					¤	¤				¤		¤	¤	¤	¤
Interswitch	B•1823		¤							¤			¤			¤
Jayco	B•1824						¤	¤	¤	¤	¤	¤		¤	¤	¤
Mechanical Enterprises	B•1826	¤	¤											¤		
Memtron	B•1828		¤			¤	¤			¤		¤		¤	¤	¤
NMB Technologies	B•1829		¤			¤			¤			¤		¤	¤	
Oak Switch	B•1830					¤		¤	¤	¤	¤		¤			¤
Orbit	B•1831		¤					¤	¤	¤	¤				¤	
Preh Electronics	B•1832					¤			¤	¤			¤	¤	¤	
George Risk Inds.	B•1833		¤								¤	¤	¤	¤	¤	¤

Bergquist Membrane Switches



Bergquist Company designs and builds custom membrane switches especially suited for harsh environments. Bergquist membrane switches are reliable and include the best graphics you can buy.

Bergquist membrane switches are often designed into an assembly to replace conventional discreet switches. Switch panels enable the designer to condense the control area and include more keys than bulky discreet switches will allow and in most cases show a significant cost savings.

Membrane switches are constructed in three different ways to meet the requirements of various applications. Circuitry can be either screened silver ink on polyester substrates or etched copper circuitry on a flexible or hardboard layer. These various constructions can be made with either pressure sensitive adhesives or Bergquist's HeatSealing for harsh environment applications. Screened silver is used for current levels below one watt and copper circuitry is used for current levels above one watt.

FEATURES

Bergquist offers many combinations of features which can be added to the basic switch constructions. These include:

- ***HeatSeal***™ The HeatSeal switch is especially designed for applications with harsh environments. Layers are bonded together with thermoplastic adhesive which completely protects them from contamination.
- LEDs added to the copper hardboard or flex copper switch.
- Embossed domes on silver switches or stainless steel snap domes for copper switches to provide tactile feedback.
- Rim or pillow embossed graphics to enhance the look and feel of switches.
- Backer panels added to the switch panel with optional studs for mounting.
- Adhesive backed switch panels to aid in mounting the switch panel to the assembly.
- A variety of interconnects for both flex circuits and hardboard switches. These include male and female pins, headers, IDC connectors, and others.
- Electroluminescent lamp panels.
- Integral lenses screened into the graphic layer, eliminate cut-outs or die-cut lenses where applicable.
- Special shielding materials such as screened silver, vapor deposited gold or aluminum, aluminum foil or Kapton for EMI/RFI and ESD shielding.
- Deadfront nomenclature which is only visible when backlit.
- Selective textures applied to the graphics layer ranging from rough to matte to non-glare to glossy.
- Hardcoated graphic panels for improved chemical and abrasion resistance.
- Custom color using recognized color matching systems such as PMS, Federal Standard and Muncell or an actual sample to be matched.

THE BERGQUIST LABORATORY

To guarantee the quality and reliability of each membrane switch, Bergquist Company has developed a complete in-house laboratory. The laboratory tests materials, processes and completed membrane switches.

Materials compatibility is a key factor in the reliability of a switch panel. Each material is analyzed and tested alone and in combination with other materials before any construction begins. This is done to prevent interactions between materials after construction, for instance, solvents in pressure-sensitive adhesives could soften conductive silver inks if not carefully controlled during manufacturing.

Along with materials compatibility, the Bergquist laboratory has done extensive testing on the effects of pressure on vented and nonvented switches, hardcoating of graphic panels, membrane switch life, actuation force and modes of failure in dielectric jumpers.

Environmental testing attempts to simulate the field environment of completed switches. Switches are tested under extremes of heat, humidity and pressure. Life testing subjects switches to millions of actuation cycles and graphic panels are exposed to chemicals and abrasives to test hardcoating.

The Bergquist laboratory also works closely with trained quality control specialists to monitor each step of the production process.

Contact Bergquist Company for free copies of technical papers on membrane switch design and testing.

Call Toll Free 1-800-328-3882

BERGQUIST

When Performance Counts
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Minneapolis, MN 55435
Phone: 612-835-2322
TWX: 910-576-2423
FAX: 612-835-4156

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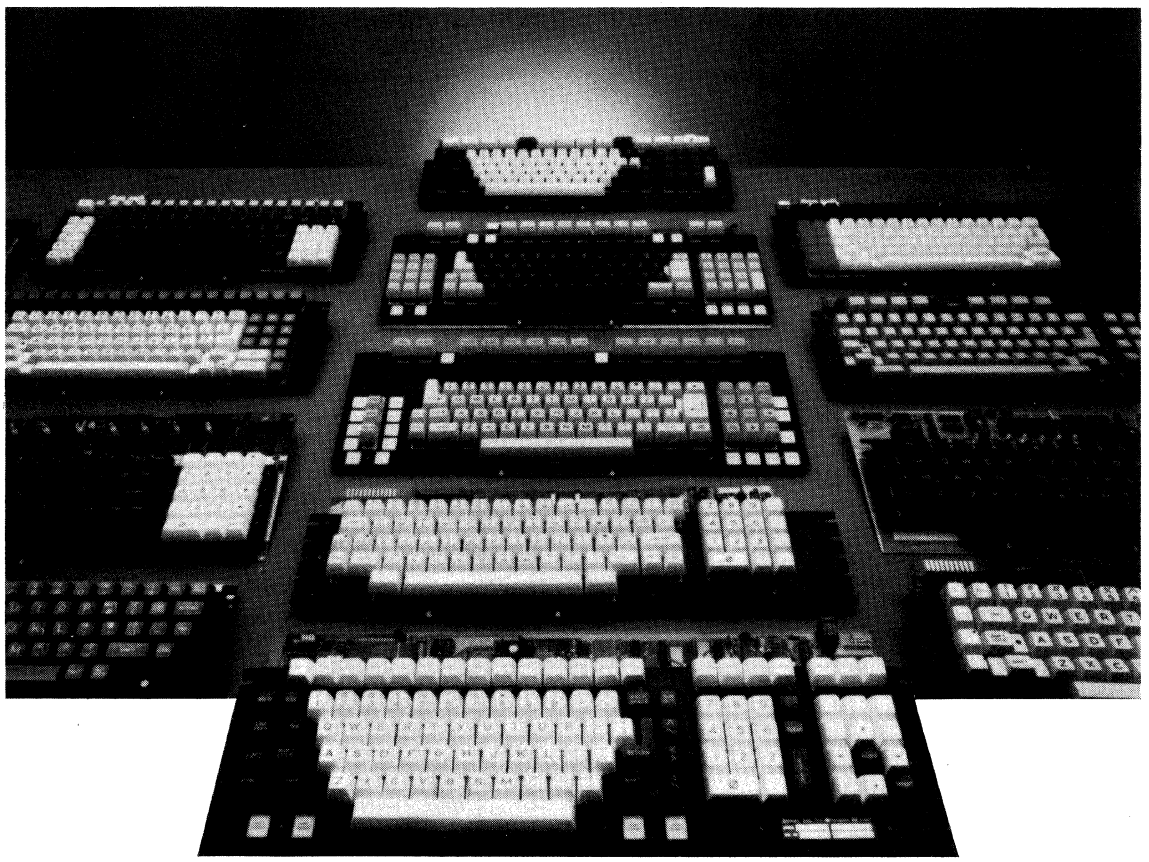
Solid State Keyboards

Amkey delivers!



custom designed keyboards

To meet your requirements cost effectively, Amkey's engineering staff works closely with your design team to build a quality keyboard. We build state-of-the-art capacitance keyboards for word processing, data entry, graphics display, CAD/CAM, typesetting and point of sale terminals.

Amkey keyboards offer features like...

- Parallel or serial output—TTL or RS232, RS423, RS422, etc.
- Amkey's silent "No-Switch" snap in keyswitches
- Custom programs for special features include different baud rates, sequential codes and key functions
- Full travel DIN standard/sculptured/stepped/sloped keyboards
- Hardware options—clickers, beepers, LEDs, displays, lighted targets, trackballs, mice, joysticks, etc.
- Prompt delivery

AMKEY OFFERS FULL TRAVEL CUSTOM COMMERCIAL, AND HI-REL MILITARY KEYBOARDS FROM CONCEPT TO FIRST ARTICLE IN LESS THAN 16 WEEKS

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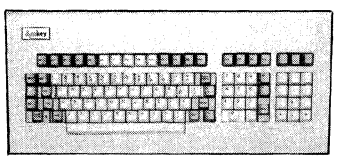
Solid State Keyboards

DIN-64

STANDARD FEATURES

- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Cursor control keys
- Amkey's patented phase-detector
- +5 volt operation
- Asynchronous serial TTL ASCII output
- Automatic-repeat enable/disable
- Power-up reset
- 4 Modes
- Two shot molded keytops with sculptured typing area and matte surface

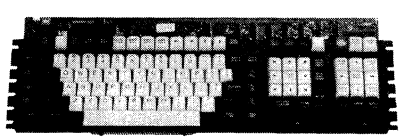
DIN 124



STANDARD FEATURES

- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- Microcomputer controlled
- 20 function keys across top row for improved software capability
- Amkey's patented phase-detector
- Asynchronous serial ASCII output and input
- RS-232 9600 baud
- Automatic-repeat enable/disable
- 4-led display
- Power-up reset
- 4 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

MPNK 114



STANDARD FEATURES

- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- Automatic repeat enable switch
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Sculptured typing area
- Shift lock and caps lock w/LED target in key
- Serial transmission at multiple baud rates

DIN 106-1

STANDARD FEATURES

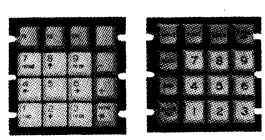
- 19mm solid state switches to meet 30mm ergonomic requirements (DIN standard) with .150" total key travel
- Solid state capacitance technology
- MCS-48 series microcomputer controlled (8048,8035, etc.)
- Full 21 function keys across top row for improved software capability
- Amkey's patented phase-detector
- +5 volt operation (12V option on longer cable)
- Asynchronous serial RS-422 ASCII output with jumper selectable 300, 2400, 4800, 9600 baud
- Automatic-repeat enable/disable
- Power-up reset and externally resettable
- Selectable serial logic
- 5 Modes
- 3 user location homing bump keys
- Two shot molded keytops with sculptured typing area and matte surface

MPNK 101

STANDARD FEATURES

- Microprocessor controlled
- Single +5 VDC supply
- Eprom programmable
- Solid state circuitry
- N-key rollover
- 5 modes
- Automatic repeat enable switch
- High reliability
- Sculptured typing area
- Two-shot molded key tops
- Rigid chassis mounting
- Low profile
- Rugged construction
- Low power requirement
- Lock key with LED target
- Serial or parallel output
- Multiple baud rates

SNK 16



STANDARD FEATURES

- Serial RS 232C interface
- Prom Programmable
- Solid state circuitry
- N-key rollover
- Two-shot molded key tops
- High reliability
- Rigid chassis mounting
- Rugged construction
- Low power requirement

CHERRY ELECTRICAL PRODUCTS
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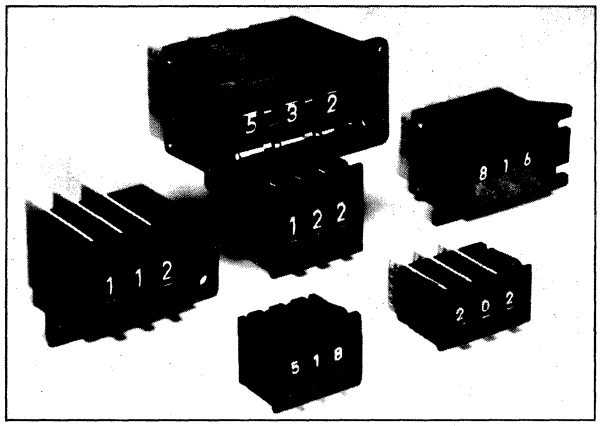
312/360-3500 • FAX 312-360-3566

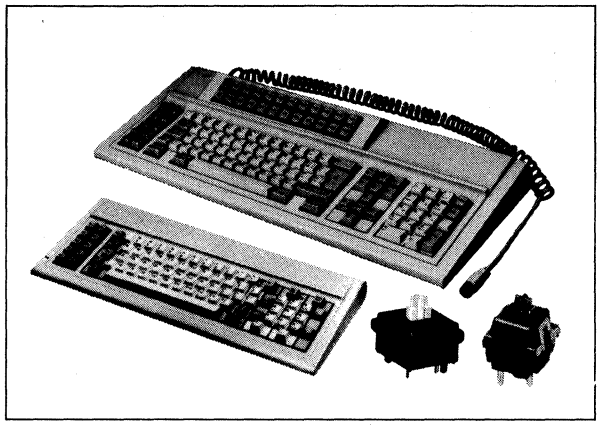
Thumbwheel Switches



Cherry's Thumbwheel, Leverwheel & Pushwheel Switches are available in over 20 types including Industrial Size Thumbwheels and Leverwheels (Series T10, L10, T11, L11) Standard Size Thumbwheels (Series T64, T65, T71, T72 and T75); Miniature Thumbwheels and Leverwheel (Series T20, L20, T24, T35, T38, T62 and T63); Subminiature Thumbwheel and Pushwheels (Series T50, T51, T52, T54, T56 and T57); Sub-Subminiature Pushwheels (Series T55 and T59). We offer many variations in output codes and readout symbols. 8-10-12 and 16 positions, gloss or matte finish.

Sizes—.590″ high .945″ high
1.15″ high 1.20″high
1.88″ high

Keyboards and Keyswitches



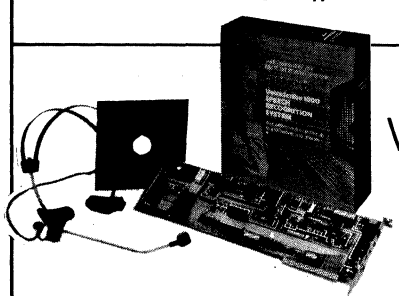
Cherry is flexible, providing a broad range of custom designed keyboards . . . plus several stocked standard keyboards with 83, 84, 101 and 126 key designs. Super enhanced G80-2000 IBM compatible including Card Reader, Bar Code Reader and Mouse for PC/XT and AT systems. All current state-of-the-art. Backed by more than 20 years of Cherry know-how.

Basic keyswitches in three types . . . all with gold wire contacts for high switching reliability:

MX—Ergonomic design in modern full travel low profile.

M8—Lowest profile keyswitch.

M7—Regular keyswitch profile.



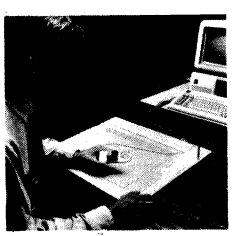
VoiceScribe™ 1000

Voice command of IBM PC/XT AT or compatible. Create custom vocabulary for any compatible application as you speak, responds to words or phrases. Ideal for hands free inventory control systems, quality assurance inspection program or technical records transcriptions . . . reduces error potential.

System includes complete operating instructions, tutorials, Dragon KEY MS-DOS program interface and Dragon LAB application tools.

Software noise cancelling microphone headset and Electronic Printed Circuit Board to fit full length expansion slot.

Graphic Tablet



Software compatible with the top CAD program. Create drawings and graphics with your personal computer.

Drawings can be erased or stored in memory. Features relegendable menu strips to execute drawing commands, macros and symbols at a touch.

Has easy to use cursor puck and sketching pen. Sixteen option selector DIP switches allow user to configure the tablet to his computer's hardware and data format requirements.

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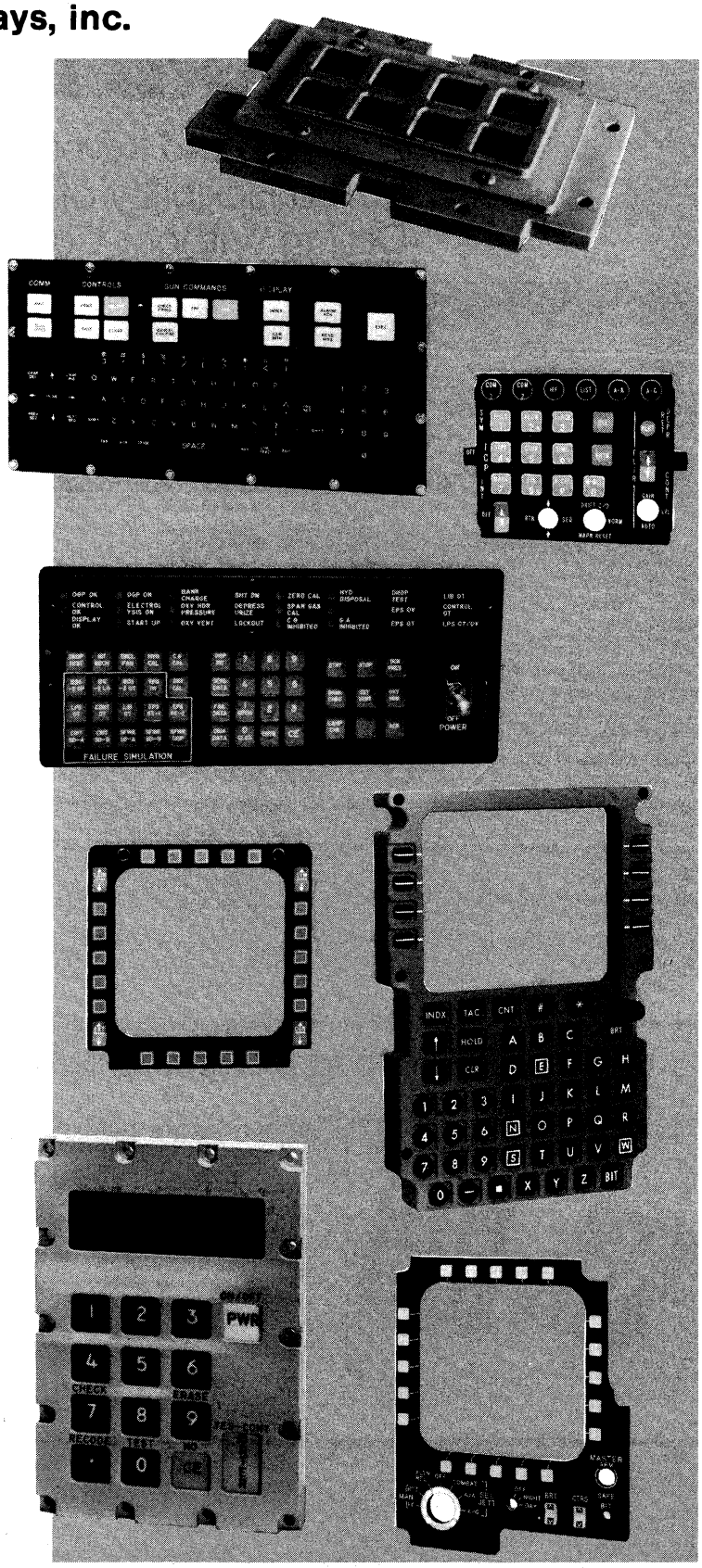
Control Displays specializes in custom keyboards and lighted panels. Our dedicated workforce with over 20 years of experience will provide the necessary engineering assistance from start to finish on your program. Our products are currently installed on spacecraft, military and commercial aircraft, surface ships, submarines, tanks, rocket launchers, helicopters, and command and control installations. Whether you provide a complete baseline specification or simple sketch our state-of-the-art facilities enable us to design, produce, and deliver on schedule.



ENVIRONMENTALS

- TEMPEST
- EMI/RFI/EMP
- RAD HARDENED
- STATIC DISCHARGE
- SHOCK
- VIBRATION
- HI/LOW TEMP.
- SAND & DUST
- SALT SPRAY
- CHEMICAL
- RAIN
- HUMIDITY
- WATERPROOF
- FUNGUS
- ALTITUDE
- DECOMPRESSION

OPTIONS

- INCANDESCENT
- ELECTROLUMINESCENT
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- NVIS
- DEAD FRONT
- REPLACEABLE LAMPS
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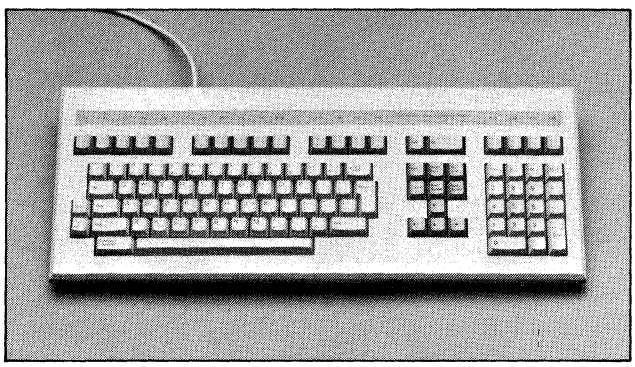
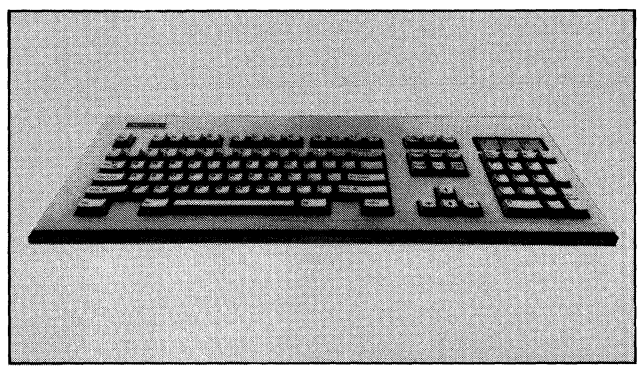
The KD-220 Standard Keyboard Series—All the Freedom and Flexibility of Custom Keyboard Design Without Costly Tooling.



MODEL KD-220-1



MODEL KD-RT

The KD-220 & KD-167 Keyboard series are available in three standard formats for DEC and IBM compatibility. Digitran also offers the most ergonomically designed, custom capacitance keyboards in addition to standard keyboards availability. While meeting DIN specifications, the keyboard features the lowest profile, full travel (.150 inch) key switches in the industry.

KD-220

- Model KD-220-1 offers DEC VT-220 layout—105 keys
- Model KD-220-2 offers IBM AT expanded layout
- Separate cursor control keys
- Separate numeric pad arrangements
- IBM XT, or AT, or ASCII codes
- 128 key positions for user customization
- Relegendable function keys
- Off-the-shelf delivery

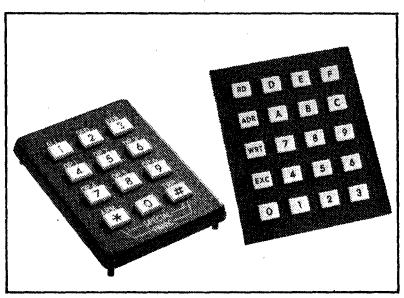
KD-167

- IBM XT, or AT
- Off-the-shelf delivery

FEATURES

- Low-cost enclosure inserts for custom configurations
- N-key rollover
- Tactile or linear feel
- DIN ergonomic design
- MCBF—100,000,000
- High RFI/EMI/ESD tolerance
- Low power consumption
- No keyswitch bounce
- Patented tease-proof switch
- Frameless design
- Enclosures and cables
- One year warranty
- Two shot molded keytops
- Stepped sculptured keytops
- Impervious to moisture, dust, debris
- ESD protected packaging
- Fully automated, vertically integrated manufacturing
- LED keys
- Keyforces from 1 to 9 oz.

For Custom Keypad Design, Choose Our KL MINIKEY® Series



12 KEY MODEL 20 KEY MODEL

MINIKEY Keypads are available in standard arrays of 6, 12, 16, and 20 keys.

Standard keys are two-color, molded with black characters on white backgrounds. Standard frames are black, textured, non-glare finished, and special key legends, colors and configurations are available.

Environmental protection is provided by a flexible barrier under the keys to prevent contamination of contact area.

MINIKEYS can be rear or front mounted, and are designed to interface with all digital logic circuitry including TTL and CMOS.

Contacts are made of precious metal to insure low contact resistance. Contact bounce is less than 3 milliseconds.

Terminations: .025" (.64mm) square pins (tin plated) standard. (.027 max. sq. pins after soldering)

- Tampo printing on frame or keys for custom applications
- One year warranty
- Standard output codes include: 6XY, SP12, 2 of 7, 12XY, SP16, 2 of 8, 16XY, and 20XY.

DIGITRAN®

A DIVISION OF XCEL CORPORATION

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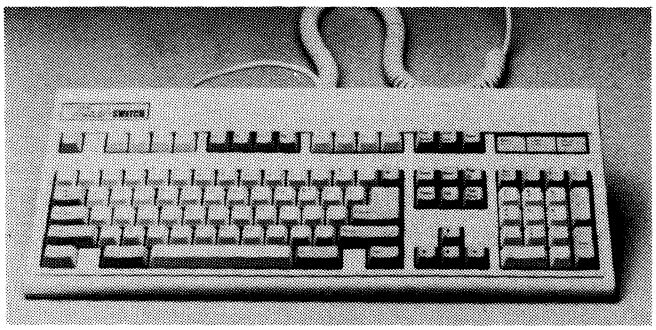
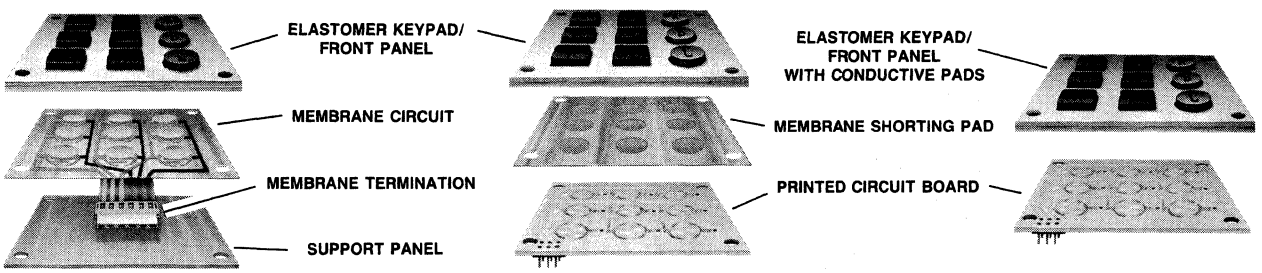
Full-travel microcomputer/data entry keyboards from EECO/Maxi-Switch



- Available now — revolutionary NEW MEMORY PRO™ for optimum PC/XT, AT computer use.
- Custom hardware and/or software.
- Plug compatible with IBM PC/XT/AT and other leading computers.
- 83/84/101/122 keys. Standard models available.
- Sealed keyboards for industrial use.
- Conductive elastomer, hard contact mechanical, membrane, reed switch technologies.
- US and international language versions available.

Low-profile elastomer keypanels can be customized to individual needs. Here are three typical choices . . .



Elastomer/membrane construction suits applications that call for the reliability and environmental protection of a fully sealed assembly. The membrane termination is an integral part of the circuitry, saving the cost of soldering and cable connections.

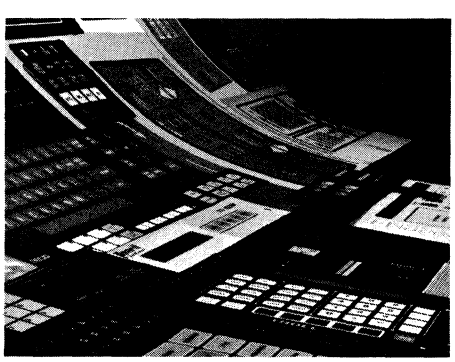
Elastomer/shorting pad/PC board construction fulfills the requirements of applications that call for board mounted components, while retaining all the benefits of sealed circuitry.

Choose the **conductive elastomer/PC board configuration** when your application does not require sealed circuitry but does demand a reliable keypanel at a lower cost.

Flat-panel membranes featuring embossed graphics, backlighting/ deadfronts/lenses, selective texturing.

Other design options include . . .

- CAD generated designs.
- ESD/EMI shielding.
- In-house PC board fabrication.
- Support panel interface.
- Tactile feedback.
- Fully sealed construction.
- Standard membrane panels available.



EECO

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REFAC KEYPADS & KEYBOARDS

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☐ MEMBRANE
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Consultation Without Obligation

ERA/REFAC's 15 years of keyboard design and manufacturing expertise is yours for the asking. Call or write us with your inquiries. Our experienced engineers will provide the answers you need regarding applications and pricing. From keyboard components to totally integrated keyboards. ERA/REFAC has the capability to provide ideas and solutions.

Quality And Reliability

ERA/REFAC carries the highest levels of commitment to quality. Years of proven performance in high reliability aerospace, military, and tough industrial applications assure our customers that their products will achieve both design criteria and field performance.
ERA/REFAC works to MIL-STD-105.

State-Of-The-Art Tooling And Assembly

You can depend on ERA/REFAC for the latest in subassemblies and turnkey products. Our manufacturing facilities in Connecticut and Taiwan are both equipped with automated assembly lines that include chip-on-board wire bonders, surface mount pick-and-place machines, wave soldering machines, and automated test equipment. Our capabilities are complemented by the ERA/REFAC Design Engineering Group, specialists in design and customer interfacing. Computer controlled tool room capabilities assure precision tooling and fast turnarounds.

There may be a Refac keyboard in your future. Write, call, or fax your specifications to us today.

ERA
REFAC TRANSPAC

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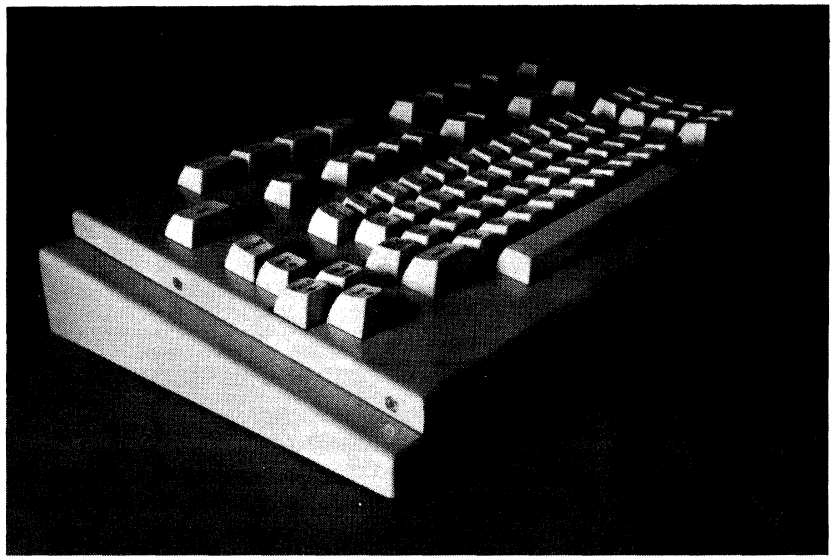
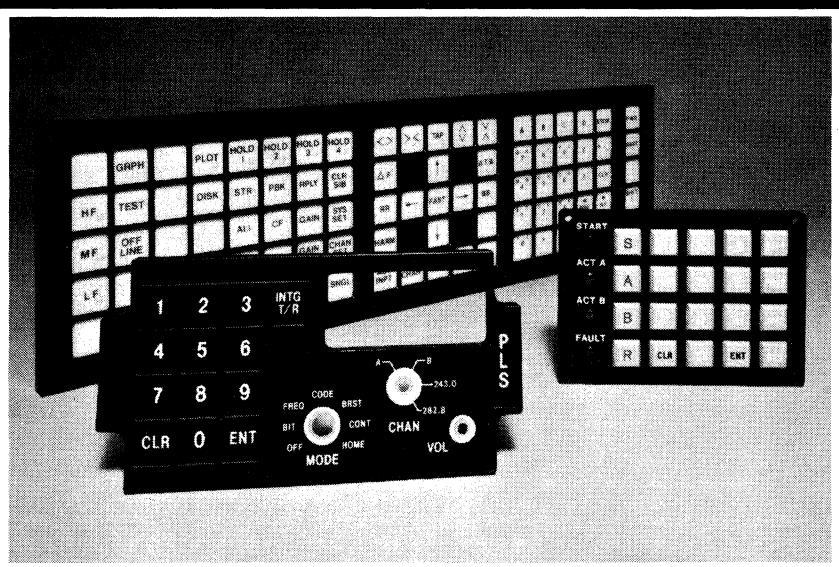


FLEX-KEY

specialists in military keyboard systems



KEYBOARD OPTIONS INCLUDE:

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- BACKLIGHTING
- TEMPEST
- HAND HELD TERMINALS
- EMI/EMP SHIELDING
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  - SHOCK
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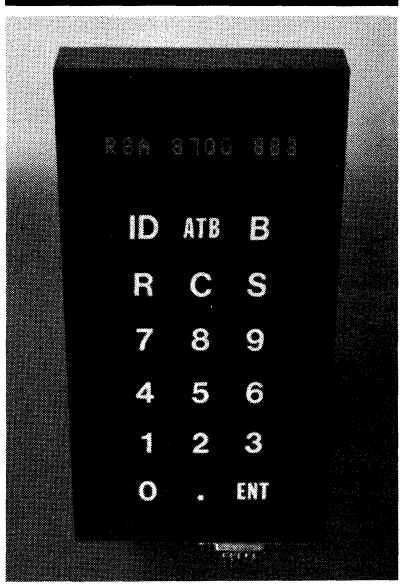

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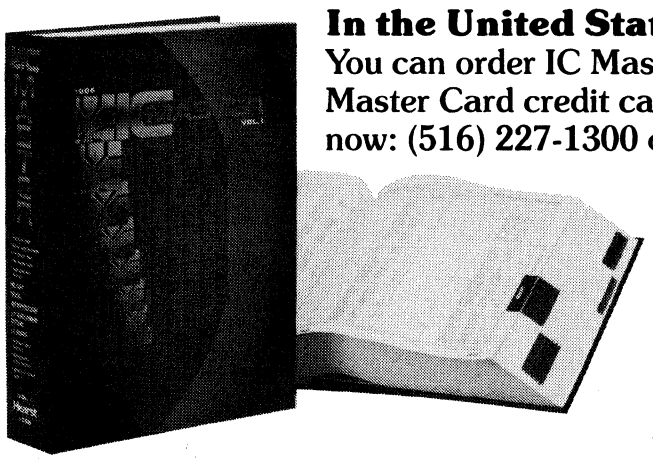

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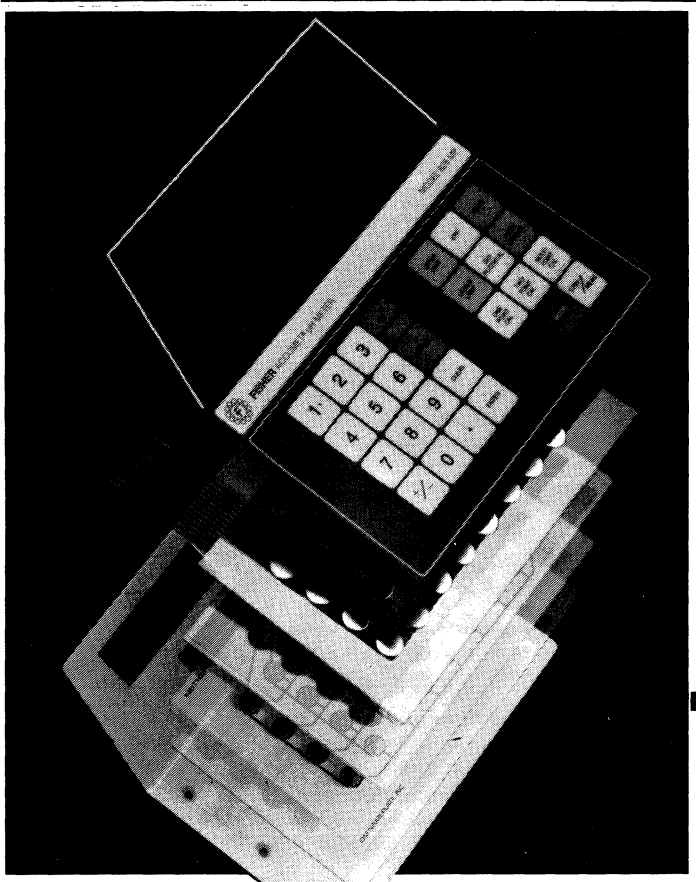

GM NAMEPLATE, INC.

Membrane Switch Products

Fully Integrated Manufacturing For Process Control and Convenience

- Custom Constructions
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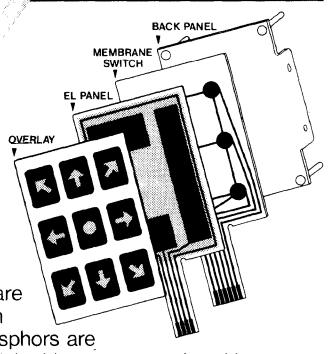
MEMBRANE SWITCH CONSTRUCTION



1. GRAPHIC OVERLAY
Subsurface and/or top printed on polycarbonate. No limit to perfectly matched colors. Top printed graphics are protected by solid or selective surface textures. Overlay designs can include transparent or tinted display windows, embossed and die cut areas.

2. ELECTROLUMINESCENT LAMP*
FLEX/EL™Electroluminescent Panels are flexible, composed of a thin, plastic film base and an encapsulant film. The phosphors are energized by AC to emit cool, uniform light. Lit areas are printed in any desired configuration. The assembly is laminated to seal it from environmental attack.

3. MEMBRANE SWITCH
Normally open, single pole, single throw momentary contact device. Consists of three layers of thin, flexible film-- printed circuit patterns, insulators and spacers-- printed, die cut and bonded with high strength adhesive to form flat, sealed switches. Conductive patterns are printed on the facing, inner surfaces of the two outermost layers, which are separated, everywhere except at the contact pad, by a polyester or polycarbonate "spacer." Light, direct pressure activates the switch. Tactile feedback can be built in. Supplied unterminated, or with solder tabs, male or female headers.

4. PRINTED CIRCUIT BOARD AND/OR SUB PANEL
Membrane Switches can be installed, at the factory, to a GM-made or customer-supplied PCB and/or sub panel, or formed to fit within a particular housing shape.

** FLEX/EL™ panels are manufactured from GM Nameplate, Inc. products and DUN-L.A.D.® screen printable electroluminescent films. DUN-L.A.D.® films are a product of Dunmore Corporation, Newtown, Pennsylvania USA.*

MEMBRANE SWITCH DESIGN SPECIFICATIONS

ELECTRICAL	
Closed contact resistance:	< 100 ohms. (Varies with design)
Voltage:	30VDC or 15V rms AC maximum 1VDC minimum
Current:	25 milliamps maximum
Power:	250 milliwatts maximum
Capacitance:	< 20pF
Contact bounce:	< 10ms on make or break
MECHANICAL	
Switch assembly thickness:	.020" - .030" (.5mm - .8mm)
Switch travel:	.005" - .014" (.2mm - .4mm)
Actuation force:	4 - 12 oz. (112 - 336g)
Operating life:	Tactile: up to 1 million cycles Non-tactile: up to 3 million cycles
ENVIRONMENTAL	
Storage temperature:	−40°C to +70°C
Operating temperature:	0°C to +55°C
Vibration:	10 - 200 Hz, 20Gs maximum (MIL Std. 202E)
Shock:	50Gs, 1/2 sine, 11 millisecond pulse
Moisture resistance:	5 - 95% relative humidity non-condensing (MIL Std. 202E)

FLEX/EL™ ELECTROLUMINESCENT LAMP* DESIGN SPECIFICATIONS

ELECTRICAL	
NominalCurrent:	mA/in^2
Capacitance:	$1.5\ NF/in^2$
Power Consumption:	Very low (mW/in^2)
Power Requirements:	DC power supply with inverter AC power supply with modulator
Output Voltage:	100-200 VAC @ ~600 Hz.
MECHANICAL	
Lamp Thickness:	0.009" - 0.013"
Termination:	Flat, tail, solder pins, Berg clinchers, etc.
Flexibility:	To 90° (180° @ 5"rad.)
ENVIRONMENTAL	
Storage Temperature:	−20°C (−4°F) to +80°C (+176°F)
Operating Temperature:	−10°C (14°F) to +80°C (+176°F)
Humidity:	95% R.H. 120°F (48.9°C)

For samples, consultation or price quotation, call Membrane Switch Design Center (206) 284-2200

GM NAMEPLATE, INC.

Membrane Products Group

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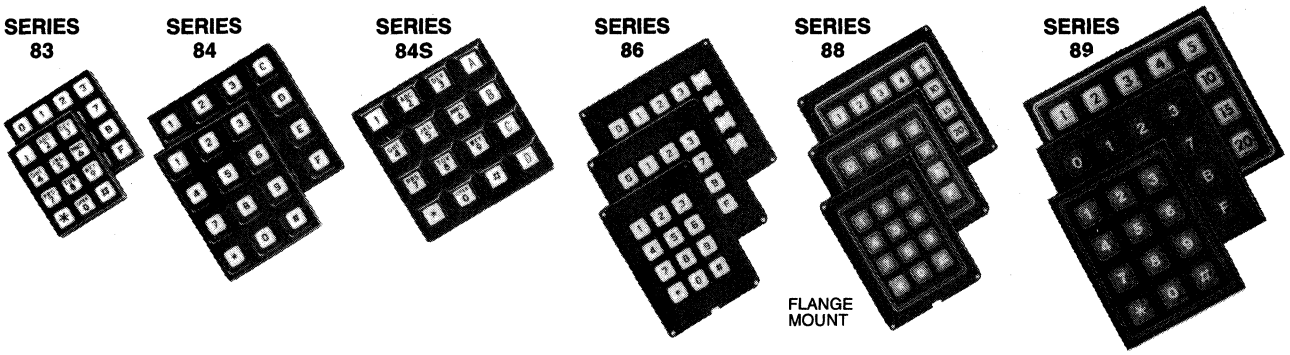
Grayhill INC. 12, 16, and 20 Button Keypads

561 HILLGROVE • P.O. BOX 10373 • LA GRANGE, ILLINOIS 60525 • PHONE: (312) 354-1055



Features	Legend	Series	Btn. Cntrs.	Pinout	Mounting	Ht.	Length	Overall Width 3x4	Overall Width 4x4	Overall Width 5x4
Very Small Size	2-shot	83	.50″	Columns	Post	.35″	2.1″	1.6″	2.1″	—
Wide Spacing	2-shot	84	.75″	Columns	Post	.35″	2.1″	1.6″	2.1″	—
Environmentally Sealed	Printed	84S	.75″	Columns	Stud	.50″	3.1″	—	3.1″	—
2 Choice Flange Mount	2-shot	86	.50″	In-line	Screw	.36″	3.0″	2.2″	2.7″	3.2″
Lit/Unlit, Sealed	Graphic	88	.50″	In-line	Screw	.36″	3.0″	2.2″	2.7″	3.2″
Thin, Wide Spacing	Graphic	89	.75″	In-line	Adhesive	.01″	3.5″	2.8″	3.5″	4.3″

STANDARD LEGENDS

Legends for 83, 84, and 86 are molded; for 84S, epoxy ink printed. 88 and 89 have colorful (blue), second surface printed graphics.

INSTANT CUSTOM LEGENDS

Blanks of 83, 84, and 86 have snap-on caps for inserts; unlit 88 uses inserts and requires overlay seal. Removable ABS 84S buttons can be hot-stamped or epoxy ink printed. Adhesive labels are used for 89.

SEALED AND LIGHTED KEYPADS

Nitrile rubber 84S housing seals it to panel; gasket is needed for the 88, plus overlay seal for blank 88. A 5 Vdc supply and DC to AC inverter are required to power the electroluminescent 88 keypads.

SPECIFICATIONS

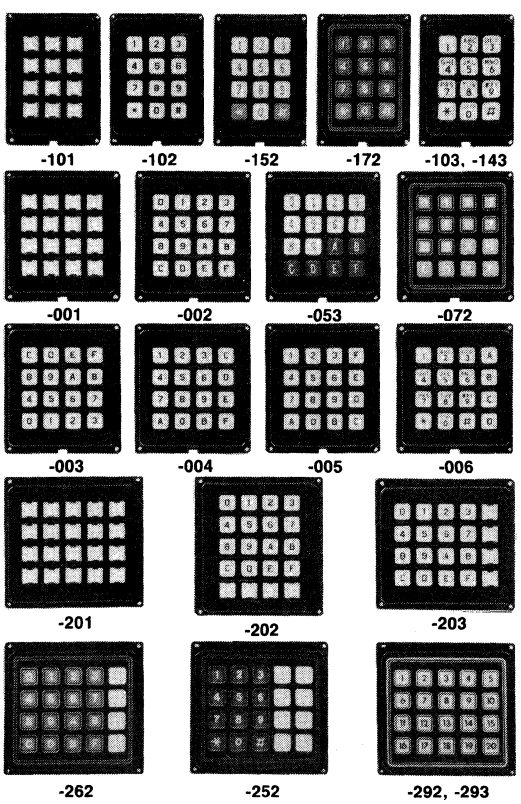
Rated for 3 million operations at 10 mA 24 Vdc, −40°C to +80°C. Contact resistance is logic compatible; bounce, less than 4 mS at make, 10 mS at break. Housings (except 84S and 89) and molded buttons are ABS plastic; graphics (88 and 89) are polyester. Snap on caps are polycarbonate.

ORDERING INFORMATION

Complete the part number by adding a legend number to the stem number.

Available From GRAYHILL Distributors

Size	Stem No. By Circuit Code: 2 of 7 (8)	Matrix	SP/Common	Legend Choices
COMPLETE KEYBOARDS				
3x4	83AA1-	83AB1-	83AC1-	-101, -102, or -103
	84AA1-	84AB1-	84AC1-	
	86AA2-	86AB2-	86AC2-	
	88AA2-E01- (lighted)	88AB2-E01- (lighted)	88AC2-E01- (lighted)	-143, -152,- or -172
	N.A.	89AB2-	89AC2-	-172-A
4x4	83AB1-	83BB1-	83BC1-	-001, -002, -003,
	84BA1-	84BB1-	84BC1-	-004, -005, or -006
	N.A.	84S-BB1- (sealed)	N.A.	-001, -004, or -006
	86BA2-	86BB2-	86BC2-	-001, -002, -003, -004, -005, or -006
	88BA2-	88BB2-	88BC2-	-053, or -072
	88BA2-E01- (lighted)	88BB2-E01- (lighted)	88BC2-E01- (lighted)	
	N.A.	89BB2-	89BC2-	-072-A
5x4	N.A.	86JB2-	86JC2-	-201, -202, or -203
	N.A.	88JB2-	88JC2-	
	N.A.	88JB2-E01- (lighted)	88JC2-E01- (lighted)	-252, -262, or -293
	N.A.	89JB2-	89JC2-	-252-A, -262-A, or -292-A
COMPLETE PART NUMBERS FOR UNLIT BLANK 88 KEYBOARDS AND REQUIRED OVERLAYS				
3x4	88AA2	88AB2	88AC2	88-101
4x4	88BA2	88BB2	88BC2	88-001
5x4	N.A.	88JB2	88JC2	88-201



Accessory Description	Series	3x4	4x4	5x4
Sheet of Legend Inserts	84 unsealed, 88 unlit, 83, and 86	All Sizes: 87AC2046		
Sheet of Legend Labels	89	All Sizes: 89AC3038-1		
Gasket Seal, Sub Panel Mount	All 88	88M2001-2	88M2009-2	88M2019-1
Gasket Seal, Top-Side Mount	All 88	88M2012-1	88M2015-1	88M2018-1
Inverter For Light Panel	88 Lighted	88NV1025-1	88NV1025-2	88NV1025-3

For prices, contact a Sales Office, a Distributor, or GRAYHILL.

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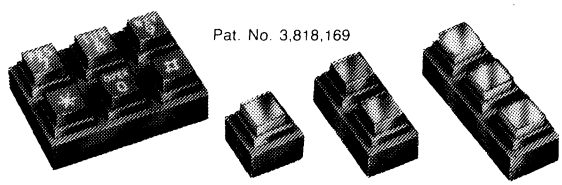
Keyboard Modules

CREATE YOUR OWN CONFIGURATION AND MAINTAIN BUTTON DISTANCES

Series 82 Modules

- 11/16″ Button Centers
- Long Stroke, Wiping Contacts
- 4 Sizes in 1 to 4 Poles
- Lightable Buttons/Legends
- Insertable Printed Legends
- Invisible Deadfront Option



STANDARD LEGENDS OR INSTANT CUSTOM LEGENDS

Telephone modules have molded-in legends. Others have slotted caps for printed inserts. Lightable gray styles have lighted buttons. Lightable black styles, have legend-only lighting with a choice of legends: visible (thru-lit style) or invisible (deadfront) when unlit. Insert sheet includes letters, 0-19, phone legends, and common symbols and terms.

SPECIFICATIONS

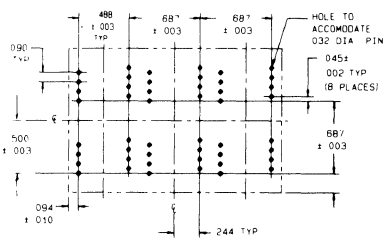
Momentary switches have a total travel of .130″ and a nominal overtravel of .080 inches. Operating force is 8 ± 3 oz depending on the number of poles. Switches are rated at 100 mA, 5 Vdc for 1,000,000 operations. Contact bounce is 10 mS or less. Voltage breakdown is 250 Vac. Insulation resistance is 1000 megohms minimum. Heat resistance to soldering is tested up to 260°C. Careful flux cleaning is required since switches are not sealed. Lightable modules fit over T-1 size LEDs/lamps which are .250″ maximum above board. Lamps are not supplied. For operating temperature, luminosity and factory legends, contact GRAYHILL.

DIMENSIONS

All modules are .750″ high.

Buttons:	Length	x	Width
1:	0.683	x	0.683
2:	1.370	x	0.683
3:	2.057	x	0.683
6:	2.057	x	1.370

PC board viewed from top.



Actual pin locations depend on circuitry and style. Layout for 4PST module is shown.

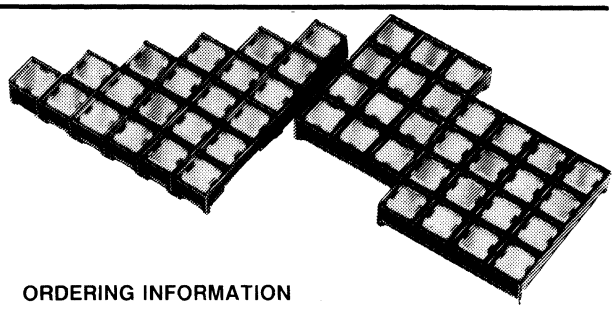
For prices and discounts, contact a local Sales Office, an authorized Distributor or Grayhill.

Available from GRAYHILL Distributors

No. Of Buttons	Circuitry Of Each Button	Part Number
Unlighted Telephone Keyset—Top Six Buttons		
6	Single Pole/Single Throw	82-601-65
6	Two Pole/Single Throw	82-601-86
6	Three Pole/Single Throw	82-601-87
6	Four Pole/Single Throw	82-601-88
Unlighted Telephone Keyset—Bottom Six Button		
6	Single Pole/Single Throw	82-601-89
6	Two Pole/Single Throw	82-601-90
6	Three Pole/Single Throw	82-601-91
6	Four Pole/Single Throw	82-601-92
Unlighted Gray Modules—For White Legend Inserts		
1	Single Pole/Single Throw	82-101-71
1	Four Pole/Single Throw	82-101-74
2	Single Pole/Single Throw	82-201-41
2	Four Pole/Single Throw	82-201-44
3	Single Pole/Single Throw	82-301-61
3	Four Pole/Single Throw	82-301-64
6	Single Pole/Single Throw	82-601-81
6	Four Pole/Single Throw	82-601-84
Lightable Gray Modules—For Legend Inserts		
1	Single Pole/Single Throw	82-150-38
1	Two Pole/Single Throw	82-150-16
3	Single Pole/Single Throw	82-350-12
3	Two Pole/Single Throw	82-350-9
6	Single Pole/Single Throw	82-650-19
6	Two Pole/Single Throw	82-650-9
Lightable Black Modules—For Thru-Lit or Deadfront Inserts		
1	Single Pole/Single Throw	82-150-211
1	Two Pole/Single Throw	82-150-213
3	Single Pole/Single Throw	82-350-41
3	Two Pole/Single Throw	82-350-43
6	Single Pole/Single Throw	82-650-71
6	Two Pole/Single Throw	82-650-73
Legend Insert Sheets		
White Legends on Clear Film		82AC2017-1
Black Legends on Clear Film		82AC2050-1
Thru-Lit White Legends Out of Black		82AC2055
Deadfront Legends Out of Black		82AC2060

SYSTEM 87 Modules

- Low Profile, Audible Dome Contacts
- 1/2″ Maintained Button Centers
- Preprinted Insertable Custom Legends



LEGEND INSERTS

Self adhesive printed inserts are die-cut to fit buttons. Sheet includes common symbols, terms, letters and 0-99, printed in black on clear film. Blank inserts are included for use with dry transfer lettering. Dry transfer assortments in 3 sizes of matching type are also available.

Snap-On Cap

SPECIFICATIONS

Logic compatible contact resistance and rated at 10 mA, 24 Vdc for 3 million operations. Voltage breakdown is 250 Vac. Contact bounce is less than 4 mS at make, 10 mS at break. Travel is .015″; operating force is 300 grams; operating temperature is −40°C to +80°C.

For prices and discounts, contact a local Sales Offices, an authorized local Distributor or Grayhill.

Available From Your Local GRAYHILL Distributor

ORDERING INFORMATION

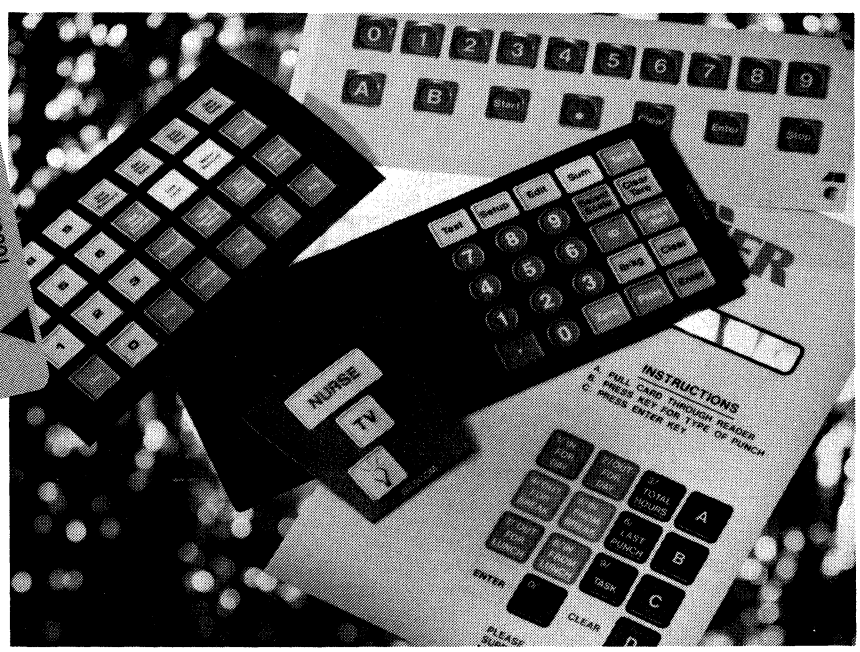
Type Of Module Or Legend	Size	Part Number
1 Button—SP/Common Bus	0.5 x 0.5	87CC3-201
2 Button Strip—SP/Com. Bus	0.5 x 1.0	87DC3-201
3 Button Strip—SP/Com. Bus	0.5 x 1.5	87EC3-201
4 Button Strip—SP/Com. Bus	0.5 x 2.0	87FC3-201
5 Button Strip—SP/Com. Bus	0.5 x 2.5	87GC3-201
6 Button Strip—SP/Com. Bus	0.5 x 3.0	87HC3-201
12 Button—Matrix Circ.	1.5 x 2.0	87AB3-201
12 Button—SP/Com. Bus Circ.	1.5 x 2.0	87AC3-201
16 Button—Matrix Circ.	2.0 x 2.0	87BB3-201
16 Button—SP/Com. Bus Circ.	2.0 x 2.0	87BC3-201
Sheet of Legends Inserts	Die-cut	87AC2046
Dry Transfer Assortment	Small Type	87-DT-2096-088
Dry Transfer Assortment	Med. Type	86-DT-2096-125
Dry Transfer Assortment	Large Type	86-DT-2096-187

Hall Membrane Switches and Product Identification —

Our total process capabilities in membrane switches with or without tactile feedback is backed by outstanding design experience.

HALL BIG SWITCH

We have developed a unique process for single-key membrane switches with active areas anywhere from 1 sq. inch to 5 sq. feet. Actuation pressure can be from ounces to pounds with actuation force maintained throughout the conductive surface. They are ideal for emergency and handicap access applications.



THE HALL COMPANY

420 East Water Street
Urbana, Ohio 43078
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The Hall Company is a vertically integrated manufacturer with total process capability. Lead times and product quality are tightly controlled as a result of our ability to provide complete "in-house" construction of your membrane switch assembly. Our 25 years of electronic component experience and metal fabrication techniques allows "one stop" sourcing of your total switch assembly, graphic panel or nameplate needs. Write for our free descriptive brochure.

INTERSWITCH
ONE OF THE PURDY GROUP OF COMPANIES

Thumbwheel & Rotary DIP Switches, Codicount 7-Segment LED Displays

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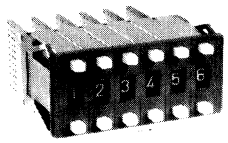
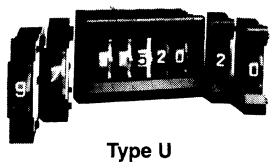
Thumbwheel Switches



Type D&Z Pushbutton

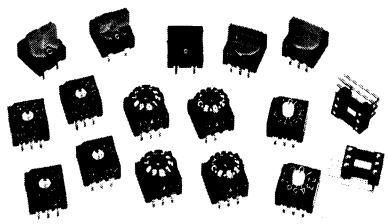


Type U

Available Switches (dimensions in millimeters)

Series A		B	D	E	G	H	L	M	N	P	R	S	U	V	Z
Front Mounting		•	•		•	•		•			•	•	•	•	•
Rear Mounting	•			•			•		•	•					
Width	11	12.5	7.62	16	20	10	8	8	7	10	20	10	8	8	7.62
Height	39	58	24	18	76	33	18	33	18	24.2	33	33	33	26.5	15
Mounting Depth	63.6	67.1	33.5	31.5	79	38	31.5	38	31.5	38.25	38	38	40	32.5	24
Spacer 2.54 mm			•												
Spacer 2.7 mm						•				•		•			

RDS Rotary DIP Switches

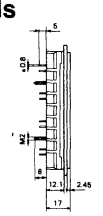


Features

- ☐ Available in BCD and hexadecimal codes.
- ☐ Kinked terminals to hold switches in PC board to prevent lift off in wave soldering. Switches are still socket pluggable.
- ☐ Knob and wheel type switches may be hand adjusted.

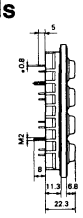
The New Interswitch Keypads 3 × 4 and 4 × 4

KNM 2 Series KNM 2, Waterproof (IP 65 Protection) with Flush Keys 3 × 4 and 4 × 4 Keypads

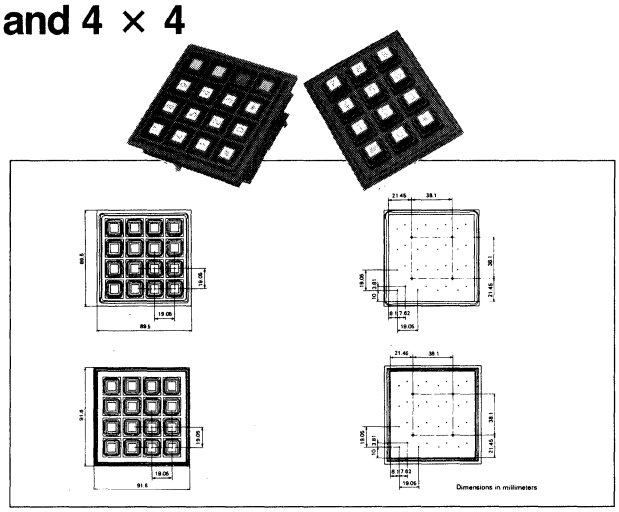


Series KNM 2

KNM 3 Series KNM 3, Waterproof (IP 65 Protection) with Raised Keys 3 × 4 and 4 × 4 Keypads



Series KNM 3



Features:

- ☐ Constant pressure point
- ☐ Reliable contact closure due to plunger thrust
- ☐ Long service life

Technical Data

Mechanical:

Housing:	Crastin/silicon rubber
Key Travel:	1.35 mm
Actuating Force:	2.2 N ± 0.4 N
Termination:	Solder pins
Service Life (at nominal load):	5 × 10^6 operations

Electrical:

Contact:	n.o. contact (5μ Ni/2μ Au)
Operating Voltage:	max. 50 V≅
Test Voltage:	500 V≅
Nominal Current (resistive load):	max. 125 mA≅
Contact Rating:	max. 2 W
Contact Resistance:	<150 mΩ
Insulation Resistance:	>10^2 MΩ
Bouncing Time:	<5 ms

Environmental:

Application Class (DIN 40040):	GSF
Operating Temperature Range:	−40°C to +70°C
Storage Temperature Range:	−40°C to +70°C
Relative Humidity:	75% annual average, 95% 30 days
Protection Type:	IP 65

Order No. Description

KNM20S34---	Numeric Keypad, monoblock 3 × 4, springless, mechanical contact, standard version, Key travel, 1.35 mm, waterproof
KZDIV34---	Toroidal sealing ring for waterproof Keypad KNM2, 3 × 4, for front mounting
KZDIH34---	Toroidal sealing ring for waterproof Keypad KNM2, 3 × 4, for rear mounting
KNM2OS44---	Numeric Keypad, monoblock 4 × 4, springless, mechanical contact, standard version, key travel, 1.35 mm, waterproof
KZDIV44---	Toroidal sealing ring for waterproof Keypad KNM2, 4 × 4, for front mounting
KZDIH44---	Toroidal sealing ring for waterproof Keypad KNM2, 4 × 4, for rear mounting
KNM3OS34---	Numeric Keypad, monoblock 3 × 4, springless, mechanical contact, standard version, key travel, 1.35 mm, waterproof
KNM30S44---	Numeric Keypad, monoblock 4 × 4, springless, mechanical contact, standard version, key travel, 1.35 mm, waterproof

*Without Keytops

Standard Keytop Sets

Keytop Sets B (ivory) with marking in black as per list below available from stock

KKE1B-A... KKE1B-AAAA Set of 12 keytops 0-9/*/#
KKE1B-ABBB Set of 12 keytops 0-9/*/−
KKE1B-ACCC Set of 16 keytops 0-9/A-F
KKE1B-ADDD Set of 16 keytops 0-15
KKE1B-AEEE Set of 12 keytops 0-9/+/−
KKE1B-AFFF Set of 10 keytops 0-9
KKE1B-AGGG Set of 26 keytops A-Z
KKE1B-ALLL Set of 21 keytops, marked 0-9/A-F/+/−/*/#/.

JAYCO

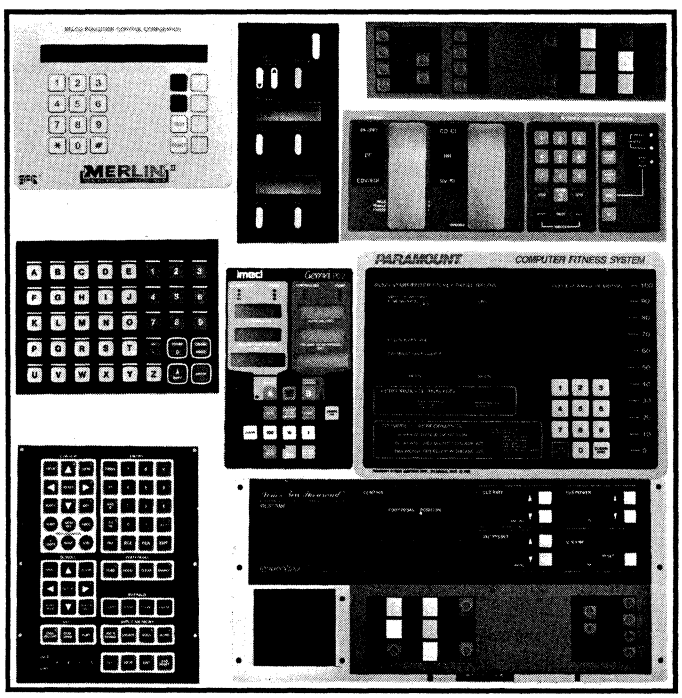
507 W. Blueridge Ave. • Orange, CA 92665, U.S.A. • Telephone: (714) 974-1701 • Fax: (714) 998-4954

LEADERS IN FLAT PANEL TECHNOLOGY

At Jayco we manufacture only flat panel switch products. This specialization has enabled us to design and manufacture products that are consistently preferred for their visual appeal, switch performance, and quality standards. These products include:

MEMBRANE SWITCHES **HYBRID SWITCH PANELS**

KEYBOARDS AND KEYPADS **SILICONE RUBBER KEYPADS**



MEMBRANE SWITCHES

Membrane switches are normally open, momentary contact switches. Their light weight and low profile (0.030" - 0.040" thick) make them ideal for use on portable equipment and on rack, console and desktop units where space may be limited.

Membrane switches are more reliable and economical than conventional switching systems and they add design flexibility which simply isn't available with any other switch technology.

Simplicity = Dependability. The switch consists of two contacts, one above the other, separated by a specific volume of air. Finger pressure on the top contact closes the switch, and release of pressure opens it.

The contacts are usually made of printed conductive ink. Therefore, membrane switches are designed specifically for low voltage and low current applications (see technical specifications).

HYBRID SWITCH PANELS

Membrane switches are made of flexible materials. Hybrid switch panels utilize some aspect of membrane switch construction, but are built on printed circuit boards. They are therefore, a hybrid of membrane and PCB technology.

All hybrid switch circuitry is usually contained on the PCB and switch closure is performed by either a printed membrane or a metal dome (as in a tactile switch).

Hybrid switches can be mounted directly to your chassis with no additional sub-panel required. They can also be supplied as a sub-assembly complete with connectors, hardware and LEDs mounted and ready for installation. Significant savings result from the reduction of the number of components necessary to order, stock, and assemble.

Hybrid switches provide all the advantages of design freedom offered by membrane switches as well as conventional mounting and connection techniques.

KEYBOARDS AND KEYPADS

These simple switch arrays usually do not incorporate all the design features available with custom membrane switch panels. Since Jayco manufactures custom keyboards and keypads to your precise design there are no limitations regarding size, layout, number of switches, circuitry or graphic design. You receive an economical keyboard with no standard keyboard compromises.

SILICONE RUBBER KEYPADS

These are an effective alternative to membranes where additional tactile feedback is required. Switch travel is typically 0.040" - 0.060" versus 0.015" for membranes and this is achieved at lower operating pressures. Silicone keypads can be conductive or non-conductive and with integral or separate keytops. Silicone keypads can also be designed into membrane and hybrid switch panels to produce totally integrated front panel assemblies. Call for further information.

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FLAT PANEL DESIGN OPTIONS

The following is a guide to aid in the selection of appropriate features. Contact your sales representative regarding any questions you may have.

EMBOSSING

Any part of the front panel can be embossed to add a third dimension. Switch areas are those most commonly embossed.

Embossing is usually pad or rim type. With pad embossing, the entire switch area is raised like a top hat. Rim embossing raises the outline of the switch like a crater. Rim and pad embossing can be combined for special effect.

The type of embossing most appropriate depends upon application. Pad embossing gives a more conventional keyboard appearance and is generally used with tactile switches. Rim embossing assures better switch location, an important factor in applications requiring a lot of data input.

Unlike many others, Jayco embosses all overlays in-house. Proprietary techniques provide exceptional results, lower tooling costs, and a perfect match between printing and embossing.

TACTILE FEEDBACK

Tactile feedback is the snap action felt at switch closure. It's achieved by the oil can effect of a stainless steel or polyester dome and gives positive feedback of closure. It's important in applications utilizing unskilled operators or where other forms of feedback are impractical.

Jayco makes switches with both stainless steel and polyester domes, depending on the application requirements. Metal domes offer consistency of operation and reliability. Plastic domes are considerably more economical, and make tactile feedback a practical feature, even on large switch arrays.

Our new tease-resistant tactile feedback mechanisms guarantee simultaneous contact and snap with both metal and plastic dome systems. This is a significant improvement over other designs and effectively eliminates the possibility of miss-keying.

SELECTIVE TEXTURING

This process allows Jayco to offer a textured background with optically clear windows for LCD displays on one uninterrupted surface. The technique can also be used to highlight particular functional areas of switch panels. For example, the background can be textured and the switch areas polished. This makes the switches more prominent while adding interest to your panel. Your sales representative has samples.

SHIELDING

All Jayco panels can be specified with EMI/RFI or ESD shielding. The shielding is usually between the overlay and the switch layer for maximum protection. Grounding or connection to the shield can be by separate tab, through the connector, or through hardware.

DISPLAYS

Through proprietary processes, Jayco can provide one piece or laminated display windows for almost any kind of display device. Windows can be transparent for use with LCDs or filtered for use with LEDs or vacuum fluorescent displays. Standard filters are available in red, green, or grey. Other filters available upon request.

In addition to providing windows for display devices we are now able to integrate thin film plastic LCDs within a membrane switch to provide seven segment displays, annunciators and lit switches, all in an assembly less than 0.060" thick. Please call for more details.

DEADFRONT PANELS

Deadfront or secret-til-lit panels are invisible or blank until their displays are lit from behind. It's typically used for warning displays or where a normal display would clutter up the appearance of the panel. Deadfront makes a complex instrument appear simpler to the user while making the displays more effective.

JAYCO DESIGN ENGINEERING, MANUFACTURING AND QUALITY

Jayco is a true custom house, and for us all the above factors go hand in hand. To us custom does not mean adapting a standard design to a new configuration but instead requires that each project undergo a careful analysis of customer requirements, application details, and the expected environment. Only then will appropriate materials and construction methods be determined.

All switch panels must undergo a comprehensive array of tests including aesthetic qualities, mechanical dimensioning, electrical testing, actuation force and life expectancy. But perhaps the most elusive quality to capture in a membrane switch is batch to batch consistency and reliability. As a result of our exclusive concentration on flat panel switch products we have devised systems that assure the required consistency. These together with quality assurance systems to provide manufacturing to MIL-I-45208 A, enable a higher degree of reliability than is available elsewhere.

TECHNICAL SPECIFICATIONS

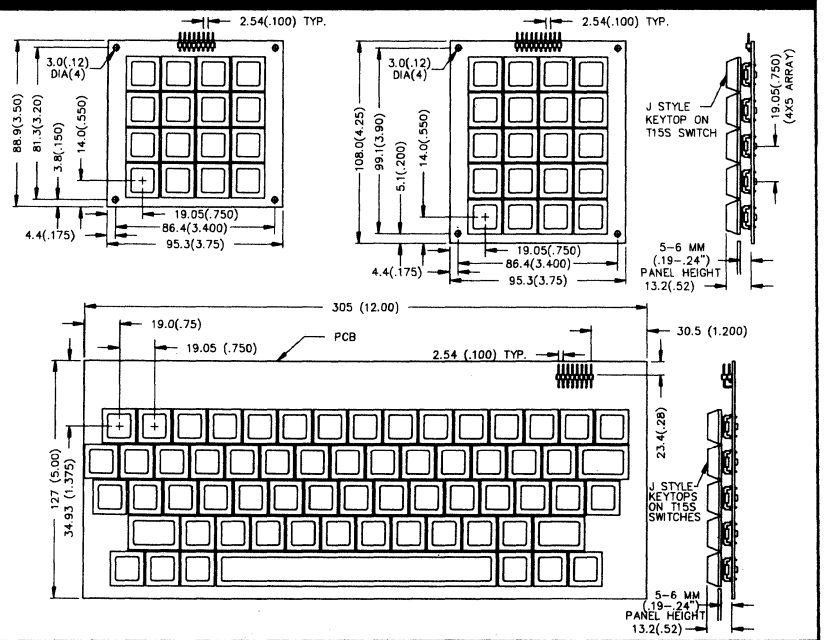
Typical Values

Current Rating	50mA at 30VDC
Circuit Resistance	Less than 100 Ohms
Contact Bounce	Less than 5 Milliseconds (non-tactile) Less than 20 Milliseconds (tactile)
Insulation Resistance	1 Gohm Min at 100VDC
Dielectric Strength	250VRMS Min
Capacitance	27 pf Max Between Any Two Traces
Actuation Force	Variable from 3oz and up
Operating Temperature	-40°C to +80°C
Operational Life	Greater than 5 Million Operations (non-tactile) Greater than 1 Million Operations (tactile)
Termination	Dupont "Clincher" Offered as Standard
Tolerances	+ or – 0.010" as Standard
Emboss Height	0.010 - 0.015"

MEI Stock Keypads and Matrix Wired Keyboards Feature Sealed Contact Full Travel Switches

STANDARD ARRAYS

MEI offers from stock 16, 20 and 64 position keyboards made from T-15 switches and standard truncated keytops of any selection from stock legends. Keyboards are all matrix only output terminating in a male 0.100 header.



MECHANICAL ENTERPRISES INC.

461 CARLISLE DRIVE
HERNDON, VA 22070
(703) 435-9496
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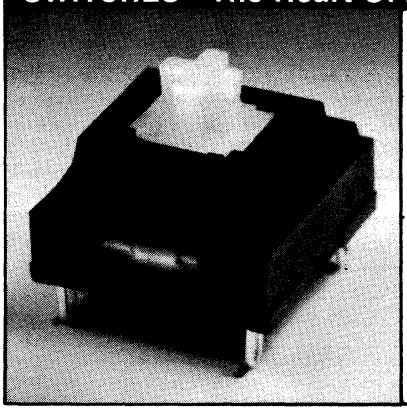
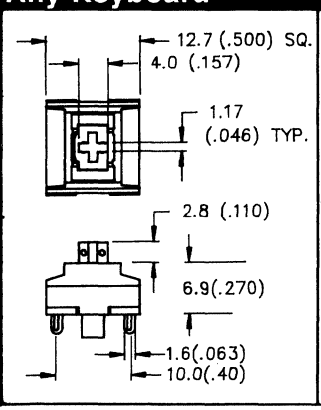
MEI Components Make In-House Keyboard and Keypad Construction Easy and Cost Effective

SWITCHES - The Heart Of Any Keyboard

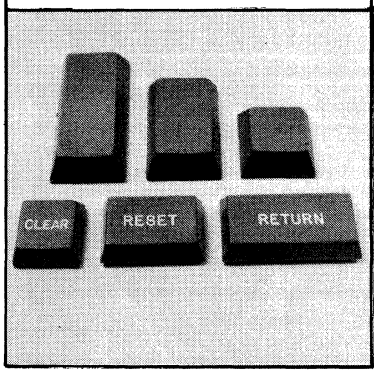


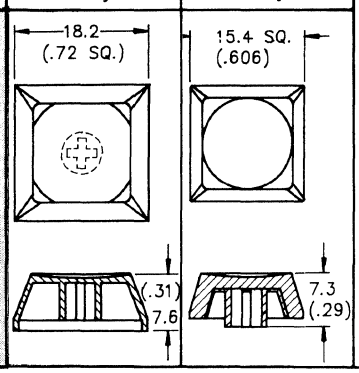


MEI's new T-15 Keyboard switch is produced and tested on fully automated machinery in the USA providing a quality and low price not matched with hand assembled switches. With their sealed contacts they may be easily wave soldered and aqueous cleaned along with other components. Primary features are:

- Sealed low resistance, low bounce contacts
- Very low profile, full travel, tactile response
- Built-in wide jumpers allowing a single sided matrix
- Spring like terminals to hold switch while soldering
- Industry standard cruciform keytop mount
- Stable mounting without a metal sub-panel
- Center to center mounting as close as 12.7mm

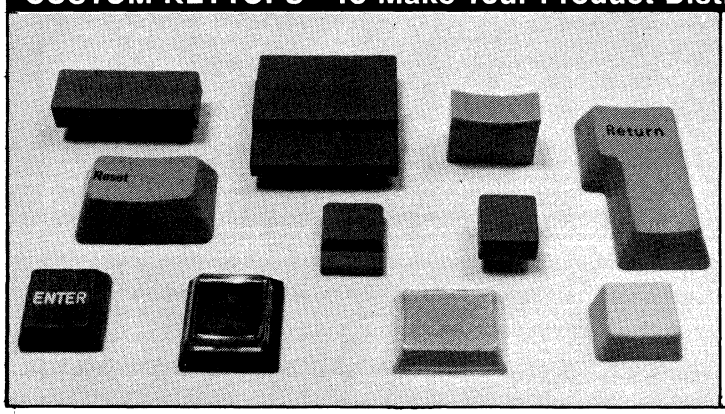
STOCK KEYTOPS - For A Fast Start





MEI offers from stock two styles of keytops to fit the T-15 switch, one for mounting on 19mm (0.75) centers and the other for a closer mounting of 15.8mm (0.625). Each is complete with 1½X, 2X and space bar lengths. Leveling kits for wide keytops are also available. A complete assortment of the most frequently needed legends such as numerals and ASCII symbols is maintained in stock as well as blanks in 5 colors. Hand engraving, custom pad printing and doubleshot molding are additional services MEI offers with the stock keytops.

CUSTOM KEYTOPS - To Make Your Product Distinctive



MEI makes extensive use of miniature family molds both for itself and its switch customers. As a result a custom keytop shape can be tooled for hundreds, not thousands of dollars, and in a reasonable time. We offer this service to OEMs whose product requires unique keytops to improve functionality or set it apart from the competition.

CUSTOMER ASSISTANCE - Provided Before and After The Sale

With years of experience in keyboard construction MEI is able and willing to assist with any design problems from the PCB layout to the selection of the most cost effective keytop legending system. This service extends to introducing customers to other sources for keyboard hardware and keytops when required.

MECHANICAL ENTERPRISES INC.

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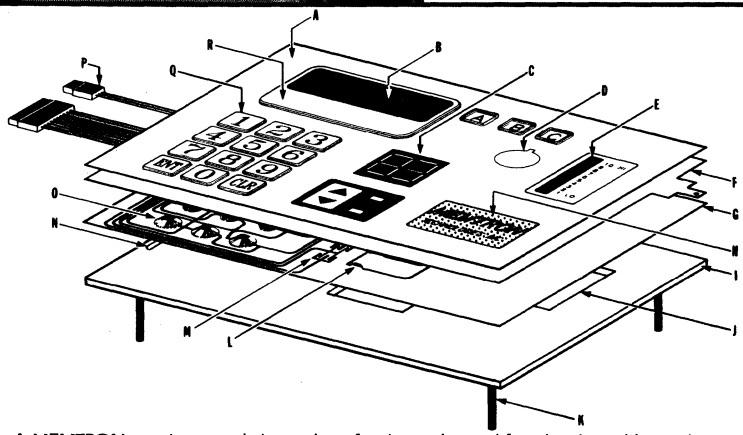
MEMTRON®
MEMBRANE SWITCHES

WHEN YOU NEED ASSURANCE, WE'LL BE IN TOUCH.

Over the years, many membrane switch manufacturers have come and gone, but at MEMTRON, we're stubborn, we've stuck to our guns. And now, when it comes to **quality, research and development, product warranties,** and **service,** we're

*"IN TOUCH WITH **YOUR** TECHNOLOGY®."*



A MEMTRON membrane switch consists of a decorative and functional graphic overlay combined with conductive inks on a polyester carrier which, when assembled, form a low-voltage switching device.

MEMTRON membrane switches are completely sealed from the environment, making them extremely impervious to chemical and solvent attack. With no mechanical parts to fail, the panel is highly reliable and efficient.

SPECIFICATIONS OF SNAP DOMES

Life Expectancy, cycles	2,000,000
Total Travel, nominal inches	0.015
Pretravel, nominal inches	0.012
Overtravel, nominal inches	0.003
Trip Force at Operating Point, grams	300
Tactile Feel	high

STANDARD OPERATING CHARACTERISTICS:

Operating Voltage, volts dc	30
Operating Current, milliamps	30
Contact Resistance, ohms	2 to 10
Circuit Resistance, ohms*	20 to 100
Life Expectancy, cycles	5,000,000
Activation Force, ounces†	5 to 8
Travel, inches	0.006
Bounce, milliseconds	1 to 10
Operating Temperature, °F (°C)**	0 to 150 (-18 to 65)

*Depending on size and configuration of circuit.
†Normal range. Any force can be obtained to meet your specifications.
**Special laminations and materials are available for high-temperature applications.
Note: Contact Memtron engineering for special operating requirements.

DESIGN OPTIONS

A. **The Membrane Switch Overlay:** To meet special environmental and design conditions. May consist of polycarbonates, polyesters, or special-composition plastics.

B. **Transparent Display Windows:** Used primarily for viewing LCD displays. May consist of the clear, glossy overlay material, with or without U.V. hardcoating. Inserted lenses are also available.

C. **Tinted or Deadfront Display Windows:** Used primarily with LED or gas-discharged displays. May be printed or inserted lenses.

D. **Die-Cut Holes With Keyways:** For application of mechanical switches, in conjunction with the membrane switch, in higher voltage applications.

E. **Gloss UV Hardcoat on Textured Overlay:** Used to create an inexpensive transparency when using a pre-textured overlay material such as velvet polycarbonate.

F. **Shielding Layer:** May consist of solid foil or plastic layer printed with conductive inks. May be designed to guard against EMI, ESD, and RFI conditions.

G.-1 **Membrane Switch Composite:** Consists of layers of heat-stabilized plastics with printed circuitry and spacer layer. Assembled with special adhesives.

G.-2 **Printed Circuit Board Construction:** Consists of tin-lead reflowed copper-etched circuits on glass epoxy or other PCB substrate.

H. **Selective Texturing:** UV hardcoat textures may be applied in selected areas on gloss overlay materials to impart abrasion, chemical attack, or glare resistance.

I. **Sub-Plates:** A rigid plate used for mounting membrane switches to an enclosure. May consist of aluminum, glass epoxy, or other materials.

J. **Sub-Plate Cut-Outs:** To allow the viewing of displays mounted on a PC board behind the sub-plate.

K. **Studs and Stand-Offs:** For fastening sub-plates to enclosures or for fastening PC boards and displays to sub-plates.

L. **Surface-Mounted Embedments:** May consist of surface-mounted LEDs within the membrane switch composite and powered through the switch circuits.

M. **Standard or Micromotion Switch Design:** Consists of upper and lower circuit layers separated by a 5- to 7-mil spacer. May also consist of a single circuit layer with shorting pad separated by a spacer.

N. **Tail Cut-Out:** An opening in the sub-plate to allow connection of switch with logic board.

O. **Domed (Tactile) Switch Design:** Consists of metal or plastic snap domes for touch response when depressing a membrane switch keypad.

P. **Connector:** May consist of prong or receptacle types with or without housing. May also consist of solder tabs or exposed traces for friction-fit connection.

Q. **Embossing (Functional):** Raised or embossed keypad areas to allow room for tactile domes. Also serves as key referencing device when keypad is ring embossed.

R. **Embossing (Decorative):** Embossed areas to enhance design or draw attention to special features. May also allow space for special legend inserts behind overlay.

For the name of our nearest representative or for literature and details, call collect 1-517-652-2656 or 1-800-234-7525

Or write Memtron Technologies, 1400 Weiss Street, Frankenmuth, MI 48734

MEMTRON®
TECHNOLOGIES INC.

"RIGHT TOUCH™" KEYBOARDS

NEW

NMB TECHNOLOGIES

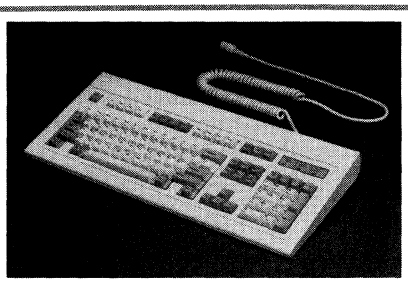
Hands-on performance with the "RIGHT TOUCH" family of Hi-Tek brand keyboards.

FEATURES

Standard or custom design, NMB Technologies offers keyboards having more features, more benefits and the highest quality. Automated factories offer high volume for OEM users world-wide at very competitive prices.

- Plug compatibility
- User friendly key layout
- 100 million cycle mechanical keyswitches
- Sublimation printed keycaps
- DIN standard, low profile
- Linear or tactile feel
- Membrane keyswitches for lower cost requirements
- Retractable legs and rubber foot pads

RT 101 KEYBOARDS

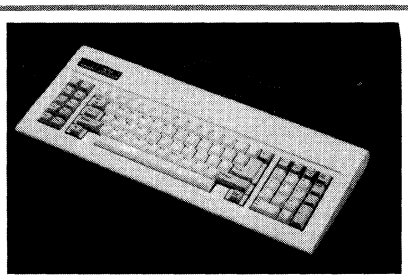


The RT keyboard line is a high performance affordable answer to requirements for PC, XT or AT systems. RT-101 is the popular new industry standard keyswitch layout.

FEATURES

- Tiered construction of outer margin keys
- Easy access slide switch changes modes
- Immediate delivery from stock
- 50 pc orders available from stock; call today to order!

AT-84 KEYBOARDS

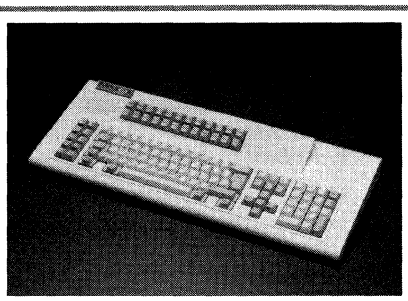


The AT-84 (PC) and the AT-84 (AT) models offer the smoothest keyswitch operation in the industry. The smooth feel and quiet operation of the key-switch attests to the inherent quality and reliability.

FEATURES

- Separate numeric key pad
- Two versions, AT and PC
- Tiered construction of outer marginal keys
- LED's in NUM, SCROLL and CAPS LOCK keys or in the case

CUSTOM KEYBOARDS



The Hi-Tek keyboard line offers custom layout, full encoded models suited for the simplest or the most sophisticated systems. The 100 million cycle mechanical keyswitch can be employed in the DIN standard, low profile layout. Membrane key-switches are also available for custom applications in low cost systems.

FEATURES

- High volume capability for large OEM's
- Domestic application engineering
- Convenient regional offices

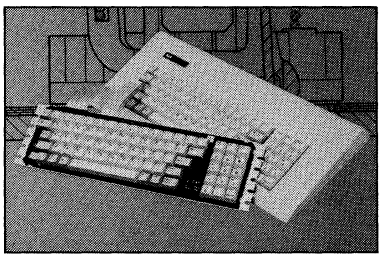
NMB || NMB TECHNOLOGIES INCORPORATED

HI-TEK KEYBOARD DIVISION

For complete specifications and pricing, contact

NMB TECHNOLOGIES INCORPORATED
9730 Independence Ave., Chatsworth, CA 91311 • Telephone: (818) 341-3355
FAX: (818) 341-8207 • TWX: (910) 494-1232 • Telex Number: 651340

OAK Keyboards and Keypads



Low Profile FTM Keyboards

Measuring just 19.9mm from the center of the home row keycap to the bottom of the aluminum baseplate, Oak's low profile FTM keyboard allows designers to place the FTM in an enclosure and still meet the international 30mm DIN standards.

One of the most notable features of the keyboard is a rocker mechanism which gives a distinct nonfatiguing feel for the keyboard operator. Other features include LED indicators for shift lock and function keys, variable operating force, RFI/EMI/ESD protection, single tail termination and custom encoding electronics. Oak's FTM keyboards can be customized to meet specific design requirements with options in profiles, legends, colors, keycap styles, enclosures and more.

Request brochure F-1119.

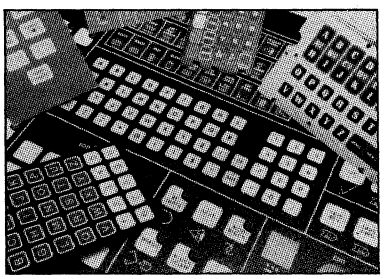
Standard Keyboards

Oak's newest line of keyboards is available in several standard styles, including the 101 and 84 function key styles. These competitively-priced keyboards come with a choice of linear or tactile feel as well as key legend and case color modifications.

The popular KB-101 keyboard features 12 user-programmable keys, a separate numeric keypad and four cursor movement keys. The 101 function keys allow the user to more effectively utilize the advanced functions of the today's high performance PC's. The KB-101 is specially designed to provide compatibility for PC/XT, PC/AT and Enhanced AT configurations.

The KB084 incorporates ten user-programmable keys on a separate keypad. The 84 function keys support the extended set of 256 characters, including scientific notation and foreign language characters for PC/AT and PC/XT configurations.

Request brochure F-1131.

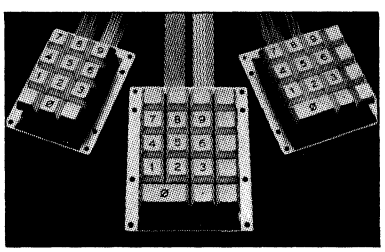


Membrane Switches

Oak Micromotion membrane switches offer the ultimate in environmental resistance and flexibility, and come in a choice of many sizes, colors and designs. Tactile feel is also available.

The membrane switch product line consists of two designs. Type A products use rigid single- or double-printed circuit boards. Operating voltage: 1 to 50 (AC or DC). Operating current: 0.05 to 100 milliamps. Type C products are completely film-based, using a non-rigid polymer-substrate instead of a PC board. Termination is achieved via a "tail" which is compatible with standard commercial connectors. Operating voltage: 1 to 30 (AC or DC). Operating current: 0.05 to 50 milliamps.

Request brochure F-1087.

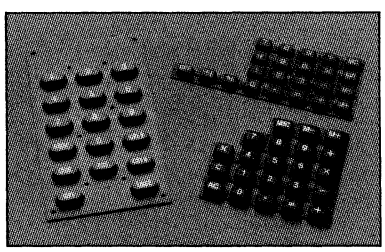


Full Travel Membrane Keypads

Oak's rugged full travel membrane keypads are low cost with high reliability and life expectancy rated at 100 million cycles per key. The keypads are EMI/RFI shielded with a front-sealed design that protects the contacts against spilled liquids, dust and other contaminants. The pretravel and overtravel features promote operator ease, input accuracy and low fatigue.

Available in standard or low profile, Oak FTM keypads are useful in a wide range of data entry applications. The FTM keypad comes in standard sizes of 3″ x 4″, 4″ x 4″ and 4″ x 5″ with a full travel of .160 in. Low profile FTM keypads are available with a .150 in. travel for DIN compatible designs.

Request brochures F-1118 and F-1118A.



Silicone Rubber Keypads

Oak also offers conductive and non-conductive short-travel rubber keypads in custom versions or standard 3″ x 4″ size. Made of silicone rubber, they are resistant to ozone, corrosion, contamination and puncture. The keypads operate at a temperature range of -40°C to +85°C and perform up to five million cycles depending upon stroke, key pressure and snap effect.

Available with a choice of tactile feel in a key travel range of 0.3 to 6.0 mm, these keypads require an actuation force of 30-260 grams.

In the non-conductive versions, the rubber keypad serves as the switch actuator over a three-layer membrane panel. Conductive keypads utilize a carbon-impregnated silicone "pill" molded on the underside of the rubber dome to accomplish the switching. The conductive switch mounts onto a glass epoxy PC board.

Molded translucent or opaque, the switches are available with custom color options, LED backlighting and alphanumeric or symbolic legends screened onto rubber or plastic keycaps.

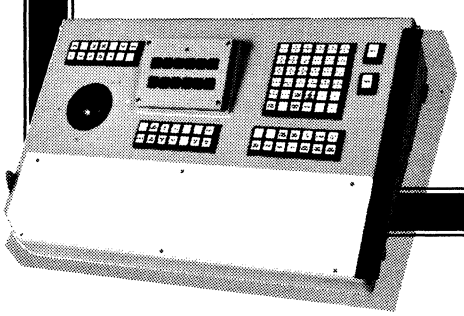
OAK Switch Systems Inc.
P.O. Box 517 • Crystal Lake, IL 60014
Phone: 815/459-5000 FAX: 815/459-5000, Ext. 2218

OAK *Your Partner in Excellence*

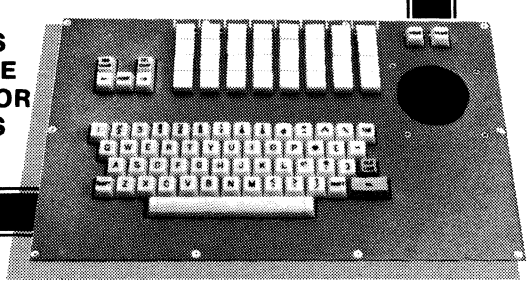
RUGGEDIZED SWITCH PANEL DESIGNS

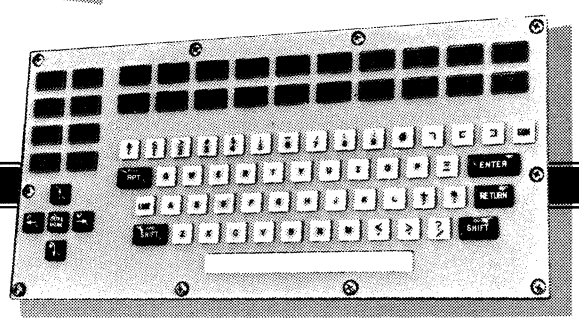
ORBIT INSTRUMENT CORP.
CORPORATE FACILITIES: 80 CABOT COURT, HAUPPAUGE, L.I., NY 11788, TELEPHONE: (516) 435-8300
6431 GLOBAL DRIVE, CYPRESS, CA 90630, TELEPHONE: (714) 527-0561

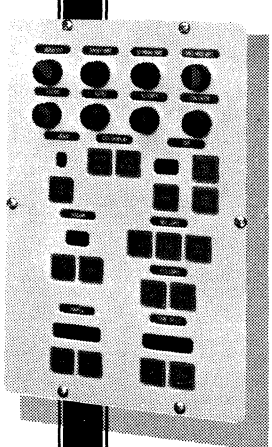
MILITARIZED KEYBOARD/BALL TRACKER ASSEMBLIES



INSTALLED IN CONSOLES AS REMOVABLE ASSEMBLIES FOR EASY ACCESS



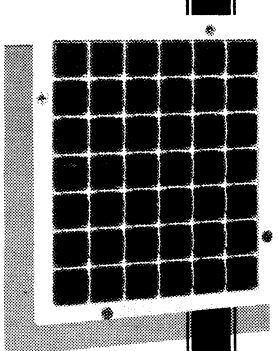


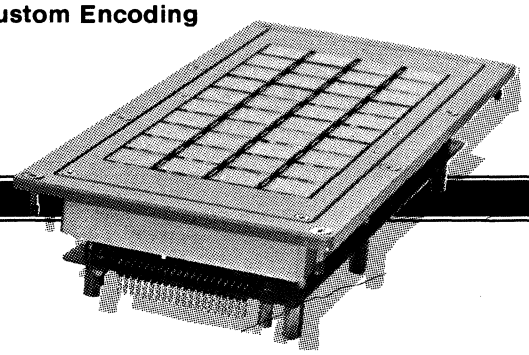


*BACK LIGHTED KEYBOARDS & *CUSTOM PANEL DESIGNS

USING

- Orbit low profile snap action switch technology
- Switches can be split legend or TRI split
- Rugged design construction
- Relegendable keycaps
- Custom Encoding



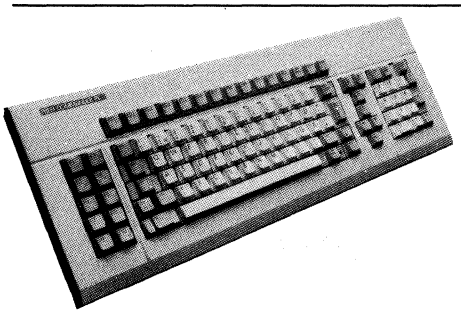


Preh Electronic Industries, Inc.
470 East Main Street, Lake Zurich, IL 60047-2578 U.S.A.
Phone (312) 438-4000 • Telex 297-112 PEI UR • FAX 312-438-5522

REMOTE CONTROLS/KEYBOARDS

Remote control systems available from Preh Electronics include both standard and completely customized units. IR remotes up to 53 keys and an optional waterproof (floating) unit with 16 channel capability are available.

Preh's flexibility allows wide design possibilities in the fields of commercial and satellite television systems, video tape recorders and monitors, and industrial controls.
Full travel membrane keyboards of unique German technology. Metal to metal contacts ensure high reliability, long life, and excellent tactile feedback. The tops (facing) of Preh keyboards are waterproof.

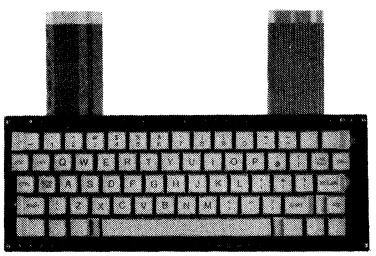


PREH COMMANDER PC-AT

Full travel membrane keyboard with 111 keys. Arranging each function group in the form of "key clusters" enables the operator expedient data entry. The system is dust and splash proof. More than just IBM compatible.

PREH COMMANDER, PC/XT

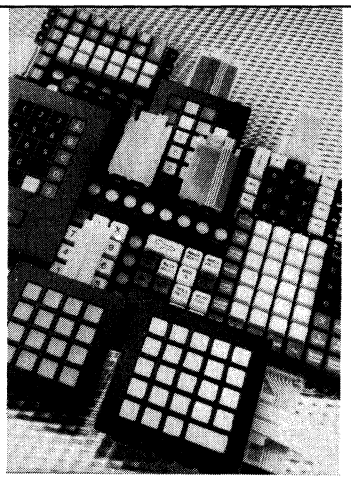
IBM-PC compatible. An extremely flat, full travel membrane keyboard with glare-free surface for operator comfort and "Crisp" tactile feedback. Additional standard units can be combined and spaced to customer requirements to provide up to 15 additional keys in the alphanumeric field. Standard unit measures 17.5" L x 7.5" W x 1.5" H. Height to center key row is 1.18".



PREH STANDARD KEYBOARDS

PREH Keyboards are dust and waterproof according to DIN 40050 specifications. The unique long life polymer domes (acting as springs) are molded in a single shot operation on a metal substrate with 20 million cycles within tolerance guaranteed.

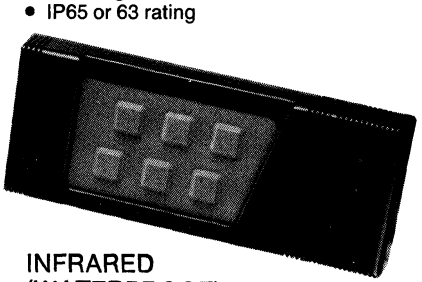
FEATURES
- full travel
- membrane technology
- low profile
- relegendable key caps
- ASCII encoder: serial (standard) parallel (optional)
- excellent tactile feel
- Standard PREH Commander or custom versions
- New IBM 101 layouts (PC-AT3)



PREH STANDARD KEYPADS

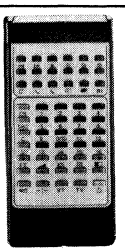
PREH offers a creative link between precision mechanics and reliable membrane technology. Standard keypads are dust and splashproof or even waterproof according to DIN 40050 specifications. Special shock resistant and vandal proof bezels are available for heavy duty or outdoor environment. Standard layouts include: 3x4, 4x4, 4x5, 4x7, 5x5, 7x8, 5x12, and 7x12 arrangements. Other custom designs available)

COMMON FEATURES
- full travel
- membrane technology
- low profile
- relegendable keycaps
- tactile feel
- reconfigurable version available
- IP65 or 63 rating



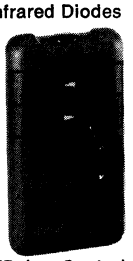
INFRARED (WATERPROOF) TRANSMITTER TYPE S-90

Up to 16 functions on this unique waterproof transmitter. Precise engineering and fine workmanship coupled with more than seven decades experience in custom tool and plastic moldmaking have established PREH as a respected industry leader.



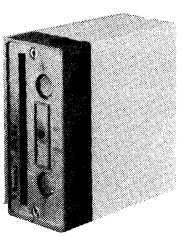
TRANSMITTER, 53 BUTTON MODEL S88/53

TECHNICAL DATA:
Transmitting Mode: PCM (Pulse Coded Modulation)
Clock Frequency: 4 MHz (Quartz)
Programmable Functions: 16 x 64 (Max. 53 Buttons)
Usable Functions: 36
Available TV Channels: 16
Analog Functions: 4
Additional Functions: 8
Supply Voltage: 9 Volt (to IEC 6F22)
Quiescent/Operating Current: 1.0 µA/6 mA Typical
Transmitting Elements: 2 Infrared Diodes



TRANSMITTER, 2 CHANNEL MODEL S11-07

TECHNICAL DATA:
Transmitting Mode: PCM (Pulse Control Modulation)
Supply Voltage: 9 Volt (to IEC 6F22)
Quiescent/Operating Current: 10µA/15 mA Typical
Transmitting Elements: 3 Infrared Diodes



RECEIVERS MODEL S12-07

TECHNICAL DATA:
Plastic Enclosure-Dim: 4" x 2" x 4"
Components: Electronic Decoder, Power Supply for Receiver and Pre-Amplifier and Switching Relay as Output Component
Electronic Systems: PCM Decoder w/ Power Supply and 4 Relay Outputs
Supply Voltage: 220 VAC, 11
Outputs: 4 Separate Outputs
Power Ratings: 250 VAC, 2000 VA, 200 VDC, 30W, 24 VDC, 100W
For Both SPST and SPDT Applications

*DETAILED CATALOG AVAILABLE UPON REQUEST

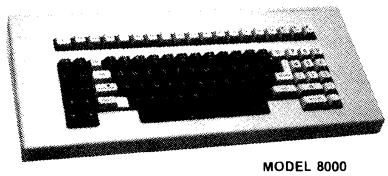
GEORGE RISK INDUSTRIES, INC.
G.R.I. PLAZA / KIMBALL, NEBRASKA 69145 / TELEPHONE (308) 235-4645 / TWX 910-620-9040

STANDARD KEYBOARDS

16.26" x 7.85"

MODEL 9062

62 keys • full 128 character ASCII encoding two-key lockout or N-key rollover • Outputs: parallel, TTL serial, RS-232, RS-422, PC-XT/AT • easy mounting provisions • non-glare double shot molded keycaps–separate cursor control keys • user defined key • auto-repeat on all keys • +5V power.

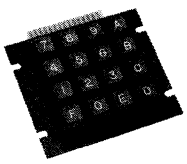


19.0" x 8"

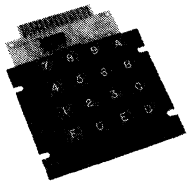
MODEL 8000

• State-of-the-art microprocessor keyboard, 95 keys, including 19 special function keys • High reliability performance • Four-wire serial interface, 300 or 1200 baud • Unique variable key rollover with phantom key lockout • High speed operation • Ergonomic design.

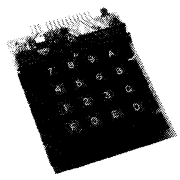
KEYPAD MODELS 10, 12 or 16 Keys



• Unencoded wiring, 1 of 16 or X-Y matrix
• One side of each keyswitch is common
• Design to be used with custom-supplied encoding.



• 4 bit hex encoded
• Full CMOS design
• Outputs compatible with LS and standard TTL logic



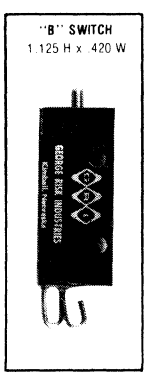
Serial RS-232, RS-422 or TTL output • parallel output • microcontroller keyboard encoder • full 7-bit ASCII characters.

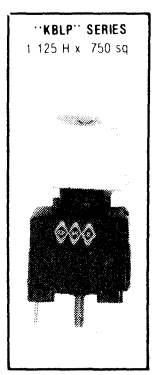
CUSTOM KEYBOARDS

GRI builds custom keyboards to your exact specifications and drawings for all types of applications—air traffic control, process control, military, etc. Our lighted keyboards are especially attractive due to their visibility and high reliability. We offer both the dry reed and mechanical contact switch technologies. We have manufactured custom keyboards for companies such as Burroughs, Eaton-AIL, FAA, Ford Aerospace, Goodyear Aerospace, Lockheed, Magnavox, Raytheon, Rockwell, Texas Instruments, and many others. Send us your specifications and drawings for a quotation today.

PUSHBUTTON SWITCHES

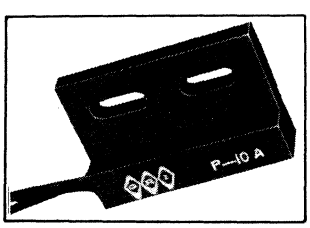
DRY CIRCUIT & LOGIC SWITCHING



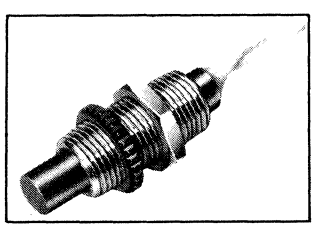


SPST-NO, NC; DPST-NO, NC-Available in 4 form A or B-Illuminated and non-illuminated Hi-rel-50 million operations-Mounting collars and buttons available-Mercury wetted reed switches available

PROXIMITY SWITCHES & VANE SENSORS



P-10



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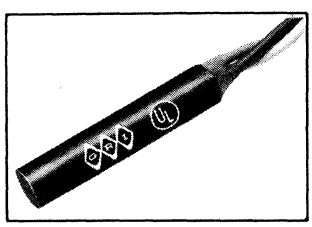
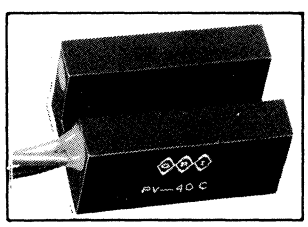


P-30



PV-40

THERMISTORS, THERMOCOUPLES, & SENSORS

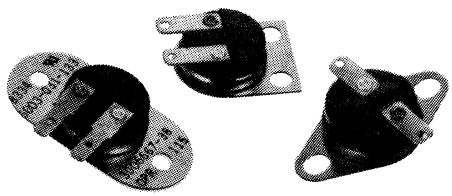
Manufacturer	Starting EEM Page No.	NTC	PTC	Leaded Chip	Bar	Cube	Disc	Hybrid Chip	Inter-change-able	Switches Temper-ature Sensing	Sensors Temper-ature	Inrush Current Sup-pressors	Thermo-couple	Other Features
Ametek/Rodan	B•1836	¤	¤	¤						¤	¤	¤		Surface Mount; Molded Probes
Best Technology	B•1839												¤	RMS Current Measurement
Dale Electronics	B•1840	¤		¤		¤	¤	¤	¤		¤			Curve Track; Surface Mount
Fenwal Electronics	B•1846	¤	¤	¤			¤		¤		¤	¤		Linear Thermis-tor Probes; Surface Mount
Keystone Carbon Co.	B•1847	¤	¤				¤			¤	¤	¤		Rod Type; Probes; Sur-face Mount
Micro-Ohm	B•1850		¤						¤		¤			Trimmer; Encapsulated; Matching TC
Midwest Components	B•1852	¤	¤				¤		¤	¤	¤	¤		Molded Probes; Freeze Sensors; Varistors
Omega	B•1860										¤		¤	Probes
Quality Thermistor	B•1863	¤	¤	¤		¤		¤	¤		¤		¤	Surface Mount
Selco Products	B•1867									¤	¤			
Sensor Scientific	B•1868	¤					¤		¤		¤			Probes; Custom
Sfernice/Techno-Components	B•1870	¤		¤	¤	¤	¤	¤	¤		¤	¤		Probes
Therm-O-Disc	B•1873										¤			Thermal Cutoff;

THERMOSTATS

Manufacturer	EEM Page No.	Low Profile	Grounded	Sealed (Immersion)	Isolated Contact	Isolated Case	Hermetic Seal	Disc
Airpax Corp.	B•1835	¤	¤	¤	¤	¤	¤	
Elmwood Sensors	B•1843	¤					¤	¤
Selco Products	B•1867	¤						¤

THERMOSTATS

Accurate. Reliable. In standard and custom design. Contact Airpax Company, Husky Park, Frederick, MD 21701. (301) 663-5141. A division of North American Philips Corporation.

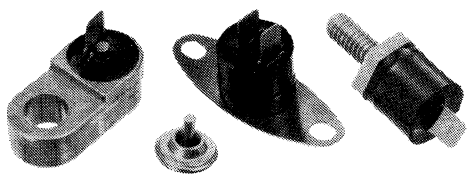


Series 5003 — Low-Profile Thermostat

Extremely thin, lightweight, wafer-type thermal switch that provides fast, positive response, excellent repeat reliability, good shock and vibration resistance over a wide operating range.

Features:

- Overall depth is only .250".
- Operating temperature range from 15°F to 355°F.
- OPR or CLR contacts are available.
- 120 VAC 5 amp, 240 VAC 3 amp.
- Weight 2.3 grams.
- Variety of mountings and terminations available.
- Environmental sealing available.
- Approval: 𝒰L ⓒ

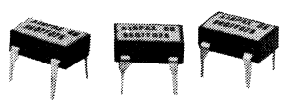


Series 5011 — Low-Cost, Grounded Thermostat

A very low-cost thermostat that will meet a number of exacting requirements for shock and vibration resistance. It is hermetically sealed and offers fast response. Plug, wire-lead, and isolated base mountings are available. 1/4-20 boss-mounted and 3/8-16 UNC-2A sizes.

Features:

- Low-cost, grounded unit.
- Operating temperature range from 15°F to 525°F.
- Many mounting packages available: 120 VAC, 32 VDC, 3 amp.
- Stud-mounted version available.

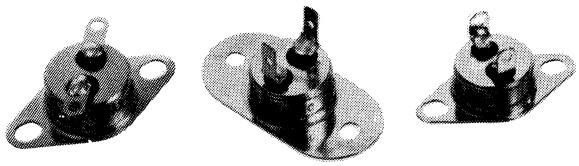


Series 6600 — PC Board-Mountable Thermostat

A miniature bimetallic snap-acting thermostat in an 8-pin N8A Dual In-Line Package. Single pole/single throw switch assembly available in either normally closed, open on rising temperature or normally open, close on rising temperature configurations. Compatible with auto-insertion equipment, the Series 6600 will withstand wave soldering and board washing operations. Typical uses include turning on an indicator light, changing the speed of a fan or switching on a control circuit.

Features:

- Operating temperature range 40°C to 120°C.
- 1 amp 48 VDC switching capability.
- Standard 8-pin N8A Dual In-Line Package for auto-insertion compatibility.
- OPR or CLR contacts available.
- Sealed to withstand wave solder and board washing.

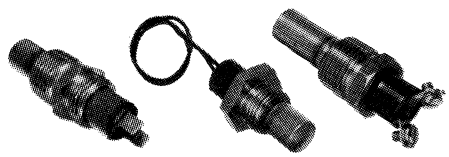


Series 5200 — Isolated Contact Thermostat

This hermetically sealed thermostat is perfect for applications requiring isolated contacts. The laser-welded construction withstands vibration and shock, and is designed to meet MIL-Spec requirements. Its size and reliability make it highly suitable for products such as business machines, hot glue-melt systems and other industrial/environment products.

Features:

- Hermetically sealed.
- Designed to meet military standards.
- Operating temperature range from 15°F to 500°F.
- UL certified for regulating.



Series 5100 — Isolated Case Thermostat

This two-terminal, immersion-type hermetically sealed thermostat can be used on water-cooled engines, hydraulic systems, degreasers, industrial air compressors and tanks where liquids are heated. Its isolated contact is designed to switch 110 VAC within your control circuitry. It offers rapid response to liquid or air temperature.

Features:

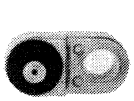
- Hermetically sealed.
- All stainless T.I.G. construction.
- Operating temperature range from 15°F to 550°F.
- 120 VAC 3 amp and 240 VAC 1.5 amp models available.
- Approval: 𝒰L ⓒ

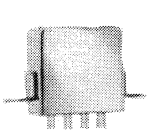
Series 5020 — Hermetically Sealed Thermostat

This snap-action hermetically sealed temperature control is designed for use wherever a sealed unit and high vibration resistance are required. Protects engines from damage from overheating by sensing high water or oil temperatures. Snap-action disc located in the very tip of the probe assures rapid and true response to liquid temperature. The all-welded construction (and grounded case) of this sealed thermostat ensures meeting Thermal Shock Specifications of MIL-STD-202, Method 107, Test Condition B. The tube will withstand a Pressure Exposure Limit of 1500 PSI. Insulation Resistance of 50 megohms minimum at 500 VDC.

Features:

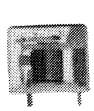
- Hermetically sealed.
- Grounded case.
- Operating temperature range from 15°F to 525°F.
- 32 VDC, 3 amp.
- 5020 — 13 Conforms to MIL-12285/1.





AIRPAX®

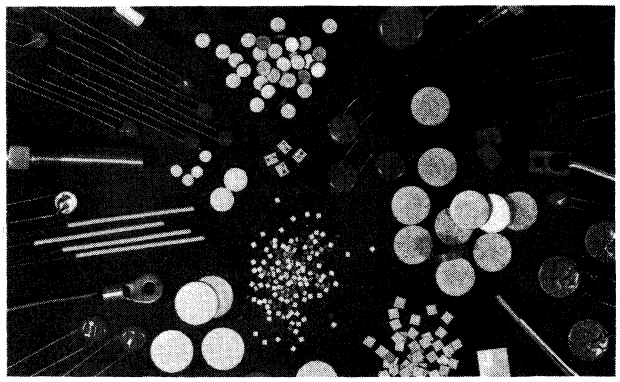
FREDERICK DIVISION



AMETEK RODAN DIVISION
2905 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • TWX 910-591-1684 • FAX: 714-630-4131

INTRODUCTION

Thermistors are temperature sensitive passive semiconductors which exhibit a large change in electrical resistance when subjected to a relatively minute change in body temperature. Negative temperature coefficient (NTC) thermistors decrease in resistance when subjected to an increase in body temperature. Conversely positive temperature coefficient thermistors (PTC) increase in resistance when subjected to an increase in body temperature. Ametek-Rodan Division manufactures NTC thermistors as well as two basic types of PTC thermistors. The silicon PTC offers a nearly linear positive temperature coefficient of approximately +.7%°/C and the switching PTC thermistor which exhibits a very large increase in resistance (several powers of 10) over a designated temperature range. Their extreme sensitivity to minute temperature changes enables them to perform many unique functions heretofore impossible with standard electronic components.



NEGATIVE TEMPERATURE COEFFICIENT THERMISTORS

The NTC devices are available in resistance values from less than 1 ohm to 1 megohm, and in sizes ranging from 0.010 inch cubes to 1 inch diameter discs. Available configurations include: discs, chips, rods, bars, probes, and resistor/thermistor networks. Units can be molded, dip coated, or encapsulated to your specifications, using packaging materials such as epoxy, glass, or high temperature silicon resin.

SURGE-GARD™ INRUSH CURRENT LIMITING DEVICES

DESCRIPTION

Rodan® SURGE-GARD devices are manufactured of a specially-formulated metal oxide ceramic material which is capable of suppressing high inrush current surges. They are especially useful in power supplies (See Fig A) where, due to the extremely low impedance of the capacitor being charged, the bridge is subjected to an exceedingly high current surge at turn-on. The SURGE-GARD, being of relatively high resistance, limits the current for 1 to 2 seconds during which time the device decreases in resistance substantially to a point where its voltage drop is negligible.

SPECIFICATIONS

Part Number	Ro @ 25°C ±15% (OHMS)	I_{max} Max Steady State Current (AMPS)	* RI_{max} Resistance At Max Current (OHMS)	"D" (Diameter max over coating)	"T" (Thickness max over coating)	"L" Lead Diameter ±.003"
SG260	.5	30	.01	1.25	.200	.040
SG100	1	20	.015	.900	.300	.040
SG110	2	18	.03	.900	.350	.040
SG120	2.5	3	.15	.600	.250	.032
SG130	2.5	7	.05	.600	.250	.032
SG140	2.5	9	.04	.600	.250	.032
SG150	2.5	10	.04	.900	.300	.040
SG160	2.5	15	.03	.900	.300	.040
SG170	4	8	.07	.600	.250	.040
SG180	5	2	.40	.600	.250	.032
SG190	5	4	.15	.600	.250	.032
SG200	5	7	.07	.600	.250	.032
SG26	5	12	.06	.900	.500	.040
SG210	7	4	.20	.600	.300	.040
SG64	7	10	.08	.950	.500	.040
SG220	10	3	.20	.450	.300	.032
SG40	10	8	.1	.900	.350	.040
SG230	20	1.75	.6	.500	.300	.032
SG240	40	2	.6	.625	.250	.032
SG250	120	3	.9	.925	.250	.040

1 Other resistance values available upon request.

2 I_{max} = The maximum steady state DC or RMS AC current.

3 * RI_{max} = The approximate resistance under maximum steady state current conditions.

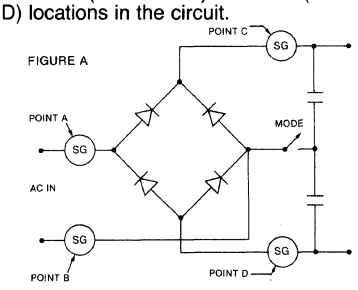
4 **Max Operating Temp** = All Rodan Surge-Gard devices are rated for operation to a maximum ambient temperature of 65°C. If your application requires operation above 65°C ambient, please consult Rodan's applications engineering department.

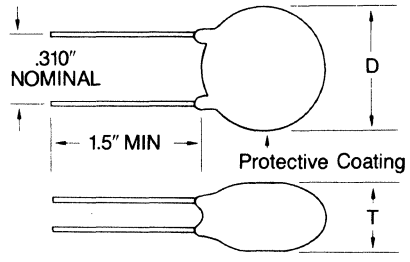
5 **Recovery Time** = Since Rodan Surge-Gards self-heat due to current flow, which in turn causes a reduction in their resistance, the devices require cool-down time after power is removed. The cool-down time allows the resistance to increase sufficiently to provide the required inrush current limiting. This time varies with the particular device, mounting method and ambient temperature. Usually, a one minute cool-down period is adequate. Selection of capacitor bleeder resistors which will provide a one minute or so bleed down time can eliminate the cool down time requirement.

APPLICATIONS

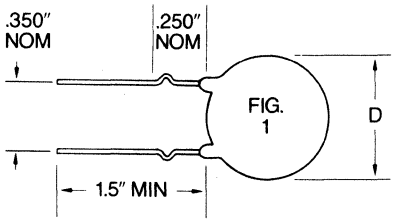
If the resistance of one Surge-Gard does not provide sufficient inrush current limiting for your application, two or more may be used in series or in separate legs of the supply circuit. Surge-Gards cannot be used in parallel since one unit will tend to conduct nearly all the current available. Surge-Gards may be used in the AC (Point A or B) or the DC (Point C or D) locations in the circuit.

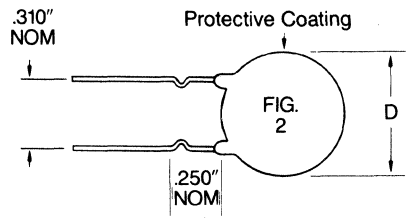
FIGURE A

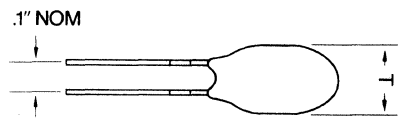




PREFORMED INSIDE AND OUTSIDE LEAD BENDS OPTIONAL. CONTACT FACTORY FOR PART NUMBERS.







Shorter leads can be supplied upon request

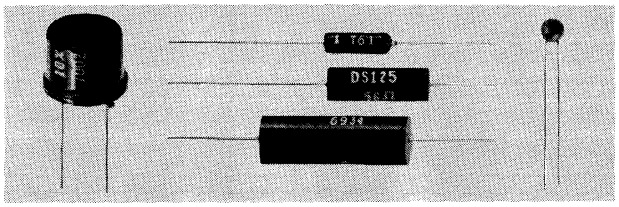
AMETEK RODAN DIVISION

2905 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • TWX 910-591-1684 • FAX: 714-630-4131

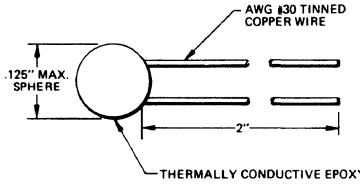
SILICON PTC THERMISTORS

DESCRIPTION

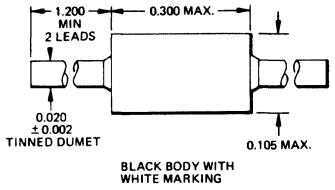
The positive temperature coefficient of resistance is very large: approximately 0.7%/°C, making these units ideal for use in temperature-compensating and sensing applications. Just a few such applications include amplifiers, power supplies, transducers, telemetry, computers, magnetic amplifiers, thermometry, meteorology, temperature regulation and overtemperature protection. Lead material other than standard, such as weldable nickel or gold plated, is available on request.



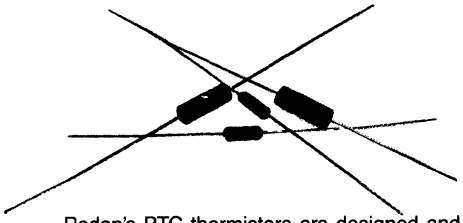
MINIATURE PROBE—DU100



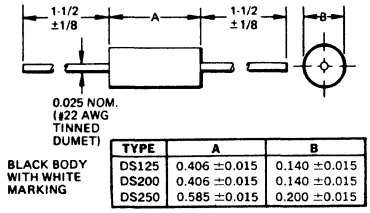
GLASS TYPE—DG125



MIL-APPROVED SERIES

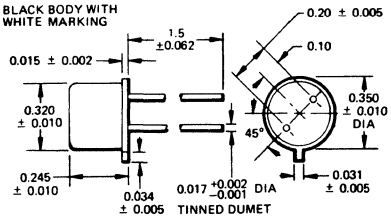


MOLDED TYPES—DS125, DS200, DS250



TYPE	A	B
DS125	0.406 ±0.015	0.140 ±0.015
DS200	0.406 ±0.015	0.140 ±0.015
DS250	0.585 ±0.015	0.200 ±0.015

TRANSISTOR TYPE—DC125



Rodan's PTC thermistors are designed and built to withstand all environmental conditions required by the most stringent Mil specs. They meet or exceed all requirements of MIL-T-23648A for Positive TC Thermistors.

RTH 42 Per MIL-T-23648A/19. Glass, hermetically-sealed type, similar to DG 125 series above.

RTH 22 Per MIL-T-23648/9. Molded style, similar to DS 200 series above.

ELECTRICAL SPECIFICATIONS

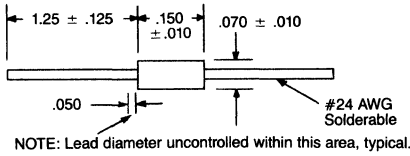
PART NUMBER	WATTAGE RATING @ 100°C	STD RESISTANCE RANGE	THERMAL TIME CONSTANT	OPERATIONAL AMBIENT TEMPERATURE RANGE
DS 125	0.125	10 to 39,000	34.8	−65 to +150
DS 200	0.250	10 to 39,000	34.8	−65 to +150
(RTH-22)	0.250	10 to 10,000	34.8	−65 to +150
DS 250	0.250	10 to 39,000	54.0	−65 to +150
DG 125 (RTH-42)	0.125	10 to 10,000	60.0	−65 to +125
DC 125	0.125	10 to 10,000	54.0	−65 to +125
DU 100	0.125	10 to 10,000	9.0	−65 to +125
UNIT	WATTS	Ohms	Sec. Max	°C

STANDARD RESISTANCE VALUES

10	27	56	150	390	820	2200	5000
12	33	68	180	470	1000	2700	5600
15	39	82	220	500	1200	3300	6800
18	47	100	270	560	1500	3900	8200
22	50	120	330	680	1800	4700	10,000

Matched pairs or other resistance values available as special devices.

MINI-SENSOR™ HERMETICALLY SEALED NTC THERMISTORS



NOTE: Lead diameter uncontrolled within this area, typical.

DESCRIPTION:

Rodan® Mini Sensor thermistors are small, rugged, hermetically sealed, glass encapsulated (DO-35) devices which are especially useful in applications where extreme temperatures and severe environmental conditions are encountered.

Their high sensitivity makes them especially useful in applications such as temperature measurement, temperature control, liquid level indication, flow measurement and temperature compensation.

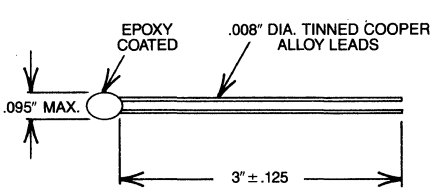
These low cost devices exhibit excellent long term stability and repeatability.

Please contact the factory for additional information.

ACCU-CURVE™ INTERCHANGEABLE THERMISTORS R-T CURVE MATCHED

DESCRIPTION

Rodan's Accu-Curve thermistors are small, high quality, low cost, epoxy encapsulated, precision curve matched devices which are available in a variety of electrical parameters. They offer true interchangeability over wide temperature ranges and eliminate the need for individual circuit adjustments or padding. These thermistors provide highly accurate and stable temperature sensing capability for applications such as temperature measurement or compensation.



SPECIFICATIONS

Part Number	Resistance* @ 25°C	Temp. Tolerance Over Temp. Range (±°C)	Temp. Range °C	D.C.* Min.	T.C.**
ACC-001	2,252	±0.2	0-70°C	1	10
ACC-002	3,000	±0.2	0-70°C	1	10
ACC-003	5,000	±0.2	0-70°C	1	10
ACC-004	10,000	±0.2	0-70°C	1	10
ACW-005	30,000	±0.2	0-70°C	1	10
ACW-006	50,000	±0.2	0-70°C	1	10
ACW-007	100,000	±0.2	0-70°C	1	10

The above device can be supplied to a wider range of specifications. Please contact the factory for requirements not listed.

***DISSIPATION CONSTANT** represents the amount of power required to raise the temperature of a thermistor 1°C above its ambient, expressed in milliwatts.

****TIME CONSTANT**, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new impressed temperature environment.

AMETEK RODAN DIVISION
2905 Blue Star Street, Anaheim, CA 92806 • (714) 630-0081 • TWX 910-591-1684 • FAX: 714-630-4131

STANDARD PTC THERMISTORS

TYPICAL APPLICATIONS

• Over-temperature Protection • Temperature Compensation • Arc Suppression • Time Delay • Liquid Level Sensing • Air Flow Sensing • Automatic Color TV Degaussing • Non-Destructive Fusing • Self-Regulating Heaters • Single Phase Motor Starting

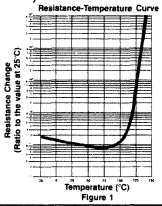
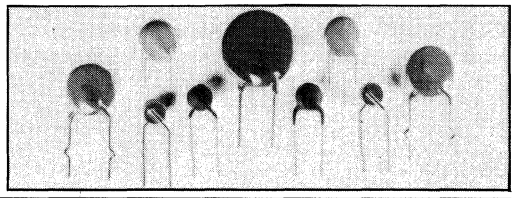
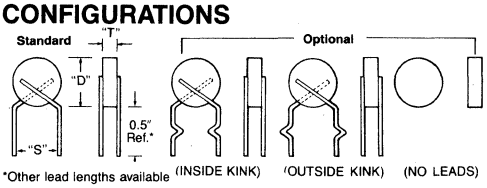


Figure 1



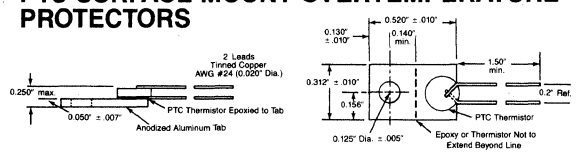
Part Number	Base Resistance R_o @ 25°C (Ω) ±30%	Switch Temp. Ts (°C)	Maximum Operating Voltage V_{max}	Dissipation Constant Dc (mW/°C)	Time Constant (Sec.)	Heat Capacity Hc (Watt-Sec./°C)	Reference Dimension (In.)			
							D	T	S	Lead Dia. (In.)
SL5003D-1R8-120	1.8	120	20	12	50	.29	0.50	0.03	0.30	0.025
SL5004D-2R0-120	2	120	25	14	50	.39	0.50	0.04	0.30	0.032
SL4005D-5R0-110	5	110	25	10	45	.31	0.40	0.05	0.30	0.025
SL3505D-7R5-120	7.5	120	50	9	40	.24	0.35	0.05	0.25	0.020
SL5510D-100-110	10	110	132	16	90	1.19	0.55	0.10	0.30	0.025
SL2505D-200-120	20	120	50	7	30	.12	0.25	0.05	0.20	0.020
SL5010D-250-065	25	65	132	15	80	.98	0.50	0.10	0.30	0.025
SL4010D-500-110	50	110	132	12	60	.63	0.40	0.10	0.30	0.025
SL2005D-101-040	100	40	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-050	100	50	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-060	100	60	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-070	100	70	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-080	100	80	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-090	100	90	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-100	100	100	50	6	30	.08	0.20	0.05	0.20	0.020
SL2005D-101-110	100	110	50	6	30	.08	0.20	0.05	0.20	0.020
SL3010D-101-110	100	110	132	8	45	.35	0.30	0.10	0.25	0.020
SL2005D-101-120	100	120	50	6	30	.08	0.20	0.05	0.20	0.020
SL2008D-251-120	250	120	150	6	30	.13	0.20	0.08	0.20	0.020
SL2010D-501-120	500	120	250	6	30	.16	0.20	0.10	0.20	0.020
SL2010D-102-110	1000	110	300	6	30	.16	0.20	0.10	0.20	0.020
SL2012D-152-110	1500	110	350	6	30	.19	0.20	0.12	0.20	0.020

CONFIGURATIONS



The values for dissipation constant and time constant are for reference only. Mounting method and environmental conditions can affect these parameters.

PTC SURFACE MOUNT OVERTEMPERATURE PROTECTORS



OVER CURRENT PROTECTORS

The PTC over current protector is connected in series with the load which is to be protected. During normal operating conditions, the PTC remains in its low resistance state resulting in negligible attenuation to current flow. When a short circuit or over-current condition occurs, the PTC will switch into its high resistance state thereby limiting the current flow in the circuit to a point well below the normal operating level. When the fault condition is removed, the PTC will return to its low resistance state allowing the current flow to recover to its normal level. Ametek-Rodan Division produces over-current protectors for a whole range of load protection applications.

TYPICAL APPLICATIONS

• Telephone Line Fault Protection • Transformer Protection • FHP Motor Protection • Transistor Protection • Speaker Protection

FEATURES

• Fast Switching
• No Electrical Noise
• Virtually Unlimited Life
• Self Resetting
• No Contacts
• Automatic Operation
• Efficient

Part Number	Base Resistance (Ohms)	Base Resistance Tolerance (±)	Maximum Voltage	Maximum* Continuous Current (Amps)	Minimum** Switching Current (Amps)	Switch Temp. (°C)	Heat Capacity (Watt-Sec./°C)	Dissipation Constant (mW/°C)	Maximum Dia. (In.)	Lead Dia. (In.)
SP5504D-1R0-120	1	20%	15	0.60	1.30	120	.48	13	0.60	.032
SP5004D-2R0-120	2	20%	25	0.44	.900	120	.39	12	0.55	.032
SP4004D-3R3-120	3.3	30%	25	.300	.690	120	.25	10	0.45	.025
SP6709D-4R7-110	4.7	20%	132	.290	.650	110	1.59	16	0.70	.032
SP4004D-5R0-110	5	20%	25	.220	.500	110	.25	10	0.45	.025
SP3505D-7R5-120	7.5	30%	50	.180	.400	120	.24	8	0.40	.020
SP5510D-100-110	10	30%	132	.170	.430	110	1.19	13	0.60	.025
SP3505D-100-120	10	30%	50	.150	.350	120	.24	8	0.40	.020
SP2505D-200-120	20	30%	50	.095	.215	120	.12	6	0.30	.020
SP3510D-300-110	30	30%	132	.075	.190	110	.48	8	0.40	.020
SP3010D-500-110	50	30%	132	.055	.140	110	.35	7	0.35	.020
SP3010D-101-110	100	30%	132	.040	.100	110	.35	7	0.35	.020
SP2008D-251-120	250	30%	150	.028	.070	120	.13	7	0.25	.020
SP2010D-501-120	500	30%	250	.020	.050	120	.16	7	0.25	.020
SP2010D-102-110	1000	30%	300	.012	.032	110	.16	7	0.25	.020
SP2012D-152-110	1500	30%	350	.010	.026	110	.19	7	0.25	.020

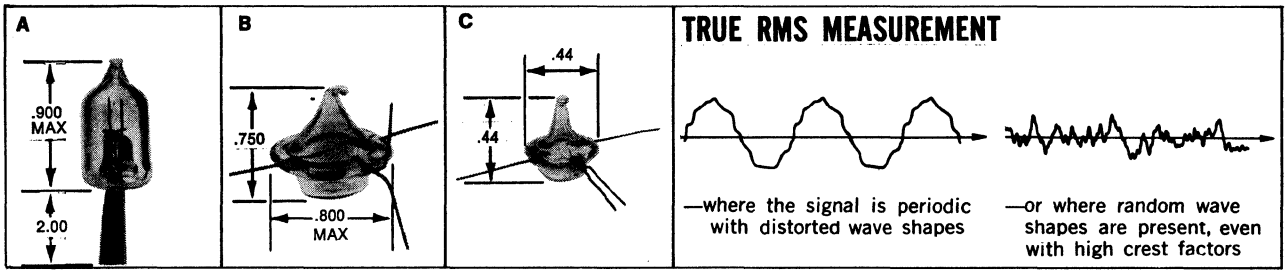
*Maximum Continuous Current (I_{cc})—The maximum amount of current, expressed in AMPS, the PTC must be capable of passing without switching into its high resistance state.

**Minimum Switching Current (I_s)—The minimum amount of current, expressed in AMPS, required to switch the PTC into its high resistance state.

The values for minimum switching current and maximum continuous current are for reference only. Mounting method and environmental conditions can affect these parameters.

BESTECHNOLOGY INC.
400 Boren Ave. N., Seattle, WA 98109 206/382-1300 FAX 206/382-0186

VACUUM THERMAL CONVERTERS

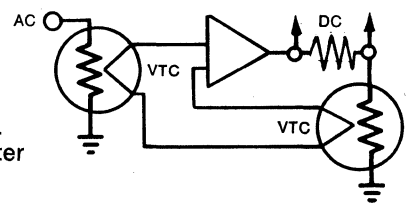


Vacuum Thermal Converters (VTC) provide a simple solution to a difficult design problem. That problem is, economically measuring the true RMS value of a current independently of waveform and frequency.

While VTCs have been in existence for many years, their work is often not understood. The basic structure looks like a simple incandescent light bulb. The outer shell is clear glass. There is a near total vacuum inside. The active elements are a heater wire with a thermocouple suspended at midpoint.

Current flows through the heater wire and the thermocouple measures the temperature at midpoint. This midpoint temperature is proportional to the true RMS current through the heater wire. The ability to calibrate at DC and measure AC accurately is inherent.

Operating range is from 0 to 65 MHz for standard pattern models, up to 300 MHz for UHF pattern and up to 1 GHz for miniature UHF pattern models. Miniature models are supplied in a low profile glass shell.



Typical application.
RMS — DC Converter
Using two VTCs

APPLICATIONS CHART

VTCs are used as basic AC-DC transfer standards as well as other instrumentation applications including vacuum measurement.

VTC Type	Current mA	Freq MHz	R/E %*	Applications
UHF	2.5-1000	0-300	.04	General purpose
UHF Matched Pairs	2.5-1000	0-300	.005	Voltmeters
Min. UHF	2.5-1000	0-1GHz	.08	Artificial squibs
Min. UHF Matched Pairs	5	0-1GHz	.005	Voltmeters
Std. Pattern	1-1000	0-65	.005	Low current models available
Std. Pattern Matched Pairs	1-1000	0-65	.005	Voltmeters
Low AC-DC Transfer error	5-100	0-65	.005	AC-DC transfer std.
Vacuum Gages	1-1000	NA	NA	Vacuum measurement
Open Heaters	1k-50k	0-300	.20	High current RF

* Best reversal error, standard is 0.2%

POPULAR MODELS

Model No.	Range mA	Heater Resis. Ohms ±10%	Couple Resis. Ohms ±10%	O/C EMF ±12% mV	Max. Overload %	See Fig.
S1	1.0	1750	13	7	250	A
S4	2.0	800	12	7	250	A
S7	5.0	90	8	7	250	A
S9	10.0	25	8	7	250	A
S48	5.0	180	8	20	200	A
S50	10.0	125	8	20	200	A
S102	5.0	125	8	10	200	A
S104	10.0	40	4	10	200	A
U1	5.0	90	8	7	250	B
U1MIN	5.0	90	8	7	250	C
U2	10.0	25	8	7	250	B
U27	2.5	200	8	7	250	B

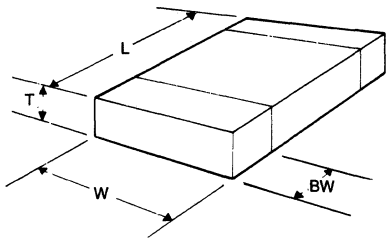
Hundreds of other models available. Write or call for application assistance.

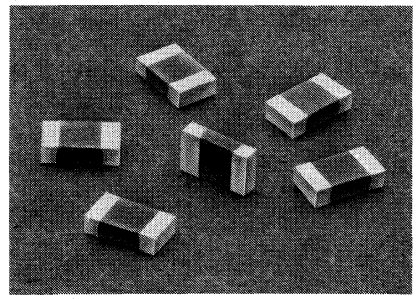
SURFACE MOUNTED HYBRID CHIP THERMISTORS

G, H and J Thermistors – Hybrid Chip

FEATURES

- Wraparound terminations
- Allows design flexibility for use with hybrid circuitry
- High-density monolithic ceramic construction
- Available in 8mm tape and reel





G, H and J Style chips are thermistor dies with wraparound terminations for mounting directly to the bonding pads of a hybrid substrate. The use of low temperature 2% to 5% silver bearing solder paste, or a suitable conductive epoxy is suggested for mounting of G and H Styles. The J Style is suitable to use with standard soldering techniques such as wave or vapor phase.

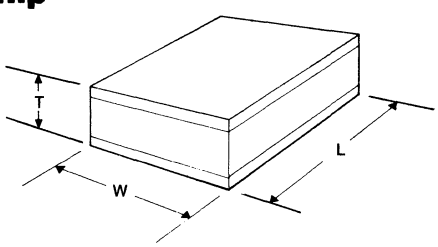
Style G = Palladium Silver
Style H = Silver
Style J = Platinum Palladium Silver

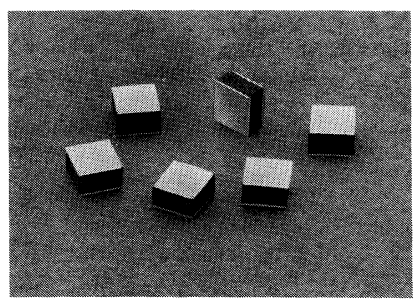
10%, 5% R_{25} tolerance Value range is 5K to 1 Meg. Ω (substitute "G", "J" or "H" in part number according to terminal style required)

W Style Thermistors – Chip

FEATURES

- Top and bottom surface terminations
- High-density monolithic ceramic construction
- Allows design flexibility for use with hybrid circuitry





W style is a thermistor die with silver conductors fired on the top and bottom surfaces. The bottom surface can be reflow soldered or conductive epoxied directly to a substrate bonding pad, and the top surface wire bonded to complete the circuit connection.

W STYLE ±10%, ±5% R_{25} tolerance Value range is 50Ω to 1Meg Ω

RESISTANCE vs. TEMPERATURE CONVERSION TABLES (Ratio = $R_T \div R_{25}$)

TEMP. °C	CURVE 1			CURVE 2			CURVE 4			CURVE 7			CURVE 9		
	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC	Ratio	MT±%	NTC
−55	96.44	4.5	7.4	53.40	6.3					132.15	6.0				
−50	67.06	3.9	7.2	38.99	6.1	6.2				90.49	5.0	7.5	44.13	3.9	
−40	33.66	3.3	6.7	21.45	5.5	5.8	40.16	5.3		43.92	4.2	7.0	23.98	3.3	5.9
−30	17.70	2.6	6.2	12.27	4.8	5.4	20.64	4.3	6.5	22.26	2.9	6.7	13.52	2.6	5.6
−20	9.712	2.1	5.8	7.278	4.0	5.1	11.03	3.5	6.1	11.73	2.7	6.2	7.891	2.1	5.2
−10	5.534	1.5	5.5	4.459	3.2	4.7	6.119	2.6	5.7	6.418	2.1	5.9	4.754	1.5	4.9
0	3.266	1.1	5.1	2.815	2.3	4.5	3.510	1.8	5.4	3.632	1.4	5.5	2.949	1.1	4.6
10	1.990	0.6	4.8	1.826	1.4	4.2	2.078	1.0	5.1	2.121	0.9	5.2	1.879	0.6	4.4
20	1.249	0.1	4.5	1.215	0.5	4.0	1.267	0.2	4.8	1.276	0.2	5.0	1.226	0.1	4.2
25	1.000	0.0	4.4	1.000	0.0	3.8	1.000	0.0	4.7	1.000	0.0	4.8	1.000	0.0	4.0
30	.8058	0.2	4.3	.8276	0.5	3.7	.7942	0.4	4.6	.7889	0.4	4.7	.8194	0.2	3.9
37	.6016	0.6	4.1				.5814	1.0	4.4				.6258	0.6	3.8
40	.5326	0.7	4.0	.5758	1.4	3.5	.5105	1.1	4.3	.5003	0.9	4.4	.5592	0.7	3.7
50	.3602	1.1	3.8	.4086	2.3	3.3	.3359	1.8	4.1	.3249	1.5	4.2	.3893	1.1	3.5
60	.2488	1.3	3.6	.2954	3.1	3.2	.2259	2.4	3.9	.2147	1.9	4.1	.2760	1.3	3.4
70	.1751	1.8	3.4	.2172	4.1	3.0	.1550	2.9	3.7	.1447	2.4	3.8	.1990	1.8	3.2
80	.1256	2.1	3.3	.1622	5.1	2.8	.1084	3.4	3.5	.09941	2.7	3.7	.1458	2.1	3.1
90	.09164	2.3	3.1	.1229	5.5	2.7	.0771	3.9	3.3	.06949	3.2	3.5	.1084	2.3	2.9
100	.06792	2.6	2.9	.09446	6.7	2.6	.0557	4.4	3.2	.04938	3.6	3.3	.08168	2.6	2.8
110	.05108	2.7	2.8	.07350	7.4	2.4	.0408	4.9	3.0	.03564	4.0	3.2	.06235	2.7	2.6
120	.03894	3.2	2.7	.05788	8.5	2.3	.0303	5.3	2.9	.02610	4.4	3.0	.04818	3.2	2.5
125	.03416	3.3	2.6	.05158	8.7	2.3	.0263	5.5	2.9	.02246	4.5	3.0	.04253	3.3	
130	.03006	3.4	2.5	.04609	8.9	2.2	.0228	5.7	2.8	.01939	4.7	2.9	.03764	3.4	2.4
140	.02348	3.7	2.4	.03708	9.7	2.1	.0173	6.0	2.7	.01459	5.0	2.8	.02972	3.7	2.3
150	.01854			.03012			.0133			.0111			.02370		

For complete information, write or phone
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INTERCHANGEABLE CURVE TRACKING AND POINT MATCHED THERMISTORS

Interchangeable curve tracking thermistors

are "curve matched" to desired temperature tolerances over selected temperature ranges. They allow component standardization and can reduce cost associated with assembly because they are "interchangeable" to within the tolerance and temperature range specified without re-calibration. They are ideally suited for use in microcomputer measurement and control circuits. The temperature tolerance corresponds to a resistance tolerance based on the temperature coefficient at each temperature point within the specified range. Standard temperature tolerance and ranges are listed below, along with the available styles and resistances.

To specify, add the appropriate suffix from the following table to the part number.

Example: 1M1002-B3 = Curve 1, 10K @ 25°C, interchangeable to ±.5°C from 0° to 70°C.

	TEMP. RANGE	0°C to +70°C			−20°C to +50°C		0°C to +100°C			+20°C to +90°C			0°C to +50°C		
	TEMP. TOLERANCE	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±.2°C	±1°C	±.5°C	±.2°C
CURVE NUMBER	PART NUMBER SUFFIX	-A3	-B3	-C3	-A2	-B2	-A4	-B4	-C4	-A5	-B5	-C5	-A8	-B8	-C8
	*R 25 Ω STYLES														
1	2252 M,T	X	X	X	X	X	X	X					X	X	X
	3000 C,T	X	X	X	X	X	X	X					X	X	X
	5000 M,F,T	X	X	X			X	X		X	X	X	X	X	X
	10,000 M,F,T	X	X	X			X	X	X	X	X	X	X	X	X
	20,000 M,T	X	X	X			X	X	X	X	X	X	X	X	X
	30,000 M	X	X	X			X	X	X	X	X	X	X	X	X
2	1000 M				X	X							X	X	
4	30,000 M,T	X	X	X			X	X		X	X	X	X	X	X
	50,000 M,T	X	X	X			X	X		X	X	X	X	X	X
	100,000 M,T	X	X	X			X	X		X	X	X	X	X	X
8	30,000 M,T	X	X	X			X			X	X	X	X	X	X
	50,000 M,T	X	X	X			X			X	X	X	X	X	X
	100,000 M,T	X	X	X			X			X	X	X	X	X	X
9	10,000 M,T	X	X	X						X	X	X	X	X	X
	20,000 M	X	X	X						X	X	X	X	X	X
	30,000 F	X	X	X						X	X	X	X	X	X

X = Available. Popular Values — contact factory for other values.

* = Standard R_{25} Values (25° resistance)

Point Matched Thermistors

are available for applications which require a specific resistance value matched to a specific temperature point. (Example: 10,000Ω ±2% at 80°C). They are useful for applications which require temperature monitoring at a critical temperature point to control, measure, or shutdown. Consult factory with requirements. Note: All thermistors listed in this catalog are point-matched thermistors at 25°C. (X Styles at 70°C)

SENSOR ASSEMBLIES AVAILABLE TO MEET STANDARD AND CUSTOM REQUIREMENTS

Note: For complete specifications on these and all models in the Dale Thermistor Line, write or call for your copy of the Dale Thermistor Catalog.

For complete information, write or phone
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THERMAL CONDUCTIVITY OF DIELECTRICS AT ROOM TEMPERATURE

Material	Thermal Conductivity, J/ (m.K)
Diamond	658
BeO	167
Graphite	117-200
Bonded SiC	42
MgO	42
Al_2O_3	33
TiC	33
BN	28
Mullite	6.3
Titania	3.3-4.2
Porcelain	1.7
Fused silica glass	1.5
Soda-lime glass	0.8
Cast epoxies	0.17-1.3
Wood	0.5-2.5
Melamines	0.3-0.7
Mica	0.3-0.7
Phenolics (molded)	0.17-0.67
Polyethylenes	0.33
Nylons	0.17-0.25
TFE fluorocarbons	0.25
Elastomers	0.08-0.17
Foams	0.003-0.04

HAWKER SIDDELEY
Elmwood Sensors

Elmwood thermostats are precision-engineered for quick, reliable response in high limit or control applications. Many meet military specifications, as well as U.L., C.S.A. and European requirements. Exposures are from −65°F to +550°F, ratings to 25 Amps, with narrow or wide differentials as required. A variety of brackets and terminals are available, as well as custom packaging. Write or phone for complete catalog.

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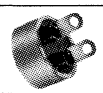
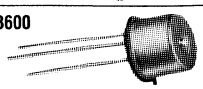
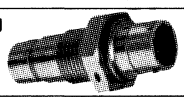
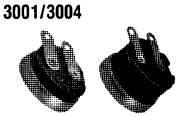
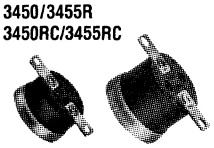
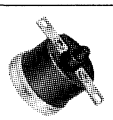
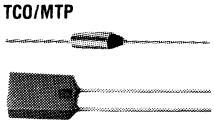
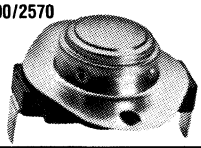
Telex: 681-4066. FAX: 1 (401) 728-5390
European Office and Plant
Elmwood Sensors, Ltd., North Shields, Tyne & Wear NE29 8SA England, Phone: (063) 25-82821. Telex: 53284

For fast service on prototypes and thermocouples call our precision sales department at (401) 727-1300.

SUB-MINIATURE SNAP-ACTION THERMOSTATS

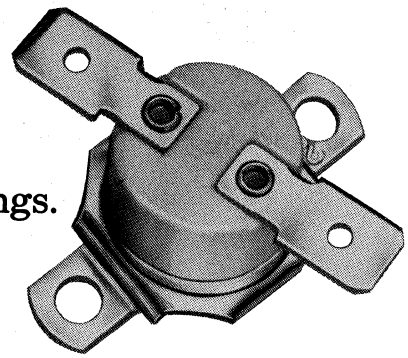
DESCRIPTION	ELECTRICAL RESISTIVE RATING	SET POINT RANGE INCLUDING TOL.	NARROWEST TOLERANCE ALLOWABLE	NARROWEST DIFFERENTIAL AVAILABLE	AGENCY LISTINGS	TYPICAL APPLICATIONS
3100/3106 Welded hermetic construction.	3100 7A-30VDC 3A-240VAC 3106 .5A-50VDC .1A-120VAC	−20° to 500°F −28.89° to 260°C	±3°F ±1.7°F	6°F Max 3.3°C Max	UL CSA	High-temp control for copy machines, computers, aircraft, electronic controls. 3106 for "Dry Circuit" applications.
3150/3156 Similar to 3100 except low silhouette .301" max. design	3150 6A-120VAC 1.5A-240VAC 3156 .5A-50VDC .1A-120VAC	−20° to 350°F −28.89° to 177°C	±3°F ±1.7°F	6°F Max 3.3°C Max	UL CSA	Copy machines, computers, aircraft, electronic controls. where space is critical. 3156 for "Dry Circuit" applications.
3800  Hermetically sealed, all welded construction. Long life.	125VA-24VAC 360VA-600VAC	20°F to 480°F −5°C to 250°C	±9°F ±5°C	18°F 10°C	UL CSA	Running overtemperature protection for AC & DC motors. Onwinding mount.
3600  Hermetically sealed, TO-5 case, with contacts for logic level.	1Amp 28V AC/DC 5 MA 5VDC	35°C to 105°C	±5°C	5°F Stand.		PC board mounted protection for power supply boards, logic boards, etc.
3000  Custom package housings	Consult Factory	0°F to 400°F −18°C to 204°C	±4°F ±2.2°C	10°F Max 5.6°C Max		Aircraft bleed air duct sensing, hydraulic oil temp control, liquid bath control, heater control.
3001/3004  Non-hermetic phenolic and metal housing	3001 6A-120VAC 3A-240VAC 3004 8A-120VAC 4A-250VAC	0° to 335°F 17.8° to 168.3°C	±4°F ±2.2°C	8°F Max 4.4°C Max	UL, CSA UL, CSA Int'l	Computer, copy machines, telecommunications equipment. 3004 meets European spacing requirements.
3450/3455R **3450RC/3455RC**  Non-hermetic "C" models have high temperature base material	15 AMP-120VAC 10 AMP-240VAC 10 AMP-277VAC	32°F to 500°F 0°C to 260°C	±5°F ±3°C	20°F 11°C	UL, CSA Int'l	Power supplies, communication, medical equipment, computers where high amp loads are present. 3455R/RC is used where increased spacing for international req's are needed.
3455RM **3450 CM**  Non-hermetic manual reset. Will not recycle automatically at room temperature. CM model for high temp.	15 AMP-120VAC 10 AMP-240VAC	125° to 500°F 0° to 260°C	±8°F ±5°C	Man. reset (auto reset below 40°F 4.44°C)	UL, CSA Int'l national	Where manual reset is required. 3455RM/ 345 CM meet increased spacing for Int'l requirements.
TCO/MTP  Non-eutectic, non-resettable thermal fuse which protects equipment from hazardous temp conditions	TCO 25A-240VAC MTP 5A-120VAC	162° to 464°F 72° to 240°C 162° to 306°F 72° to 152°C	+0°C −4°C	N/A	UL, CSA Int'l UL, CSA	Electric heaters, table-top appliances, small motors and transformers. Special configuration avail.

¾" DISC THERMOSTATS

DESCRIPTION	ELECTRICAL RESISTIVE RATING	SET POINT RANGE INCLUDING TOL.	NARROWEST TOLERANCE ALLOWABLE	NARROWEST DIFFERENTIAL AVAILABLE	AGENCY LISTINGS	TYPICAL APPLICATIONS
2500/2570  3/4" Non-hermetic automatic reset device. 2570 series used for Defrost applications.	2500 25A-240VAC 2570 10A-120VAC 5A-240VAC	0°F to 350°F −18°C to 177°C −20°F to 221°F −29°C to 105°C	±5°F ±3°C	10°F 5°C	UL, CSA	Electric heaters, clothes dryers, wood stoves. 2570 Series is designed for refrigerators, freezers, HVAC and food dispensing applications.

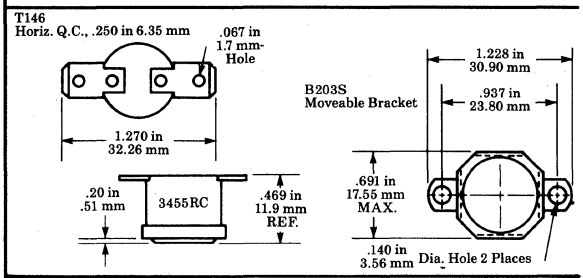
ELMWOOD REDI-TEMP 3455RC THERMOSTAT.

- Electrical rating to 15AMP 120VAC resistive.
- Environmental exposure 0° to 500°F (-18° to 288°C).
- UL, CSA, European Approval Agency listings.
- Single contact (SPST).
- Pre-set and tamperproof.
- Shipped from stock.



Applications: Copy machines, power supplies, telecommunications, ovens.

OPEN TEMP °F	TOLER (+/-) °F	CLOSE TEMP °F	TOLER (+/-) °F	PART NUMBER
65	5	30	8	3455RC-100-220
75	5	40	8	3455RC-100-221
85	5	55	8	3455RC-100-222
95	5	65	8	3455RC-100-223
105	5	75	8	3455RC-100-224
115	5	85	8	3455RC-100-225
125	5	95	8	3455RC-100-226
135	5	105	8	3455RC-100-227
145	5	115	8	3455RC-100-228
155	5	125	8	3455RC-100-229
165	5	135	8	3455RC-100-230
175	5	145	8	3455RC-100-231
185	5	155	8	3455RC-100-232
195	5	165	8	3455RC-100-233
205	6	175	8	3455RC-100-234
215	6	185	8	3455RC-100-235
225	6	195	8	3455RC-100-236
235	6	205	8	3455RC-100-237
245	6	215	8	3455RC-100-238
255	7	225	8	3455RC-100-239
275	7	245	8	3455RC-100-240
295	7	265	8	3455RC-100-241
315	10	275	15	3455RC-100-242
70	8	35	5	3455RC-100-243
90	8	60	5	3455RC-100-244
110	8	80	5	3455RC-100-245
130	8	100	5	3455RC-100-246
150	8	120	5	3455RC-100-247
170	8	140	5	3455RC-100-248
190	8	160	5	3455RC-100-249
210	8	180	6	3455RC-100-250
230	8	200	6	3455RC-100-251



RATINGS—RESISTIVE

CATALOG TYPE	ELECTRICAL CYCLES	120 VAC	240 VAC	277 VAC
3455RC	100,000	15 AMP	10 AMP	10 AMP
	100,000	4.4 FLA 26.4 LRA	2.2 FLA 13.2 LRA	—
	6,000	5.8 FLA 34.8 LRA	2.9 FLA 17.4 LRA	—
	6,000	125 VA	125 VA	—

FLA: Full Load Amps LRA: Locked Rotor Amps

The 3455RC utilizes a patented metal sleeve insert-rivet construction with increased clearance which is listed by all major European approval agencies, featuring a high density base.

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European Division: Elmwood Sensors, Ltd., England/Telex: 53284.

HAWKER SIDDELEY Elmwood Sensors

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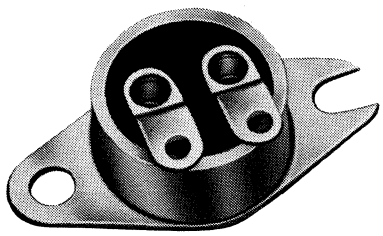
ELMWOOD REDI-TEMP 3100 SPST THERMOSTAT.

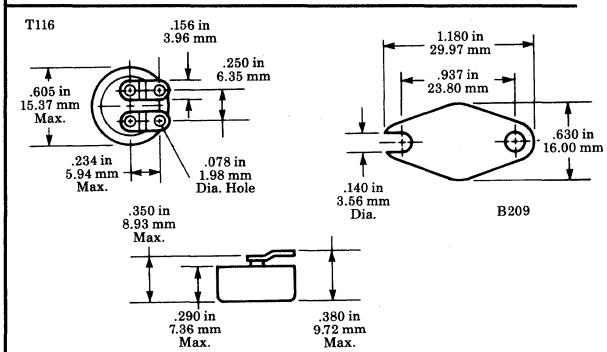
- Hermetically Sealed.
- Environmental Exposure −80° to 550°F (−62° to 288°C).
- U.L. Listings. • Single contact (SPST).
- Pre-set and Tamperproof.
- Shipped from stock.



Applications: Computers, medical electronics, power supplies, industrial controls, test equipment.

OPEN TEMP °F	TOLER (+/−) °F	CLOSE TEMP °F	TOLER (+/−) °F	PART NUMBER
40	5	20	5	3100U-3-1431
50	5	30	5	3100U-3-1432
60	5	40	5	3100U-3-1433
70	5	50	5	3100U-3-1434
80	5	60	5	3100U-3-1435
90	5	70	5	3100U-3-1436
100	5	80	5	3100U-3-1437
110	5	90	5	3100U-3-1438
120	5	100	5	3100U-3-1439
130	5	110	5	3100U-3-1440
140	5	120	5	3100U-3-1441
150	5	130	5	3100U-3-1442
160	5	140	5	3100U-3-1443
170	5	150	5	3100U-3-1444
180	5	160	5	3100U-3-1445
190	5	170	5	3100U-3-1446
200	5	180	5	3100U-3-1447
210	8	185	6	3100U-3-1448
220	8	195	6	3100U-3-1449
230	8	205	6	3100U-3-1450
240	8	215	6	3100U-3-1451
250	8	225	6	3100U-3-1452

CLOSE TEMP °F	TOLER (+/−) °F	OPEN TEMP °F	TOLER (+/−) °F	PART NUMBER
40	5	20	5	3100U-3-1453
50	5	30	5	3100U-3-1454
60	5	40	5	3100U-3-1455
80	5	60	5	3100U-3-1456
100	5	80	5	3100U-3-1457
120	5	100	5	3100U-3-1458
140	5	120	5	3100U-3-1459
160	5	140	5	3100U-3-1460
180	5	160	5	3100U-3-1461
200	5	180	5	3100U-3-1462
220	6	195	8	3100U-3-1463



RATINGS—RESISTIVE

LIFE CYCLES	30 VAC/DC	120 VAC	240 VAC
5,000	7.0 AMPS	6.0 AMPS	3.0 AMPS
10,000	6.5 AMPS	5.0 AMPS	2.5 AMPS
25,000	6.0 AMPS	4.0 AMPS	2.0 AMPS
50,000	5.5 AMPS	3.0 AMPS	1.5 AMPS
100,000	5.0 AMPS	2.0 AMPS	1.0 AMPS

U.L. RATINGS

LIFE CYCLES	120 VAC	240 VAC
6,000	6.0 AMPS	1.15 AMPS
6,000	1/10 H.P.	-
100,000	3.0 AMPS	-

The 3100 thermostat is a single-pole, single-throw switch activated by a snap-action bi-metal disc. Temperature calibrations are preset at the factory, and each unit is 100% thermally and mechanically inspected. It is available to open or close on temperature rise. The case is laser welded to form a hermetically sealed steel housing, with glass-to-metal seal at the terminal junction.

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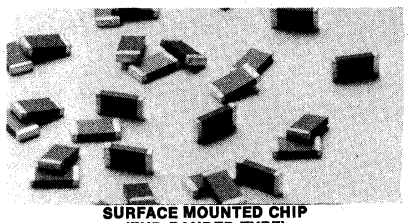
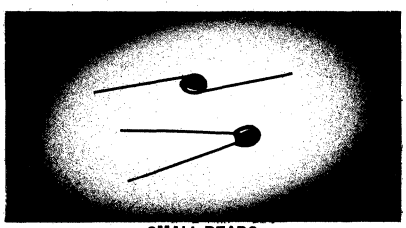
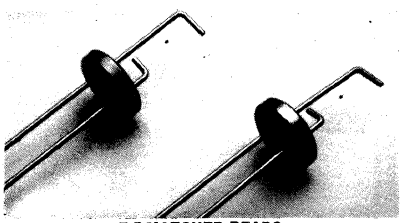

SURFACE MOUNTED CHIP (END-BANDED TYPE)

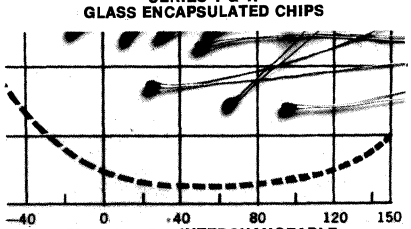

SMALL BEADS

UNI-CHIP SERIES


E-I MATCHED BEADS

SERIES I & II GLASS ENCAPSULATED CHIPS

STANDARD BEADS



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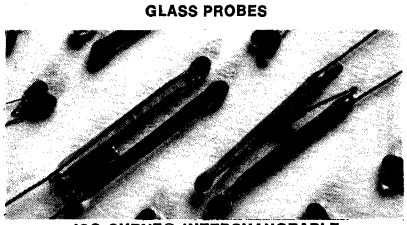
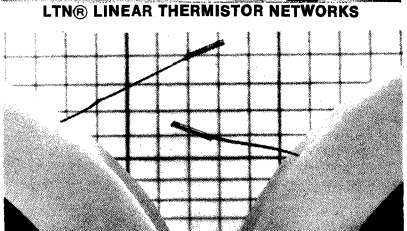
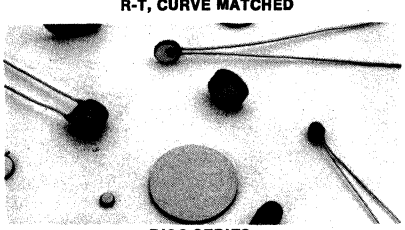
GLASS PROBES

LTN® LINEAR THERMISTOR NETWORKS


ISO-CURVE® INTERCHANGEABLE, R-T, CURVE MATCHED


MICRO-MINI CHIP SERIES


DISC SERIES

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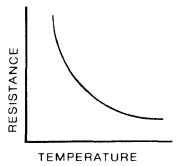
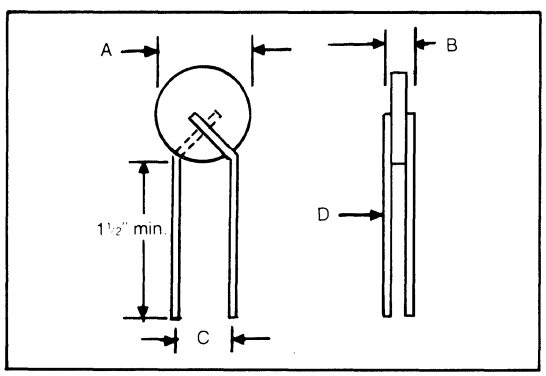
DISC TYPE THERMISTORS WITH CROSSED LEADS



NTC (Negative Temperature Coefficient) thermistors decrease in resistance as temperature increases. Their maximum operating temperature is 125° C. Zero-power resistance values at 25° C range from 10 Ω to 250K Ω ; other values upon request. Disc thermistors are available with various coatings, lead styles, and resistance tolerances. Contact Keystone Thermistor Engineering or write for catalog T787.



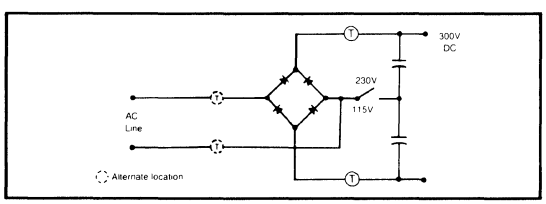
KCC TYPE	R_o @ 25°C (Ω)	Tol. ±%	A (in.)	B (in.)	C (in.)	D (AWG)	Dissipation Constant (mW/°C)	Resist.† Ratio	Temp. Coef. @ 25°C (%/°C)
RL1004-65.6-59-D1	100	20	0.110	0.120	0.100	26	2.5	5.6	-3.42
RL1003-312-73-D1	500	10	0.110	0.110	0.100	26	2.5	6.9	-3.83
RL1007-624-73-D1	1,000	10	0.110	0.150	0.100	26	2.8	6.9	-3.83
RL1003-1157-95-D1	2,000	10	0.110	0.110	0.100	26	2.8	9.2	-4.43
RL1003-1746-97-D1	3,000	10	0.110	0.110	0.100	26	2.5	9.1	-4.40
RL1004-2910-97-D1	5,000	10	0.110	0.120	0.100	26	2.5	9.1	-4.40
RL1009-5820-97-D1	10,000	10	0.110	0.170	0.100	26	3.0	9.1	-4.40
RL1005-5744-103-D1	10,000	10	0.110	0.130	0.100	26	2.5	9.6	-4.49
RL1007-13.8K-120-D1	25,000	10	0.110	0.150	0.100	26	2.8	11.4	-4.84
RL1003-26.7K-140-D1	50,000	10	0.110	0.110	0.100	26	2.5	12.9	-5.08
RL1006-53.4K-140-D1	100,000	10	0.110	0.140	0.100	26	2.7	12.9	-5.08
RL1004-104.7K-155-D1	200,000	10	0.110	0.120	0.100	26	2.5	13.8	-5.23
RL1006-135.2K-138-D1	250,000	10	0.110	0.140	0.100	26	2.7	12.1	-4.96
RL2004-16.4-59-D1	25	20	0.220	0.130	0.156	24	6.5	5.6	-3.42
RL2007-32.8-59-D1	50	20	0.220	0.160	0.156	24	6.5	5.6	-3.42
RL2003-62.4-73-D1	100	10	0.220	0.120	0.156	24	6.5	6.9	-3.83
RL2006-125-73-D1	200	10	0.220	0.150	0.156	24	6.5	6.9	-3.83
RL2008-187-73-D1	300	10	0.220	0.170	0.156	24	6.5	6.9	-3.83
RL2003-289-95-D1	500	10	0.220	0.120	0.156	24	6.0	9.2	-4.43
RL2004-582-97-D1	1,000	10	0.220	0.130	0.156	24	6.5	9.1	-4.40
RL2007-1164-97-D1	2,000	10	0.220	0.160	0.156	24	6.5	9.1	-4.40
RL2006-1600-103-D1	2,786	10	0.220	0.150	0.156	24	6.5	9.6	-4.49
RL2005-2203-120-D1	4,000	10	0.220	0.140	0.156	24	6.5	11.4	-4.84
RL2006-2753-120-D1	5,000	10	0.220	0.150	0.156	24	6.5	11.4	-4.84
RL2012-5506-120-D1	10,000	10	0.220	0.210	0.156	24	7.2	11.4	-4.84
RL2006-13.3K-140-D1	25,000	10	0.220	0.150	0.156	24	6.5	12.9	-5.08
RL2005-27K-138-D1	50,000	10	0.220	0.140	0.156	24	6.5	12.1	-4.96
RL2008-52.3K-155-D1	100,000	10	0.220	0.170	0.156	24	6.5	13.8	-5.23
RL3004-6.56-59-D1	10	20	0.320	0.130	0.250	24	7.0	5.6	-3.42
RL3504-31.2-73-D1	50	10	0.370	0.130	0.250	24	7.5	6.9	-3.83
RL3006-59.4-85-D1	100	10	0.320	0.150	0.250	24	7.2	8.4	-4.23
RL3004-144-95-D1	250	10	0.320	0.130	0.250	24	7.0	9.2	-4.43
RL3004-291-97-D1	500	10	0.320	0.130	0.250	24	7.0	9.1	-4.40
RL3005-574-103-D1	1,000	10	0.320	0.130	0.250	24	7.0	9.6	-4.49

†Resistance Ratio: Ratio of zero-power resistance @ 0°C to zero-power resistance @ 50°C.

Keystone Thermistors are distributed by

Allied Electronics	1-800-228-6705	Newark Electronics	312-638-4411
SIN-TEC Electronics	1-800-526-5960	Hi-Cor (West Coast)	415-368-5087
(In N.J.)	201-996-4093	Digi-Key Corp.	1-800-344-4539

INRUSH CURRENT LIMITERS



The circuit diagram above displays a typical way to limit inrush current.

Protection against extremely high peak inrush current, especially in AC/DC switching power supplies, is now available with Keystone Inrush Current Limiters. These special NTC thermistors effectively control surge currents because the thermal time constant of the current limiter is longer than the electrical time constant (RC) of the thermistor and the capacitor.

All inrush current limiters are insulated with a protective coating.

Type	R_t @ 25°C ± 25% (Ω)	Max.* Steady State Current (amps)	Nominal Resistance @ Imax (Ω)	A max. (in.)	B max. (in.)	C ref. (in.)	D (AWG)
CL-10	0.7	12	0.03	0.770	0.220	0.328	18
CL-20	1.3	8	0.04	0.550	0.210	0.328	18
CL-30	2.5	8	0.06	0.770	0.220	0.328	18
CL-40	5	6	0.11	0.770	0.220	0.328	18
CL-50	7	5	0.16	0.770	0.260	0.328	18
CL-60	10	5	0.18	0.770	0.220	0.328	18
CL-70	16	4	0.27	0.770	0.220	0.328	18
CL-80	47	3	0.49	0.770	0.220	0.328	18
CL-90	120	2	1.18	0.930	0.220	0.328	18
CL-100	0.5	16	0.02	0.930	0.220	0.328	18
CL-110	10	3.2	0.18	0.400	0.170	0.250	24
CL-120	10	1.7	0.34	0.400	0.170	0.250	24
CL-130	50	1.6	0.76	0.450	0.170	0.250	24
CL-140	50	1.1	0.89	0.450	0.170	0.250	24
CL-150	5	4.7	0.11	0.550	0.180	0.328	22
CL-160	5	2.8	0.20	0.550	0.180	0.328	22
CL-170	16	2.7	0.33	0.550	0.180	0.328	22
CL-180	16	1.7	0.49	0.550	0.180	0.328	22
CL-190	25	2.4	0.41	0.550	0.180	0.328	22
CL-200	25	1.7	0.49	0.550	0.180	0.328	22

*These values are *suggested* maximums based upon a 25° C ambient, no air flow environment with the thermistor mounted ½" from the circuit board. Contact Keystone Engineering to discuss Iss ratings with air flow.

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Thermistor Division, St. Marys, PA 15857
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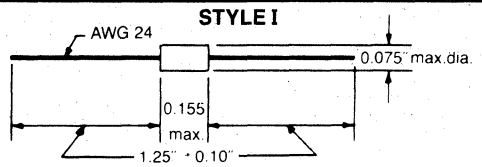
Keystone CARBON COMPANY

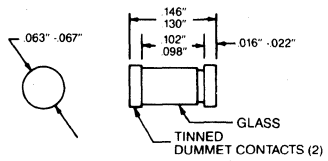
GLASS ENCAPSULATED THERMISTORS

STYLE I



Temperature Range: -50°C to +204°C
Dissipation Constant: 2.0 mW/°C
Time Constant: 3 sec.
Tolerance: ±10% @ 25°C

STYLE II (SURFACE MOUNT)



NOTE: FOR KCC TYPE FOR STYLE II DELETE AL PREFIX AND ADD G100 SUFFIX

Keystone glass encapsulated NTC thermistors are tiny pellets of thermistor material hermetically sealed in glass bodies with a controlled amount of selected atmosphere. The hermetic seal makes these parts extremely stable in applications up to 204°C (400°F).

RESISTANCE/TEMPERATURE CHARACTERISTICS

Type	R_0 @ 25°C Ω	Temp. Coef. @25°C (%/°C)	Material
AL03006-624-73-G1	1K	-3.83	GE73
AL03006-1248-73-G1	2K	-3.83	GE73
AL03006-1847-76-G1	3K	-3.85	GE76
AL03006-2463-76-G1	4K	-3.85	GE76
AL03006-3079-76-G1	5K	-3.85	GE76
AL03006-5818-97-G1	10K	-4.41	GE97A
AL03006-11.7K-98-G1	20K	-4.34	GE98
AL03006-17.53K-98-G1	30K	-4.34	GE98
AL03006-29.1K-97-G1	50K	-4.32	GE97B
AL03006-58.2K-97-G1	100K	-4.32	GE97B
AL03006-110K-130-G1	200K	-4.84	GE130
AL03006-269.8K-138-G1	500K	-4.99	GE138
AL03006-535K-145-G1	1M	-5.07	GE145
AL03006-2.6M-164-G1	5M	-5.26	GE164

PTC SURFACE-MOUNT OVERTEMPERATURE PROTECTORS

Positive Temperature Coefficient (PTC) thermistors — act as solid-state switches. A typical application of these surface mount units is to prevent destruction of a power transistor.

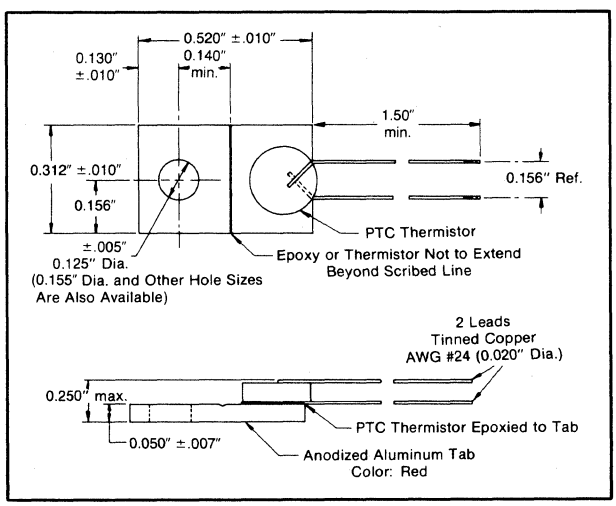
The PTC Sensor is mechanically mounted to the power transistor package. The PTC thermistor measures the surface temperature of the transistor. When the temperature of the transistor case reaches a critical point, the PTC switches and turns off the drive circuitry for the transistor. This action prevents its destruction. Then, as the transistor cools, so does the thermistor, automatically resetting itself to once again guard the power transistor.

Specifications

1. Resistance @ 25°C: 100Ω ± 30% (70Ω — 130Ω).
2. Transition temperature per table is defined as the temperature at which the measured resistance is two times the minimum resistance.
3. Maximum voltage that can be applied to the device in DC or 60Hz sinusoidal wave form AC is 30 volts.
4. Maximum operating temperature 140°C.
5. Dielectric withstand between PTC element and aluminum tab is 50 VDC min.
6. Basic construction: .200" dia. x .060" thk. PTC disc with radial leads attached to an anodized aluminum tab.
7. Physical design — per drawing.
8. Optional resistance values, switch temperatures and physical designs are available upon request.

PTC SURFACE TEMPERATURE SENSORS

Type Number	Transition Temp. °C (Ref.)
RL2006-100-30-30-PT1	30
RL2006-100-40-30-PT1	40
RL2006-100-50-30-PT1	50
RL2006-100-60-30-PT1	60
RL2006-100-70-30-PT1	70
RL2006-100-80-30-PT1	80
RL2006-100-90-30-PT1	90
RL2006-100-100-30-PT1	100
RL2006-100-110-30-PT1	110
RL2006-100-120-30-PT1	120



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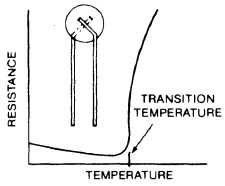
PTC — POSITIVE TEMPERATURE COEFFICIENT THERMISTORS



Positive Temperature Coefficient (PTC) thermistors are characterized by an extremely large resistance change in a small temperature span. The figure at left depicts a generalized resistance temperature plot for a PTC. The temperature at which the resistance begins to increase rapidly is referred to as the transition temperature. This point can be changed from below 0° C to above 160° C.

TYPICAL PTC APPLICATIONS

• Automatic Color TV Degaussing • Air Flow Measurement • Non-Destructive Fuse • Single Phase Motor Starting • Liquid Level Sensing • Combination Heater-Thermostat • Arc Suppression • Time Delay Fusing.

For detailed application notes, write for Catalog T787.

Operating Voltage V_{OP}	Type Number	R_o @25°C ±30% (Ω)	Transition Temperature T_{TR} (°C)	Reference Dimensions (In.) A	B	C	D	E	Dissipation† Constant δ (mW/°C)	Time† Constant τ (Sec.)	Fig. No. *
12	RL5505-1-120-12-PTO	1	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5305-2-120-12-PTO	2	120	0.53	0.05	1.5	0.33	0.032	14.0	50	A
	RL3005-10-120-12-PTO	10	120	0.30	0.05	1.5	0.25	0.020	7.0	35	A
	RL3005-25-120-12-PTO	25	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
20	RL5505-2.5-120-20-PTO	2.5	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
	RL5505-5-120-20-PTO	5.0	120	0.55	0.05	1.5	0.33	0.032	14.0	50	A
25	RL3006-20-120-25-PTO	20	120	0.30	0.06	1.5	0.25	0.025	7.0	35	A
	RL3006-50-30-25-PTO	50	30	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-40-25-PTO	50	40	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-50-25-PTO	50	50	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-60-25-PTO	50	60	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-70-25-PTO	50	70	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-80-25-PTO	50	80	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-90-25-PTO	50	90	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-100-25-PTO	50	100	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-110-25-PTO	50	110	0.30	0.06	1.5	0.25	0.020	7.0	35	A
	RL3006-50-120-25-PTO	50	120	0.30	0.06	1.5	0.25	0.020	7.0	35	A
50	RL5506-5-65-50-PTO	5	65	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5506-10-110-50-PTO	10	110	0.55	0.06	1.5	0.33	0.032	14.0	50	A
	RL5510-20-110-50-PTO	20	110	0.55	0.10	1.5	0.33	0.032	15.0	80	A
	RL4010-50-110-50-PTO	50	110	0.40	0.10	1.5	0.33	0.025	12.0	60	A
120	RL7510-10-120-120-PTO	10	120	0.75	0.10	1.5	0.33	0.020	20.0	90	A
	RL6010-20-120-120-PTO	20	120	0.60	0.10	1.5	0.33	0.032	18.0	90	A
	RL5510-25-65-120-PTO	25	65	0.55	0.10	0.5	0.33	0.025	15.0	90	B
	RL4510-50-120-120-PTO	50	120	0.45	0.10	1.5	0.33	0.025	12.0	70	A
240	RL5515-50-65-240-PTO	50	65	0.55	0.15	1.5	0.33	0.032	17.0	80	A
	RL6015-100-120-240-PTO	100	120	0.60	0.15	1.5	0.33	0.032	18.0	90	A
	RL3020-1500-100-240-PTO	1500	100	0.30	0.20	1.5	0.25	0.020	12.0	60	A

† The values for dissipation constant and time constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone Engineering for further information.
* Represents standard lead configurations. Other lead styles shown are available for custom made thermistors.

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TYPICAL CONFIGURATIONS

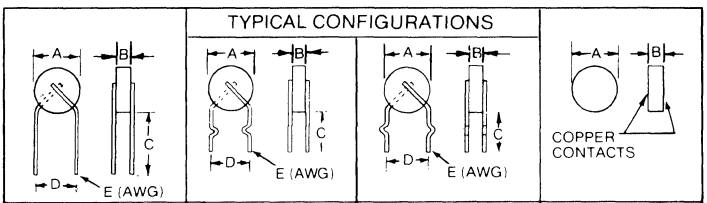


FIG. A (STRAIGHT LEAD) | FIG. B (INSIDE KINK) | FIG. C (OUTSIDE KINK) | FIG. D (NO LEADS)

NOTE: 1. Operating Voltage: D.C. or 60Hz A.C. (for higher voltage req. — contact factory).
2. The specifications and configurations shown above are typical of standard items. Special characteristics, designs and alternate physical sizes are available upon request.

PTC RESETTABLE FUSES

Typical applications for PTC fuses:
- Telephone line fault protection
- Fuse for intermittent solenoids
- Over-current protection for transformers
- Locked rotor protection for FHP motors

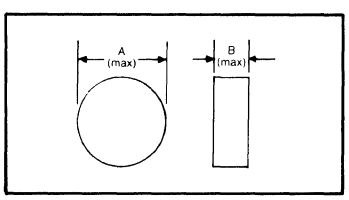
Minimum Limit Current — The minimum amount of current required by the PTC to guarantee switching at the minimum ambient temperature.

Maximum Limit Current — The maximum amount of current the PTC must be able to pass without switching at the maximum ambient temperature.

Operating Voltage V_{op}	No Load Resistance @ 25°C (±20%) (Ω)	Type Number	Minimum Limit† Current (amps) 0°C	20°C	Maximum Limit† Current (amps) 30°C	55°C	T_{TR} (Ref.) (°C)	Heat Capacity (Watt-Sec/°C)	Diss.† Const. (mW/°C)	Max. Dia. (In.)
12	1	RL5305-1-110-12-PTF	1.30	1.20	0.80	0.60	110	0.5	14.0	0.60
	5	RL4005-5-110-12-PTF	0.44	0.37	0.29	0.20	110	0.3	10.0	0.45
	10	RL3005-10-110-12-PTF	0.33	0.30	0.20	0.16	110	0.2	7.0	0.35
	25	RL2505-25-110-12-PTF	0.23	0.19	0.13	0.09	110	0.1	6.0	0.32
50	5	RL5506-5-110-50-PTF	0.55	0.50	0.30	0.25	110	0.7	14.0	0.60
	10	RL4006-10-110-50-PTF	0.30	0.27	0.18	0.16	110	0.4	10.0	0.45
	50	RL5310-50-110-50-PTF	0.23	0.20	0.11	0.10	110	1.1	15.0	0.60
	100	RL3810-100-110-50-PTF	0.10	0.09	0.06	0.05	110	0.5	12.0	0.42
120	10	RL7510-10-110-120-PTF	0.39	0.36	0.25	0.17	110	2.2	20.0	0.80
	50	RL4510-50-110-120-PTF	0.16	0.15	0.09	0.07	110	0.7	14.0	0.50
	100	RL3510-100-110-120-PTF	0.09	0.08	0.06	0.04	110	0.5	11.0	0.40

†The values for minimum and maximum limit current and dissipation constant are for reference only. Actual values are a function of method of mounting, air flow, and other factors which affect the PTCs ability to dissipate heat. Contact Keystone engineering for further information.

PTC HEATERS



Typical applications for PTC heaters:
- Contact lens cleaner kits
- Medical equipment
- In-line diesel fuel heaters
- Temperature stabilization of electronic components

Operating Voltage V_{OP}	Type Number	No Load Resistance @ 25 C (Ref.) (Ω)	Transition Temperature (Ref.) (C)	A (In.)	B (In.)	Typical Operating Temperature Minimum Heat Sinking† C
24	6306-200-15-24-PTH	200	15	0.68	0.08	50
	5506-20-120-24-PTH	20	120	0.60	0.08	160
	5506-20-140-24-PTH	20	140	0.60	0.08	180
	5506-40-110-24-PTH	40	110	0.60	0.08	130
120	5510-100-120-120-PTH	100	120	0.60	0.12	160
	5510-200-110-120-PTH	200	110	0.60	0.12	140
	5510-150-140-120-PTH	150	140	0.60	0.12	180
240	6315-250-120-240-PTH	250	120	0.68	0.18	160
	5520-250-140-240-PTH	250	140	0.60	0.23	180
	6315-500-110-240-PTH	500	110	0.68	0.18	140

†Measured at 25°C ambient. PTC mounted in small spring clip.

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for temperature compensating and trimming applications.

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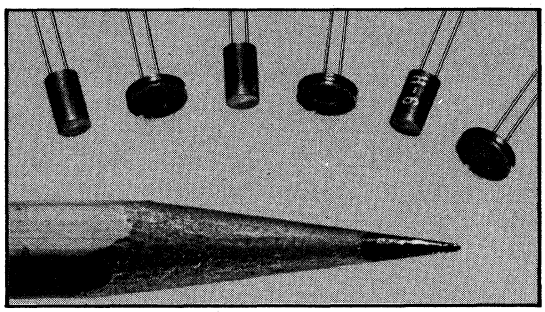
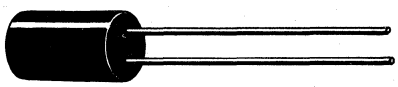
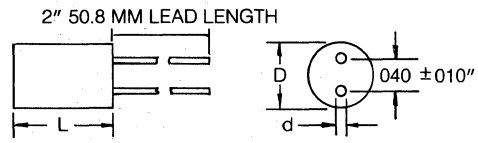


TYPE 401
ENCAPSULATED





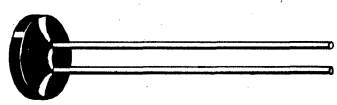
SPECIFICATIONS

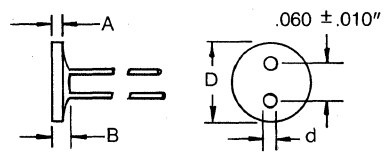
Part No.	Rated Watt 70°C	Temp. Coeff.	Resistance Range (ohms)	Resistor tolerance	T.C.R. tolerance	Dimensions L ±.032	Dimensions D ±.015	Dimensions d	Max volts D.C.
401E	0.05W	0+20ppm	.5-30K	.05% to 10%	7%	.175	.105	28awg	75
401B	0.05W	0+4500ppm	.5-5K	*1% to 20%	7%	.175	.105	28awg	75
401N	0.05W	0+6000ppm	1-1.5K	*1% to 20%	7%	.175	.105	28awg	75

* 1% tolerance available only on values over 10 ohms
Also available in axial lead configuration — order as type 110.

TYPE D-100
CONFORMAL COATED

Flat surface facilitates bonding for excellent response time





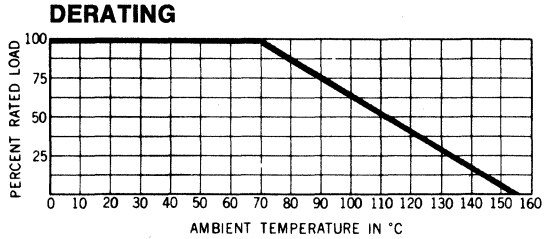
SPECIFICATIONS

Part No.	Rated Watt 70°C	Temp. Coeff.	Resistance Range (ohms)	Resistor tolerance	T.C.R. tolerance	Dimensions A ±.010	Dimensions B ±.032	Dimensions D ±.015	Dimensions d	Max Volts
D-100E	.05W	+20ppm	40-25K	1% to 10%	7%	.045	.100	.200	30awg	75
D-100B	.05W	+4500ppm	10-2K	1% to 20%	7%	.045	.100	.200	30awg	75
D100-N	.05W	+6000ppm	10-350	5% to 20%	7%	.045	.100	.200	30awg	75

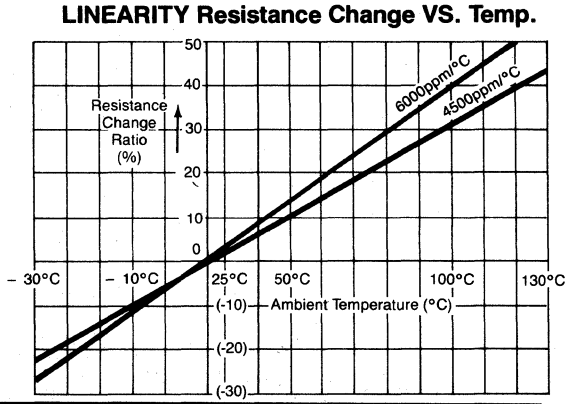
FEATURES:
- Wirewound for accuracy/Epoxy construction.
- Matching temperature coefficient available.
- Ratio match resistance available.
- Excellent repeatability/Quick response time.
- High positive temperature coefficient.
- Linear Resistance Change with Temperature.
- High Ohmic Values.
- Wide Operating Temperature Range.
- Guaranteed Part-to-Part Interchangeability.

APPLICATIONS:
- Load Cell compensating & trimming.
- Temperature control, detection and indication.
- Temperature protection indication.
- Measuring and testing equipment.
- Liquid temperature sensors.

DERATING



LINEARITY Resistance Change VS. Temp.



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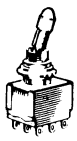
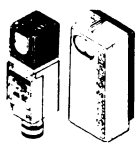
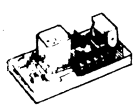
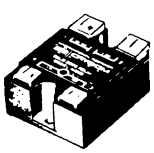

TOGGLE SWITCHES

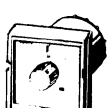

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

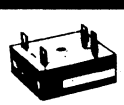
TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

PADDLE SWITCHES

TRANSFORMERS


TIMERS

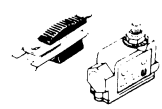
COUNTERS

FANS

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

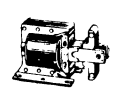
KNOBS

LAMPS & LEDS


SWITCHES

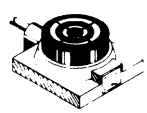
RELAYS

INDICATOR LIGHTS


SOLENOIDS

SOCKETS

PUSHBUTTON SWITCHES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H-Series and leadless SMS™ Hermetically Sealed Thermistors Manufactured by MIDWEST COMPONENTS INC. are small, rugged and good for use up to 400°C. Their fast response, interchangeability and long-term stability makes both series ideal for temperature sensing and compensation.

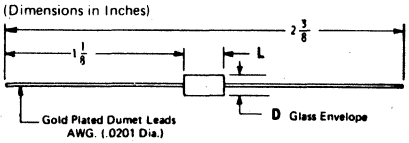
The leadless SMS™ Thermistor is designed for applications where surface mounting is required. Both sensors are available on tape and reel for automatic mounting.

H-SERIES LEADED SENSOR

Typical Characteristics	Test Condition	Catalog Number 1H	PIH	UH	2H	4H
Specification						
Resistance @ 25° C. (OHMS)	Zero Power	3K-100K	3K-100K	3K-100K	2K-5K	200K-1M
Resistance Ratio $\frac{R_{25C}}{R_{128C}}$		29.85	29.85	29.85	19.80	48.78
Maximum Withstand Temperature. °C		-55 to 400	-55 to 400	-55 to 400	-55 to 400	-55 to 400
Operating Temperature Range. °C		-50 to 400	-50 to 400	-50 to 400	-50 to 400	-50 to 400
Interchangeability °C (see curve reverse side)	0-100°C	N/A	1°C	.2°C	N/A	N/A
Stability (change in resistance)	1000 Hours at 100°C	< .1%	< .1%	< .1%	N/A	N/A

OUTLINE DRAWING

(Dimensions in Inches)



GRADE	D	L	AWG
1H (3K-3K)	.095	.170	20
1H (10K-100K)	.070	.150	24
2H (2K-5K)	.070	.150	24
4H (200K-1M)	.070	.150	24

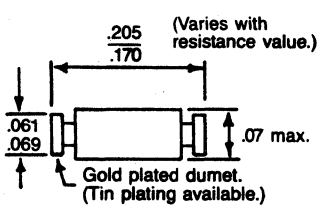
*Dissipation Constant—Free Air
1H (3K-9K)—5mw/°c
1H (10K-100K) 2H-4H—2mw/°c

**Time Constant—Stirred Oil
1H (3K-9K)—1.5 sec. max.
1H (10K-100K)—2H-4H—1 sec. max.

SMS™ - SURFACE MOUNT SENSOR

Typical Characteristics	Catalog Number 2S202	2S502	1S103	1S203	1S503	1S104	4S204	4S504	4S105
Zero Power Resistance @ 25°C: OHMS ± 10%	2,000	5,000	10,000	20,000	50,000	100,000	200,000	500,000	1,000,000
Resistance Ratio: $\frac{R_{25°C}}{R_{125°C}}$	19.80	19.80	29.41	29.41	29.41	29.41	48.78	48.78	48.78
*Dissipation Constant (∂): $\frac{\text{milliwatts}}{°C}$	2	2	2	2	2	2	2	2	2
**Thermal Time Constant (τ):(sec.)	8	8	8	8	8	8	8	8	8
Time Constant with Stirred Oil (sec.)	1	1	1	1	1	1	1	1	1
Maximum Operating Temperature: (°C)	400	400	400	400	400	400	400	400	400
(°F)	752	752	752	752	752	752	752	752	752

OUTLINE DRAWING



*The ratio in a 25°C still air ambient, of the power input to raise the Thermistor temperature to 125°C and its temperature rise (125°C-25°C) above ambient.

**Time required for a Thermistor to change 63.2% of the temperature difference between its initial and final body temperature when subjected to a step function change in temperature under zero-power conditions.

Temperature °C	Temperature °F	Resistance Ratio Characteristics R_T/R_{25} MULTIPLIER 1H-	2H-	4H-
-55	-67	95	54	131
-40	-40	34	21.7	45.5
-21.5	-6.7	10.5	8.0	13.2
0	32	3.3	2.82	3.71
25	77	1.00	1.00	1.00
37.8	100	.58	.62	.543
50	122	.36	.41	.32
75	167	.148	.182	.114
104.4	220	.0595	.082	.0399
125	257	.0335	.505	.0205
150	302	.0180	.0300	.0101
200	392	.00670	.0116	.00285
250	482	.00280	.00555	.00110
300	572	.00140	.00291	.000454
350	662	.000800	.00178	.000113
400	752	.000450	.00104	.000113

To find the resistance of a particular H-Series Thermistor at any temperature in this table, multiply its 25°C resistance by the multiplier for that temperature.

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MIDWEST COMPONENTS INC.
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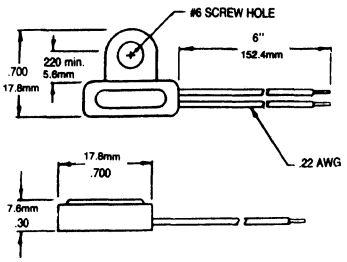
Muskegon, MI 49443/(616) 777-2602/TWX 510-394-4130

NTC THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

TAB MOUNTED PROTECTORS

Midwest Components' Over Temperature Protectors provide shutoff or regulation of expensive Power Transistors and protect against over-heating that occurs from component failure or short conditions. The sensor is an NTC (Negative Temperature Coefficient) device. Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect. Available in resistance packages from 10K to 100K in tolerances of ± 10% to .8%.



TOL: K-10% J-5% G-2% M-.8%

KEY TO ORDERING:

NTP (Style) XXX (Resistance 25°) X (Tol)

EXAMPLE: TMP 103K 10K Ω 25°C 10° Tol

Temperature °C	Temperature °F	Resistance Ratio Characteristics R_T/R_{25} Multiplier
-55	-67	95
-40	-40	34
-21.5	-6.7	10.5
0	32	3.3
25	77	1.00
37.8	100	.58
50	122	.36
75	167	.148
104.4	220	.0595
125	257	.0335
150	302	.0180

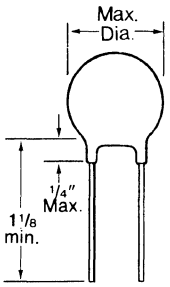
TYPICAL CHARACTERISTICS

Specifications	Test Condition				
Resistance @ 25°C (OHMS)	Zero Power	± 10%	± 5%	± 2%	± .8%
Resistance Ratio $R_{25°C}/R_{25°C}$		29.85	29.85	29.85	29.85
Maximum Withstand Temperature: °C		-55 to 150	-55 to 150	-55 to 150	-55 to 150
Operating Temperature Range: °C		-55 to 150	-55 to 150	-55 to 150	-55 to 150
Interchangeability: °C	0-100°C	6°C	3°C	1°C	.2°C
Stability (Change in Resistance)	1000 hrs. at 100°C	< .17°	< .1%	< .1%	< .1%
Resistance Range		10K-100K	10K-100K	10K-100K	10K-100K

SUPPRESSORS

INRUSH CURRENT SUPPRESSORS FOR SWITCHING POWER SUPPLIES.

Switching power supplies present high initial currents due to filter capacitor impedance upon turn-on. The use of Midwest's NTC (Negative Temperature Coefficient) devices limits this current to a low value. After current flow their resistance becomes negligible and offers little voltage drop.



OUTLINE DRAWING

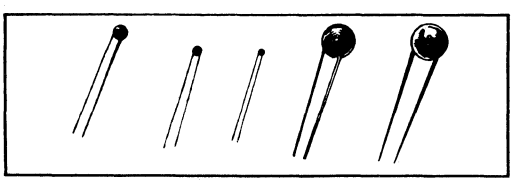
Characteristics

Part Number	R at 25° C ±25%	Imax at 25° C	Pnom at Imax	Max. Dia	Wire AWG
D204EL	10 Ω	2 AMP	.3 Ω	.27	24
E204EL	10 Ω	2.5 AMP	.22 Ω	.27	24
D302EL	30 Ω	1.5 AMP	.8 Ω	.37	24
E302EL	30 Ω	2 AMP	.6 Ω	.37	24
D304EL	10 Ω	2 AMP	.35 Ω	.37	24
E304EL	10 Ω	3 AMP	.18 Ω	.37	24
D404EL	25 Ω	2 AMP	.5 Ω	.48	20
E404EL	25 Ω	3 AMP	.3 Ω	.48	20
D402EL	10 Ω	4 AMP	.18 Ω	.48	20
D403EL	2.5 Ω	5 AMP	.08 Ω	.48	20
E403EL	2.5 Ω	7 AMP	.05 Ω	.48	20
D502EL	10 Ω	4 AMP	.2 Ω	.58	20
D504EL	5 Ω	4 AMP	.17 Ω	.58	20
E504EL	5 Ω	7 AMP	.1 Ω	.58	20
D505EL	2.5 Ω	3 AMP	.06 Ω	.58	20
E505EL	2.5 Ω	9 AMP	.04 Ω	.58	20
D752EL	25 Ω	4 AMP	28 Ω	.85	18
D755EL	2.5 Ω	6 AMP	.09 Ω	.85	18
E775EL	2.5 Ω	10 AMP	.06 Ω	.85	18
D904EL	1 Ω	10 AMP	.03 Ω	1.1	18
E904EL	1 Ω	15 AMP	.018 Ω	1.1	18

Marking — all parts marked MCI and Part Number

DISC THERMISTORS

Disc Series Thermistors are small rugged Thermistors with close electrical tolerances. Their small mass gives short thermal time constants, yet they are not so small that it is difficult to handle them. The tinned copper leads are easily soldered into electrical circuits.



• TEMPERATURE COMPENSATION AND SENSING

Type	Ohms @ 25°C	Res. Ratio 25°C/125°C	Diss. Const. MW/°C	Time Const.	Dia. In.
4D101	100K	48.78	4	12	.1
4D103	50K	48.78	4	8	.1
1D051	20K	29.85	2	4.5	.05
1D101	10K	29.85	4	12	.1
1D103	5K	29.85	4	8	.1
1D201	3K	29.85	8	34	.2
1D501	1K	29.85	19	140	.5
2D054	1K	19.80	2	3	.05
2D102	1K	19.80	4	10	.1
2D104	500	19.80	4	6	.1
2D202	300	19.80	8	24	.2
3D504	5	12.95	15.5	70	.5
4D051	200K	48.78	2	4.5	.05

BEAD PROBES

Glass coated bead Thermistors feature SMALL SIZE; FAST RESPONSE, and improved HIGH-TEMPERATURE STABILITY. Leads are fired-in platinum-iridium. Bead probes, incorporating the bead in the tip of a glass probe, offer the additional advantages of more rugged construction in an easy to mount package which can be used in liquid media. Tinned Dumet leads are supplied on probes. The maximum operating temperature for beads and bead probes is 400°C.

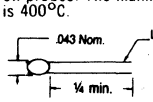


FIGURE 1

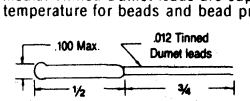


FIGURE 2
Bead probes also available in 2" lengths

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TUFF-SENSORS™

TEMPERATURE SENSORS INCAPSULATED IN THERMOPLASTIC
MANUFACTURED BY MIDWEST COMPONENTS, INC.

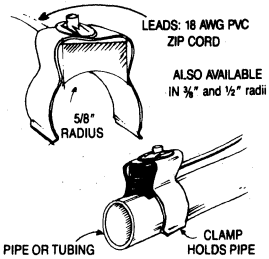
TUFF-SENSORS™, a family of thermoplastic molded probes, provide reliable protection against environmental extremes for our line of temperature sensors and switches. Use of high performance plastics creates a temperature probe that resists temperature variations, humidity, chemicals and rough handling.
Many standard sizes and shapes are available, with selection of type based on conditions of use.
Custom designs available to your specifications.

PLASTICS AND THEIR PROPERTIES

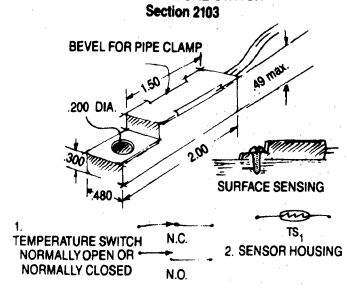
PROPERTIES	UNIT TERMS	ASTM TEST STD	VALOX* 310SEO(GE)	NORYL* N225(GE)	RYTON† R10(PHILLIPS)	POLYPROPYLENE SHELL 5620
1 DIELECTRIC	V/MIL	D149	560	630	324	600
2 MELT TEMP	°F	———	437	520	540	334
3 MOISTURE ABSORPTION @73°F	%/24H	D570	08	07	04	.03
4 TENSILE STRENGTH	———	D638	8500	8000	12000	4800
5 COMPRESSIVE STRENGTH	PSI	D695	14500	8000	17500	———
6 FLEXURAL STRENGTH	PSI	D790	14700	1100	18000	1450
7 SHEAR STRENGTH	PSI	D732	7700	8500	11200	60
8 IMPACT RESISTANCE	FT#/IN	D256	07	6.0	80	90
9 HARDNESS (ROCKWELL)	R	D785	120	116	———	84
10 THERMAL CONDUCTIVITY	BTU IN/HR FT °F	———	1.2	1.35	4.3	H.B
11 FLAMMABILITY U.L. RATING	UL94V	———	VO	VO	VO	———
12 ACCEPTABILITY FOR FOOD CONTACT	———	———	YES	———	———	YES

*Registered trademarks of the General Electric Co. †Registered trademark of the Phillips Chemical Co.

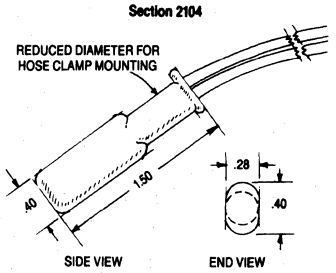
PRECISION SENSOR
Section 2114



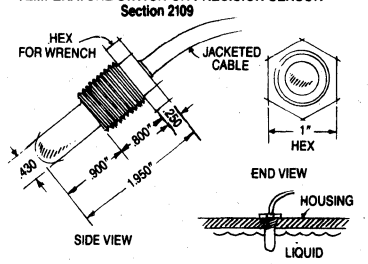
TEMPERATURE SWITCH
Section 2103



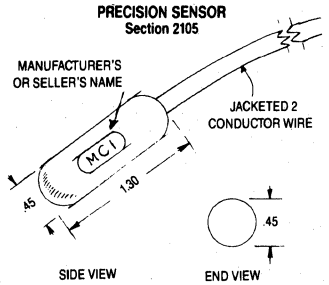
PRECISION SENSOR
Section 2104



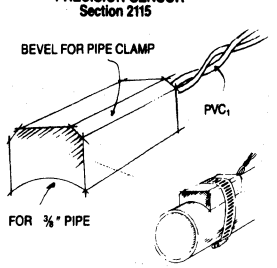
TEMPERATURE SWITCH OR PRECISION SENSOR
Section 2109



PRECISION SENSOR
Section 2105



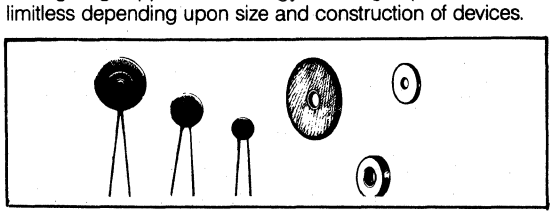
PRECISION SENSOR
Section 2115



VARISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

Varistor manufactured by MIDWEST COMPONENTES INC. offer inexpensive answers to problems of transient, surge, and lighting suppression. Energy handling capabilities are limitless depending upon size and construction of devices.



SMALL TYPE DISCS DESIGNED FOR PROTECTION OF CONTACTORS, RELAYS, AND SOLID STATE COMPONENTS

3" (76.2) AND 6" (152.4) DIAMETER DISCS FOR MEDIUM POWER APPLICATIONS ALLOW FOR CUSTOM ASSEMBLIES FOR POWER SUPPLY COMPONENTS

Catalog Number	Maximum Values: Continuous Operating Voltage (Volts) (DC)	(AC)	Continuous Power Rating (Watts)	Discharge Capacity (Watt-Seconds)	Peak Discharge - Voltage for Given DC Discharge Current (Amps)	(Volts)	Specifications: DC Test Voltage & Current (Volts ±20)%	(Amps)
.5" (12.7) DIA.								
70D5010	150	135	.25	30	.10	400	175	.001
68D5010	60	54	.25	30	.10	200	75	.0025
57D5010	30	27	.25	30	.25	100	35	.005
65D5010	15	13.5	.25	20	.25	60	15	.010
.75" (19.05) DIA.								
71D7000	150	135	.75	50	.125	400	175	.005
68D7000	60	54	.75	50	.25	185	70	.0125
66D7000	30	27	.75	50	.25	185	70	.0125
63D7000	15	13.5	.75	50	.50	100	35	.025
1.0" (25.4) DIA.								
71D10000	300	270	1.5	275	.25	1000	350	.005
68D10000	150	135	1.5	275	.50	575	175	.010
66D10000	60	54	1.5	275	1.0	305	70	.025
63D10000	30	27	1.5	275	1.5	175	35	.050

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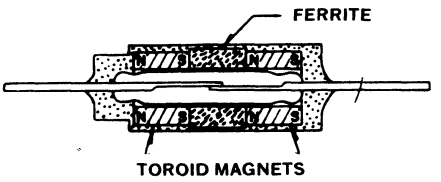
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

TEMPERATURE SENSING SWITCHES

MANUFACTURED BY MIDWEST COMPONENTS, INC.

CONVENIENT AND RELIABLE TEMPERATURE CONTROL

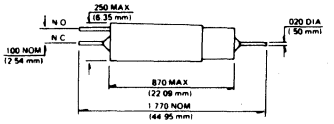
Miniature temperature switches use an electro-ceramic element instead of a bimetallic switch. The Reed Switch Temperature Sensor works on these two principles: a reed switch actuation occurs because of changes in strength of a magnetic field in the vicinity of the contact gap; and certain materials exhibit great changes in magnetic reluctance when the temperature is varied in the vicinity of the material's curie temperature.



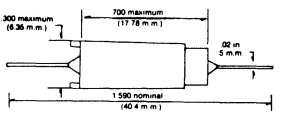
The unit has good response time, and is operable in a variety of atmospheres and solutions. Variations in configurations suitable for installation in automotive engine crankcases and automatic transmissions, or mountings for use in computer cabinets are possible. Other applications include oven over-heat alarms, corrosive liquid temperature control, food freezer thaw warning and cooling fan stop indication. This switch replaces many thermally actuated devices now used where increased life is required or protection of the switching contacts from adverse environments is deemed desirable.

MOLDED SWITCHES

Switches feature small size for fast response. epoxy package resists most chemicals and is good for use up to 115°C. Standard units from 0° to 115°C are available in five degree nominal increments.



SPDT Form C



SPST Form B (NC)
SPST Form A (NO)

SPECIFICATIONS

	ST Form B (NC) SPST Form A (NO)	SPDT Form C
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V.A. maximum	Watts – 10W maximum Volt Amps – 12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum	Carry – 1 amp maximum Break – 1 amp maximum Make – .500 amp maximum
OPEN TEMPERATURE – NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum

KEY TO ORDERING:

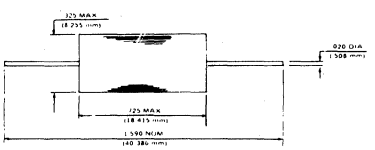
MTS	*XXX*	*A or B*
Temp. Switch	Temp. in °C	Form

EXAMPLE: MTS 50B

FREEZE SENSORS

The Solar Freeze Sensor, Catalog Number TS-5B1, was developed to provide controller activation before freezing conditions damage collector. This activation will then provide recirculation or drain down to protect system. To meet the needs of high temperature exposure, the switch is packaged to withstand 400°C. Switch has also found application as road surface freeze indicator, refrigerated van warning sensor and is widely used as a frost sensor in the agricultural industry.

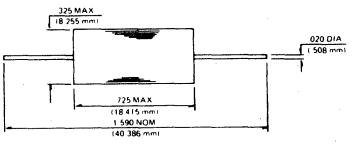
CONTACT ARRANGEMENT	SPST Form B (Normally Closed)
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V A maximum
VOLTAGE	Volts D C – 100 VDC maximum Volts A C – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – 5 amp maximum
ACTIVATION (TEMPERATURE FALL)	1-7°C
RESET (TEMPERATURE RISE)	10°C maximum
OVERALL LENGTH	1 590" nominal
DIAMETER	.325" maximum
WEIGHT	1 6 grams



HIGH TEMP. SWITCHES

In addition to the three standard temperature switches, we now offer a high temperature Form B version. This new high temperature version is available from 0°C to 250°C. Typical applications include sensing temperature increases in temperature chambers, instrumentation, liquids, semi-solids or solids.

CONTACT ARRANGEMENT	SPST Form B (Normally Closed)
CONTACT RATING	Watts – 10W maximum Volt Amps – 12 V A maximum
VOLTAGE	Volts D C – 100 VDC maximum Volts A C – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – 5 amp maximum
TOLERANCE	±10°C
RESET DIFFERENTIAL	10°C maximum
OVERALL LENGTH	1 590" nominal
DIAMETER	.325" maximum
WEIGHT	1 6 grams



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BI-METAL TEMPERATURE SWITCHES

MANUFACTURED BY MIDWEST COMPONENTS, INC.

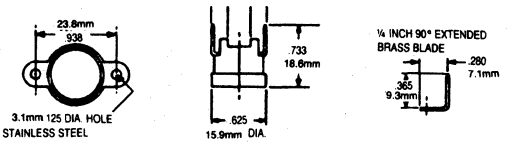
SNAP-ACTION BI-METAL SWITCHES

The electrical switch of the SAS is operated by a thermally-responsive ½inch diameter bimetal disc. The switch is used as a temperature limiting or regulating thermostat. Because of its relatively small size and inexpensive design, it is suitable for a vast array of applications.

Features

Impact Action: The bimetal disc of the SAS is factory calibrated at both its top and bottom temperatures. When the disc, which is dished like a saucer, reaches its calibrated temperature it suddenly snaps through and imparts its kinetic energy to the bumper, then to the contacts. The resulting high speed of contact separation insures long life at high electrical loads, and a minimum of radio and TV interference.

SURFACE MOUNTING BRACKET



SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form A (NO) or Form B (NC)
CONTACT RATING—AC	Watts—2400 maximum AC Volt Amps—125 V.A. maximum AC
CONTACT RATING—DC	Volts Amps—30 V.A. maximum DC
VOLTAGE	Volts D.C.—120 VDC maximum Volts A.C.—240 VAC maximum
CURRENT—RESISTIVE LOAD	Carry—10 amp maximum AC Carry—25 amp maximum DC
OPEN TEMPERATURE—NOMINAL	5° increments starting at 0°C
TOLERANCE	±5°C
RESET DIFFERENTIAL	25° maximum

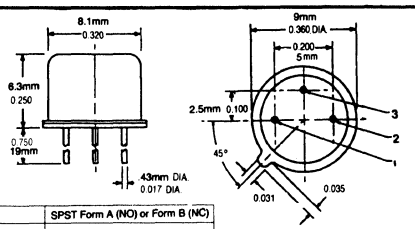
KEY TO ORDERING:
SAS XXX A
Temp Switch | Temp in °C | Form
EXAMPLE: SAS 50A

SNAP-ACTION HERMETIC SWITCHES

Midwest Components, Inc. introduces the SAH series control which offers the advantages of bimetal disc technology in a miniature mounting package. Developed for application to printed circuit boards, it is housed in a standard TO-5 package and is designed to switch logic level circuits.

The operating temperature of the SAH can be specified between 30°C and 120°C. The gold alloy crosspoint switch contacts are operated by a snap acting bimetal disc. This assures high speed contact separation, as well as calibration stability throughout its rated life of 10,000 cycles.

The SAH design includes a hermetically sealed case for wave soldering and cleaning operations, as well as application in harsh environments. The SAH is designed for reliable operation with loads as low as 1mA at 10mV DC, or up to 1A at 35V DC.



SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form A (NO) or Form B (NC)
CONTACT RATING	Volt Amps—35 V.A. maximum
VOLTAGE	Volts D.C.—35 VDC maximum Volts A.C.—35 VAC maximum
CURRENT—RESISTIVE LEAD	Carry—1 amp maximum Break—1 amp maximum Make—1 amp maximum
OPEN TEMPERATURE—NOMINAL	10° increments starting at 30°C
TOLERANCE	±5°C
RESET DIFFERENTIAL	20°C maximum
HEIGHT ABOVE PC BOARD	.25 nominal
LEAD LENGTH	.750 nominal
DIAMETER	.32 nominal

PIN	FUNCTION
1-2	Switch Contacts
3	Connected to Metal Case

KEY TO ORDERING:
SAH XXX B
Temp Switch | Temp in °C | Form
EXAMPLE: SAH 50B

TEMPERATURE SWITCH PROBES

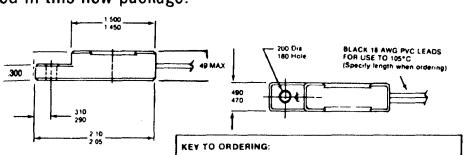
MANUFACTURED BY MIDWEST COMPONENTS, INC.

REED SWITCHES—PMS SERIES

Midwest Components, Inc. has now packaged the reliable temperature sensing reed switch in a convenient and easy to use housing. The molded plastic body offers the additional advantages of complete moisture and dust protection at an economical price.

This rugged switch can be quickly mounted with a screwdriver. An indentation on the housing also facilitates attachment by ordinary hose clamps or clip hardware supplied by the user. Type A (normally open) or Type B (normally closed) switches may be used in this new package.

CONTACT ARRANGEMENT	SPST Form B (NC)	SPST Form A (NO)
CONTACT RATING	Watts — 10W maximum Volt Amps. — 12 V.A. maximum	Watts — 10W maximum Volt Amps — 12 V.A. maximum
VOLTAGE	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum	Volts D.C. — 100 VDC maximum Volts A.C. — 120 VAC maximum
CURRENT	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp maximum	Carry — 1 amp maximum Break — 1 amp maximum Make — .5 amp. maximum
SWITCH TEMPERATURE — NOMINAL	5° increments starting at 0°C	5° increments starting at 0°C
TOLERANCE	±5°C	±5°C
RESET DIFFERENTIAL	10°C maximum	10°C maximum



KEY TO ORDERING:
PMS XXX A or B XX
Temp Switch | Temp in °C | Form | Lead Length in Inches

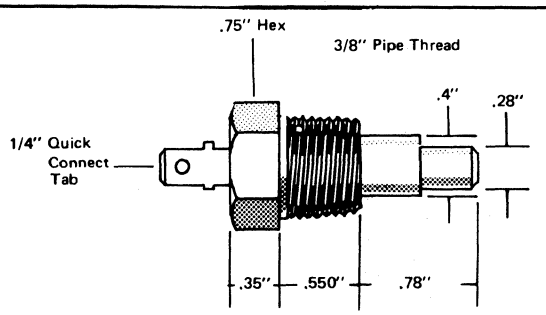
BRASS PROBES

Now Available . . .

The ultra reliable temperature sensing reed switch in a convenient probe assembly. Probe is designed for liquid temperature sensing on auto, truck, compressor, or equipment cooling systems. Rugged brass body is hermetically sealed against harsh environments. Switching temperatures are available from - 10°C to 150°C. 3 million operations are possible at full rated load.

SPECIFICATIONS

CONTACT ARRANGEMENT	SPST Form B (Normally Closed) *
CONTACT RATING	Watts – 10W maximum Volt Amps–12 V.A. maximum
VOLTAGE	Volts D.C. – 100 VDC maximum Volts A.C. – 120 VAC maximum
CURRENT	Carry – 1 amp maximum Break – 1 amp maximum Make – .5 amp maximum
TOLERANCE	±10°C
RESET DIFFERENTIAL	10°C maximum



PHYSICAL DIMENSIONS

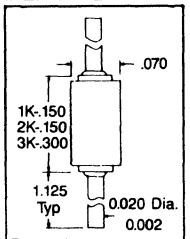
MIDWEST COMPONENTS INC.
P.O. Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

TEMPSISTOR

TEMPSISTOR® TEMPERATURE COMPENSATOR®

MANUFACTURED BY MIDWEST COMPONENTS, INC.

LEADED

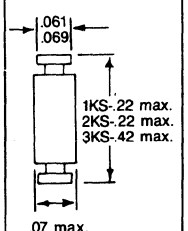


The Tempsistor® manufactured by MIDWEST COMPONENTS INC. is a temperature compensator designed to offset the temperature drift of metallic and semi-conductors. Applications include pressure transducers, opto amplifiers, inductive motor controllers, and automatic gain controls. Small size can replace ⅛ watt or resistors.

The Tempsistor® is available in resistances from 10 to 12K ohms at 25°C.

Both devices are available on tape and reel for automated assembly.

SMS™ - SURFACE MOUNT SENSOR



TEMPSISTOR® SPECIFICATIONS

Resistance Ratio Temperature Characteristics

Temp.		R / R Multiplier			
		RESISTANCE VALUE (Ohms)			
°C	°F	10-56 Ω	68-820 Ω	1-2.7K Ω	3.3-39K Ω
-25	-13	.73	.65	.65	.61
0	32	.86	.82	.81	.83
25	77	1.00	1.00	1.00	1.00
50	122	1.15	1.21	1.19	1.19
75	167	1.32	1.44	1.39	1.37
100	212	1.49	1.68	1.58	1.52
125	257	1.68	1.94	1.75	
150	302	1.89	2.21		

DISSIPATION CONSTANT -
Style 1K and 2K = 2.5 MW/°C
Style 3K = 5 MW/°C

TIME CONSTANT -
Style 1K and 2K = 8 sec. in still air, 1 sec in rapidly stirred oil.
Style 3K = 19 sec. in still air, 2.2 sec. in rapidly stirred oil.

STANDARD ZERO-POWER RESISTANCE VALUES (Ohms) at 25°C AMBIENT TEMPERATURE

10	11	12	13	15	16	18	20	22	24	27	30
100	110	120	130	150	160	180	200	220	240	270	300
1000	1100	1200	1300	1500	1600	1800	2000	2200	2400	2700	3000
10000	11000	12000									
33	36	39	43	47	51	56	62	68	75	82	91
330	360	390	430	470	510	560	620	680	750	820	910
3300	3600	3900	4300	4700	5100	5600	6200	6800	7500	8200	9100

PART NUMBER DESIGNATION:
XXX—XXX—X

LEADED DEVICE

SPECIFY ONE OF THREE CHOICES FOR FIRST 2 DIGITS
1K — Resistance range 10-820 Operate Temp. 150°C
2K — Resistance range 1K-3.0 K Operate Temp. 125°C
3K — Resistance range 3.3K-12K Operate Temp. 100°C

SMS™ - SURFACE MOUNT SENSOR

SPECIFY ONE OF THREE CHOICES FOR FIRST 3 DIGITS
1KS — Resistance range 10-820 Operate Temp. 150°C
2KS — Resistance range 1K-3.0K Operate Temp. 125°C
3KS — Resistance range 3.3K-12K Operate Temp. 100°C

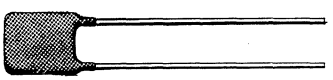
NEXT 3 DIGITS DENOTE RESISTANCE VALUE AT 25°C.
1st digit denotes 1st significant figure
2nd digit denotes 2nd significant figure
3rd digit denotes multiplier by the power of 10

LAST DIGIT OF PART NUMBER DENOTES TOLERANCE AT 25°C.
L — ±20% K — ±10% (standard) J — ±5%

EXAMPLE OF PART NUMBER SPECIFICATION (FOR LEADED DEVICE)
2K — 272 — K
Part would be a .150" long body, 2.7 K ±10% @25°C.

POLY FUSE

MANUFACTURED BY MIDWEST COMPONENTS, INC.



The polymer is designed for automotive and marine motor protection. It protects against over-current conditions by switching from a low resistance (typically less than 200mΩ) to a high resistance (greater than 5KΩ when its rated current is exceeded. (Fig. 1) When power is removed it will automatically return to its low resistance state.

PART NUMBER	R NOM AT 25°C	HOLD CURRENT	TRIP CURRENT	H NOM	W NOM	T NOM	A NOM	B	AWG
PCL0150.00	1.40Ω	150mA	300mA	.15	.13	.08	.09	.03	26
PCL0250.00	.75Ω	250mA	500mA	.22	.18	.08	.09	.03	26
PCL0375.00	.60Ω	375mA	750mA	.23	.18	.09	.13	.03	24
PCL0500.00	.30Ω	500mA	1.00A	.28	.23	.09	.13	.03	24
PCL0750.00	.15Ω	750mA	1.50A	.28	.23	.09	.13	.03	24
PCL1000.00	.11Ω	1.00A	2.00A	.28	.27	.10	.13	.04	22
PCL1250.00	.08Ω	1.25A	2.50A	.35	.28	.10	.13	.04	22
PCL1500.00	.065Ω	1.50A	3.00A	.37	.33	.10	.13	.04	22
PCL1750.00	.06Ω	1.75A	3.50A	.43	.33	.11	.13	.045	20
PCL2000.00	.05Ω	2.00A	4.00A	.43	.38	.11	.13	.045	20
PCL2250.00	.04Ω	2.25A	4.50A	.43	.43	.11	.25	.045	20
PCL2500.00	.035Ω	2.50A	5.00A	.49	.43	.11	.25	.045	20
PCL2750.00	.030Ω	2.75A	5.50A	.56	.43	.11	.25	.045	20
PCL3000.00	.028Ω	3.00A	6.00A	.63	.40	.11	.25	.045	20
PCL3500.00	.022Ω	3.50A	7.00A	.66	.50	.11	.25	.045	20
PCL4000.00	.015Ω	4.00A	8.00A	.71	.63	.11	.25	.045	20

Maximum Voltage — 40 VDC continuous.

Functional Advantages

Solid State. No moving parts. Switching is accomplished internally in response to a temperature rise that exceeds the built-in switching temperature.

Stable Resistance. The resistance will remain within specified design values even after hundreds of switching cycles.

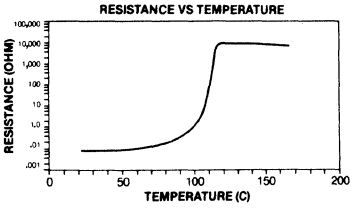
Self-Restoring. When power is removed, it will automatically return to its low resistance state. Will not cause a false reset like bi-metal breakers.

Fool Proof. The PolyFuse is normally mounted on the printed circuit board and cannot be readily replaced with a higher rating or circumvented like cartridge type fuses.

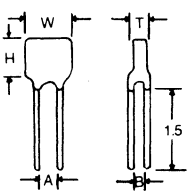
Typical Applications

- Power Windows
- Windshield Wipers & Washers
- Power Antennas
- Cassette Drives
- Power Seats
- Power Door Locks

(Fig. 1)
RESISTANCE VS TEMPERATURE



OUTLINE DRAWING



MIDWEST COMPONENTS INC.
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Muskegon, MI 49443/(616) 777-2602/TWX: 510-394-4130

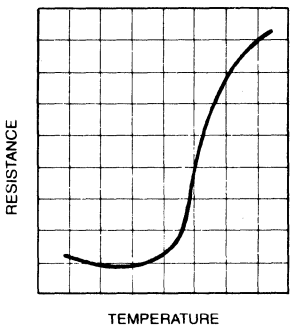
PTC SWITCHING THERMISTORS

MANUFACTURED BY MIDWEST COMPONENTS, INC.

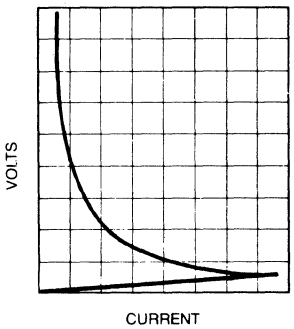
THE POSITIVE WAY TO SENSE, MEASURE, CONTROL, REGULATE AND PROTECT.

MIDWEST COMPONENTS INC. **PTC switching thermistors** are thermally sensitive resistors which exhibit large positive increases in resistance with temperature. At customer specified temperatures the resistance rises abruptly from a low value to a high value. This resistance shift is infinitely repeatable and has no hysteresis associated with its action.

TYPICAL PTC RESISTANCE VS. TEMPERATURE CURVE



TYPICAL VOLTAGE CURVE VS. CURRENT



• DISCRETE PTCS

Popular styles for current limiting or sensing. Most types come standard with protective coatings.

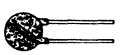


Fig. 1

Fig. 2

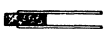


Fig. 3

Fig. 4

Fig. 5

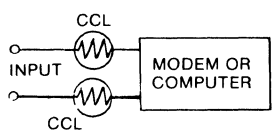
ORDER NUMBER	FIG.	SWITCH TEMPERATURE	BASE RESISTANCE	TEST PARAMETERS	NOMINAL DIMENSIONS	Protective Coating (✓)
100D10112	1	0°C ± 5°C	100 ohms ± 40% @ −35°C	R @ 0°C ± 5°C 500 ohms ± 40%	42" Dia .05" Thk	
108D10001	5	8°C ± 10°C	10 ohms ± 40% @ −35°C	R @ 50°C = 3000 ohms min	65" Dia .05" Thk	
110Q20101	3	10°C ± 5°C	250 ohms ± 40% @ −35°C	R @ 10°C ± 5°C = 1250 ohms ± 40%	30" x .10" x .15"	
130D25000	5	30°C ± 5°C	25 ohms ± 20% @ −5°C	R @ 30°C ± 5°C = 5 x R 25°C ± 20%	78" Dia .08" Thk	
140D25001	1	40°C ± 5°C	25 ohms ± 50% @ 25°C	R @ 50°C = 125 ohms ± 50%	38" Dia .065" Thk	
150Q80112	2	50°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 50°C ± 5°C = 3,750 ohms ± 33%	30" x .10" x .15"	
160D10116	1	60°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 60°C ± 5°C = 5 x R 25°C Protective Current Level = 20 ma	3" Dia .20" Thk	✓
165D15001	5	65°C ± 5°C	15 ohms ± 33% @ 25°C	R @ 65°C ± 5°C = 75 ohms ± 33%	58" Dia .050" Thk	
165Q80113	2	65°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 65°C ± 5°C = 3,750 ohms ± 33%	30" x .10" x .15"	
170D10117	1	70°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 70°C ± 5°C = 5 x R 25°C Protective Current Level = 40 ma	3" Dia .20" Thk	✓
175Q15114	3	75°C ± 5°C	150 ohms ± 30% @ 25°C	R @ 75°C ± 5°C = 750 ohms ± 30%	30" x .10" x .15"	
180D10113	1	80°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 5 x R 25°C Protective Current Level = 60 ma	340" Dia .240" Thk	✓
180D15015	5	80°C ± 5°C	15 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 75 ohms ± 40%	48" Dia .15" Thk	
180Q20206	2	80°C ± 5°C	2000 ohms ± 40% @ 25°C	R @ 80°C ± 5°C = 10,000 ohms ± 40%	45" x .12" x .15"	
180W30115	4	80°C ± 5°C	300 ohms ± 50% @ 25°C	R @ 80°C ± 5°C = 1500 ohms ± 50%	6"O D — 4"I D .17" Thk	
185D10102	1	85°C ± 5°C	100 ohms ± 20% @ 25°C	R @ 85°C ± 5°C = 500 ohms ± 20%	25" Dia .15" Thk	✓
195Q80115	2	95°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 95°C ± 5°C = 3,750 ohms ± 33%	30" x .10" x .15"	
200D40012	1	100°C ± 5°C	40 ohms ± 40% @ 25°C	R @ 100°C ± 5°C = 200 ohms ± 40%	30" Dia .20" Thk	✓
200D65011	1	100°C ± 5°C	65 ohms ± 38% @ 25°C	R @ 100°C ± 5°C = 5 x R 25°C Protective Current Level = 80 ma	4" Dia .275" Thk	✓
220Q32214	2	120°C ± 5°C	3200 ohms ± 25% @ 25°C	R @ 120°C ± 5°C = 16,000 ohms ± 25%	30" x .10" x .15"	✓
222W75101	4	122°C ± 5°C	750 ohms ± 33% @ 25°C	R @ 122°C ± 5°C = 3,750 ohms ± 33%	6"O D — 38"I D .17" Thk	
223D80011	1	123°C ± 5°C	8 ohms ± 40% @ 25°C	R @ 123°C ± 5°C = 40 ohms ± 40%	6" Dia .20" Thk	✓
225D10102	1	125°C ± 5°C	100 ohms ± 40% @ 25°C	R @ 125°C ± 5°C = 5 x R 25°C Protective Current Level = 100 ma	40" Dia .25" Thk	✓
225D28011	1	125°C ± 5°C	28 ohms ± 27% @ 25°C	R @ 125°C ± 5°C = 140 ohms ± 27%	28" Dia .23" Thk	
227D11212	1	127°C ± 5°C	1100 ohms ± 40% @ 25°C	R @ 127°C ± 5°C = 5500 ohms ± 40%	1" Dia .160" Thk	
227D60010	1	127°C ± 5°C	60 ohms ± 40% @ 25°C	R @ 127°C ± 5°C = 5 x R 25°C Protective Current Level = 125 ma	6" Dia .30" Thk	✓

ALL LEADS TINNED COPPER 1" MINIMUM

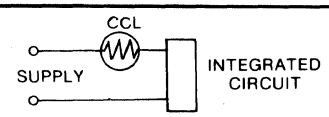
• CURRENT LIMITERS

The ceramic element protects circuits from destructive overcurrent conditions by switching to a high resistance which trims the current back to a safe level. The unit then recovers automatically when the overcurrent condition is corrected.

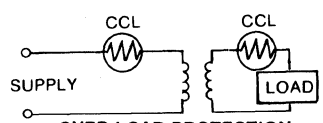
The ceramic current limiter is an inexpensive alternative to fuses and fixed resistors. It has obvious advantages over all of these since it has infinite life, is self resetting which eliminates field servicing and will not "flame out" eliminating the fire hazard of fixed resistors.



DATA COMMUNICATIONS LINE PROTECTOR



OVER-CURRENT PROTECTION



OVER-LOAD PROTECTION

ORDER NUMBER	MAXIMUM Ω @ 25°C	MAXIMUM VOLTS DC	NOMINAL CONTINUOUS CURRENT	RESIDUAL CURRENT @ APPLIED VOLTAGE 50VDC	100VDC	150VDC	NOMINAL DIMENSIONS IN INCHES
CCL020.01	140 Ω	125	20 MA	8 MA	6 MA	N/A	.23 dia. x .1 thk.
CCL060.01	86 Ω	150	60 MA	16 MA	10 MA	8 MA	.4 dia. x .3 thk.
CCL100.01	40 Ω	150	100 MA	19 MA	13 MA	11 MA	.4 dia. x .3 thk.
CCL140.01	80 Ω	150	140 MA	23 MA	15 MA	13 MA	.56 dia. x .25 thk.
CCL150.01	23 Ω	150	150 MA	24 MA	16 MA	14 MA	.65 dia. x .32 thk.
CCL300.01	10 Ω	70	300 MA	31 MA	N/A	N/A	.55 dia. x .14 thk.
CCL450.01	12 Ω	100	450 MA	40 MA	30 MA	N/A	.6 dia. x .07 thk.

MIDWEST COMPONENTS INC.
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P O Box 787/1981 Port City Boulevard
Muskegon, MI 49443/(616) 777-2602/TWX 510-394-4130

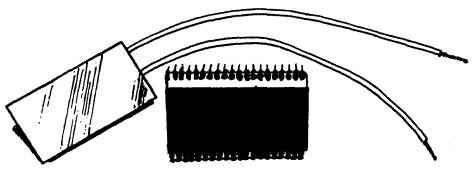
SPECIALTY CERAMICS

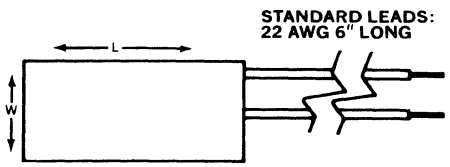
MANUFACTURED BY MIDWEST COMPONENTS, INC.

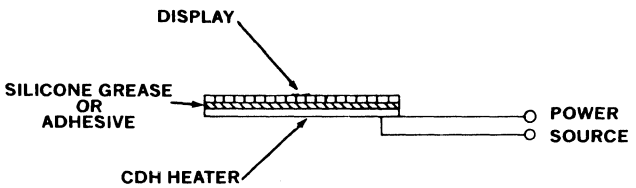
SELF REGULATING DISPLAY HEATER

The unique self-regulating heating effects of specially doped ceramics are utilized to create a new type heater for liquid crystal or other temperature sensitive displays. These devices produce heat at cold temperatures and curtail heating at normal or high temperatures. This feature allows its use in battery operated instruments due to low normal current drain. Use of this heater allows a broader application of displays by removing the adverse effects of temperature.

Heater is attached to reverse side of display with thermally conductive epoxies or silicone adhesives depending upon display's thermal coefficient of expansion or temperature to which it may be subjected. Actual performance of the display will depend upon manufacturers specifications.







ORDER NUMBER	SIZE* L X W	OPERATING VOLTAGE**	NOMINAL RESISTANCES	
			R@ - 35°C	R@ 50°C
CDH001	2.0" x .9"	12-28 AC or DC	5 OHMS	1500 OHMS MIN.
CDH002	3.1" x 1.1"	12-28 AC or DC	3 OHMS	1000 OHMS MIN.
CDH003	3.6" x 1.1"	12-28 AC or DC	2.5 OHMS	750 OHMS MIN.

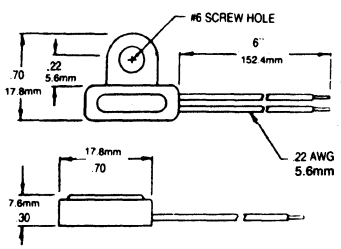
*Other sizes available — consult factory.

POSITIVE OVER TEMPERATURE PROTECTORS

MIDWEST COMPONENTS' Over Temperature Protector provides shutoff or regulation of expensive RF or AF Power Transistors. Protects against over heating that occurs from output stage component failure, antenna breakage, or short conditions.

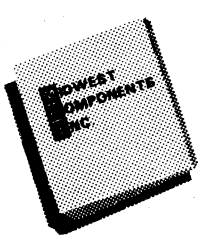
Unlike fuses or bi-metal elements its action is recyclable and has no hysteresis effect.

Also available:
- Other switching temperature or resistances compatible with package constraints.
- Special lead types or end terminations.
- Body styles for protection of TRIAC or SCR Rectifiers.



KEY TO ORDERING:
PTP XXX
Style Switch Temp. in °C

Order Number	Switching Temp. (Nom.)	Resistance at 25°C (Ohms)	Resistance at Switching Temperature	Max. Cont. Oper. Temp.
PTP60	60°C	100 ± 40%	250 OHMS (min.)	150°
PTP70	70°C	100 ± 40%	250 OHMS (min.)	150°
PTP80	80°C	100 ± 40%	250 OHMS (min.)	150°
PTP100	100°C	100 ± 40%	250 OHMS (min.)	150°
PTP120	120°C	100 ± 40%	250 OHMS (min.)	150°
PTP125	125°C	100 ± 40%	250 OHMS (min.)	150°



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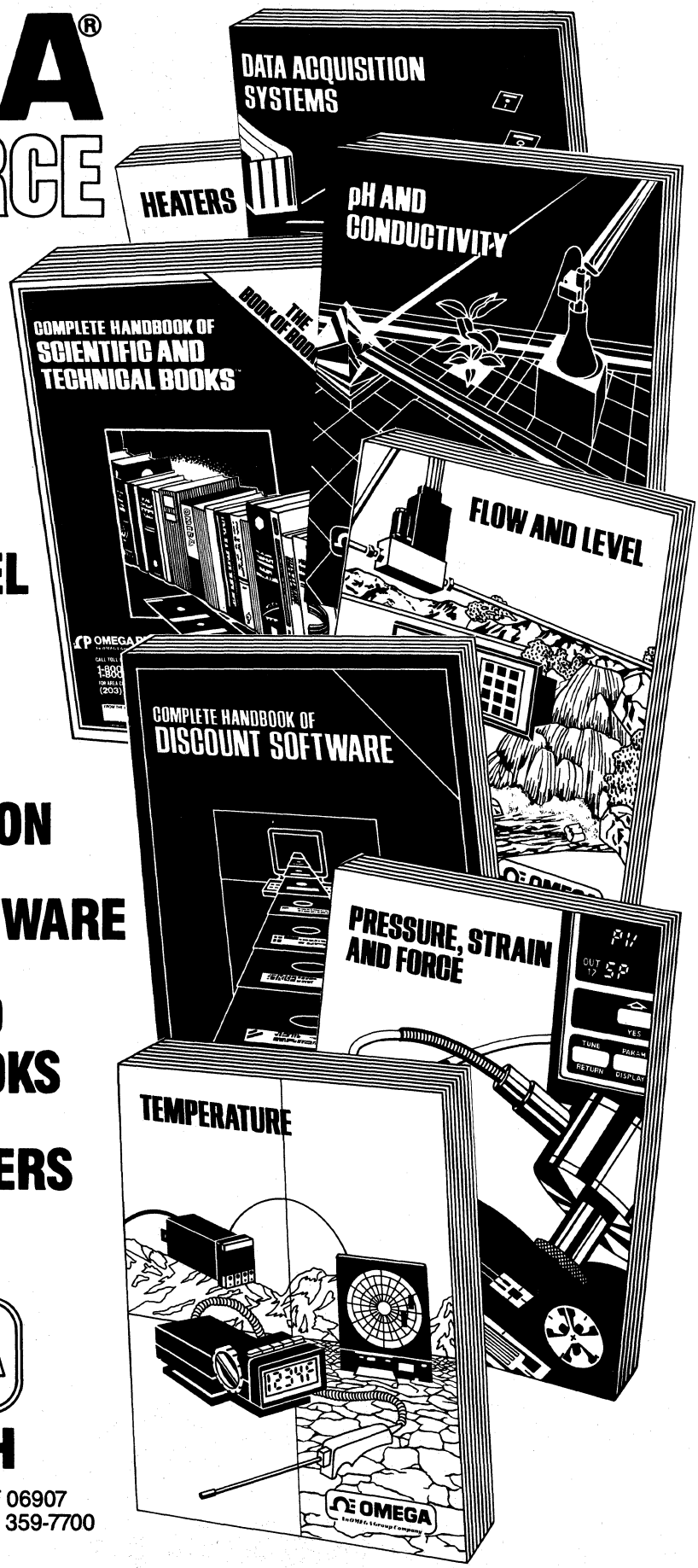

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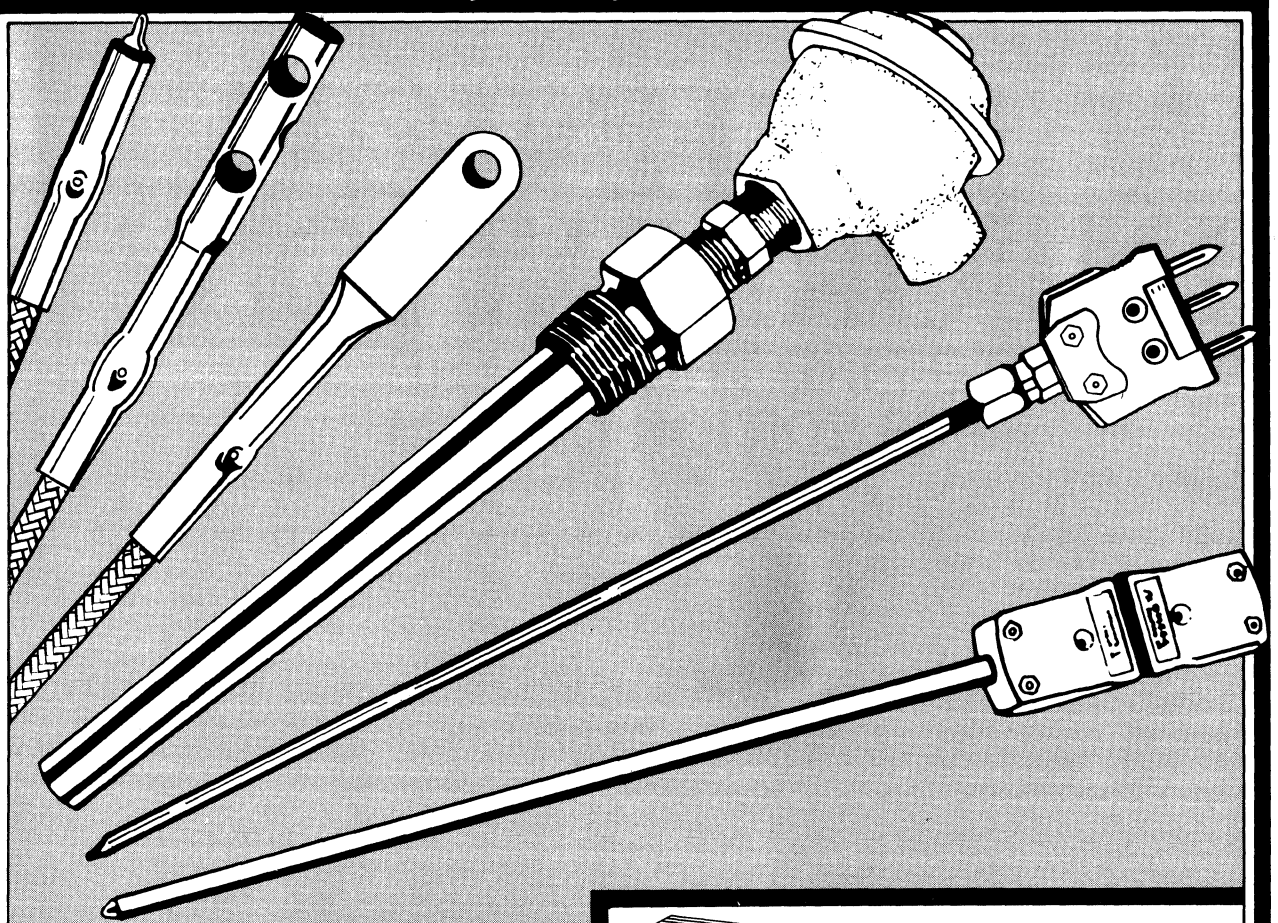
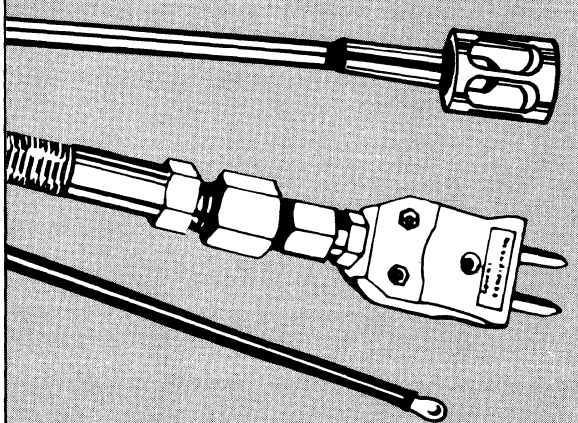
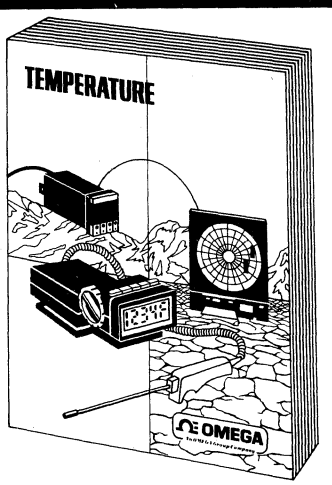
THERMOCOUPLE, RTD, THERMISTOR PROBES







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FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide ..... **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
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Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
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Power Supplies, DC, Product Selection Guide ..... **D**•1497
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Relay Contact Forms ..... **B**•1371
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Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
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Trademark & Logofinder Directories ..... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph ..... **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

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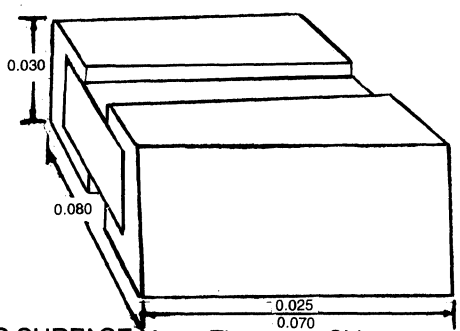


NTC SURFACE Mount Thermistor Chips
FEATURING LEACH-GUARD WRAP AROUND TERMINATIONS–

ENGINEERING INFORMATION
1. Time Constant: 8 seconds max.
2. Dissipation Const: 1mw/deg. C
3. Operating Temp: – 65 to + 125C
4. Termination: Silver/Nickel Barrier Finish

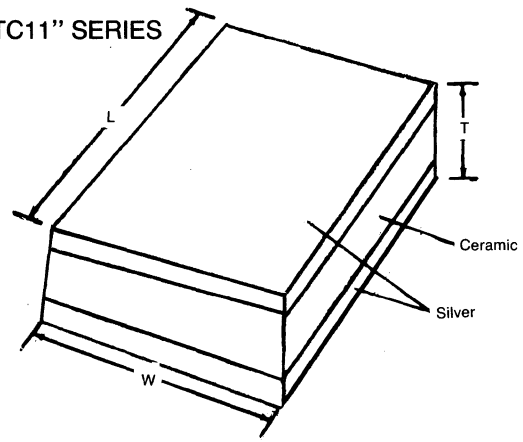
R-T Curve	X	T	Y	S	M	Z	W	V	P
R25 Range (Ohms)	300 to 750	1.0K to 1.5K	5.0K to 10.0K	100.0K to 200.0K	200.0K to 500.0K	50.0K to 100.0K	300.0K to 750.0K	500.0K to 1.0M	3.0M to 10.0M

ORDERING INFORMATION

QTH11 T - 10 2 J

- Prefix
- R-T Curve
- 1st & 2nd Resistance Digit
- # Zeroes following
- Resistance Tolerance

"QTC11" SERIES



NTC WIRE BONDABLE CHIPS

ENGINEERING INFORMATION
1. Time Constant: 8 seconds max.
2. Dissipation Const: 1mw/deg. C
3. Operating Temp: – 65 to + 125C
4. Termination: Silver

R-T Curve	X	T	Y	S	M	Z	W	V	P
R25 Range (Ohms)	20 to 250	100 to 1.0K	300 to 5.0K	10.0K to 50.0K	20.0K to 150.0K	1.0K to 50.0K	100.0K to 500.0K	50.0K to 1.0M	100.0K to 3.5M

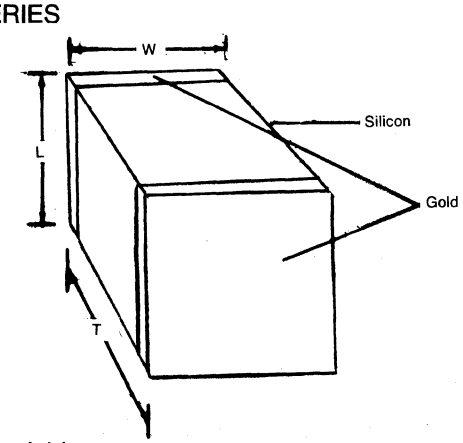
ORDERING INFORMATION

QTC11 Z - 50 3 J

- Prefix
- R-T Curve
- 1st & 2nd Resistance Digit
- # Zeroes following
- Resistance Tolerance

POSITIVE TEMPERATURE COEFFICIENT CHIP THERMISTORS

"QTC11" SERIES



Gold Wire Bondable

ENGINEERING INFORMATION
1. Time Constant: 8 seconds max.
2. Dissipation Const: 1mw/deg. C
3. Positive TCR: 0.7%/deg. C
4. Operating Temp: – 55 to + 125C
5. Termination: Gold

Resistance Range (Ohms)	L +/– 0.010"	W +/– 0.010"	T +/– 0.005"
10–1800	0.032"	0.032"	0.050"
2200-6800	0.038"	0.038"	0.072"
8200-10.0K	0.025"	0.025"	0.072"

ORDERING INFORMATION

QTC11 - 10 2 K

- Prefix
- 1st & 2nd Resistance Digit
- # Zeroes following
- Resistance Tolerance

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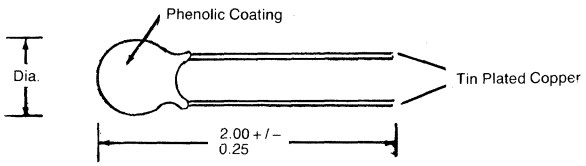
NTC & PTC LEADED THERMISTORS FOR CIRCUIT BOARD AND PROBE ASSEMBLIES

"QTMC" SERIES

Radial Leaded Negative Temperature Coefficient Thermistors
Operating Temperature – 55 to + 125 C



Part # QTMC	R@25C (Ohms)	R-T Curve	NTC@25C %R/deg. C	Body Diam. inches	Leads #AWG
–1	500	Z	–4.4	0.240	28
–7	2.252K	Z	–4.4	0.125	28
–11	5.000K	Z	–4.4	0.125	28
–14	10.00K	Z	–4.4	0.125	28
–19	20.00K	Z	–4.4	0.125	30
–21	100	Y	–3.9	0.220	28
–24	300	Y	–3.9	0.150	28
–28	2.000K	Y	–3.9	0.125	30
–38	50.00K	V	–4.9	0.125	30
–43	100.0K	V	–4.9	0.125	30
–48	100.0K	M	–4.2	0.125	30
–65	1.0Meg	P	–5.3	0.125	28
–70	9.8Meg	R	–6.2	0.125	30
–82	10.00K	S	–4.0	0.125	30

"QTMC" units listed are typical values. Consult factory for full range. Available Tolerances: K = 10% J = 5% G = 2% F = 1% C3 = 0.2 deg. C from 0 to 70 C.

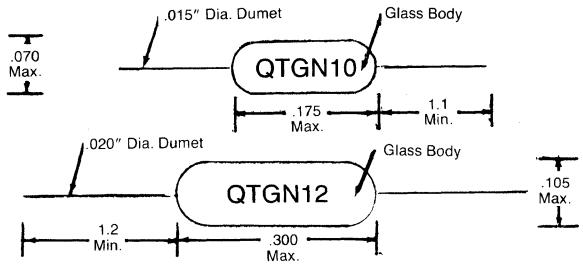
ORDERING INFORMATION

QTMC - 14 C3

Prefix
Value Designator
Tolerance

"QTGN" SERIES

Hermetically Sealed Negative Temperature Coefficient Operating Temperature Range: – 55 to + 125 C



Part Number	R@25C (ohm)	R-T Curve	NTC@25C %R/deg. C	R125 / R@25
QTGN10-1	3000	Y	–3.9	0.05040
QTGN10-2	5000	Y	–3.9	0.05040
QTGN10-3	10000	Y	–3.9	0.05040
QTGN10-4	20000	Z	–4.4	0.03416
QTGN10-5	50000	Z	–4.4	0.03416
QTGN10-7	250000	V	–4.9	0.02170
QTGN10-8	500000	V	–4.9	0.02170
QTGN10-9	1.0Meg	V	–4.9	0.02170
QTGN12-10	5000	Z	–4.4	0.03416
QTGN12-12	10000	Z	–4.4	0.03416
QTGN12-14	50000	Z	–4.4	0.03416

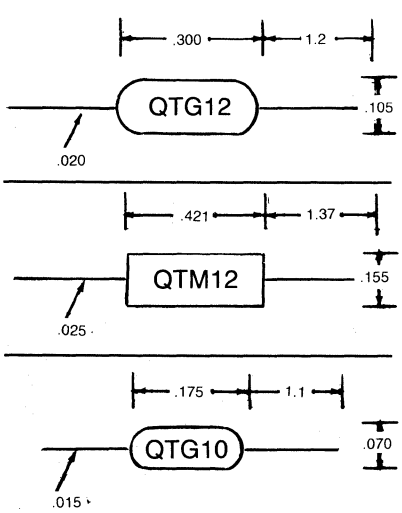
Available Tolerances: K = 10% J = 5%

ORDERING INFORMATION

QTGN10 - 4 J

Prefix
Value Designator
Tolerance

POSITIVE TEMPCO THERMISTORS
0.7% TRC from – 55 to + 125 C



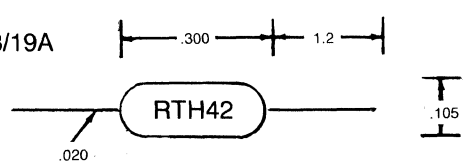
QTG12
Hermetically Glass Sealed Thermistor
Leads: 0.020" Tinned Dumet
Power: 1/8 Watt @ 100 C
Resistance Range: 10 to 10K Ohm

QTM12
Rugged Molded Design Thermistor
Leads: 0.025" Tinned Copper
Power: 1/8 Watt @ 100 C
Resistance Range: 10 to 40K Ohm

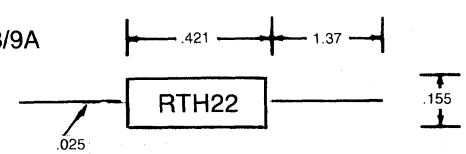
QTG10
Miniature Hermetically Glass Sealed Thermistor
Leads: 0.015" Tinned Dumet
Power: 1/16 Watt @ 100 C
Resistance Range: 10 to 5.0K Ohm

MILITARY GRADE PTC THERMISTORS: MIL-T-23648A

"RTH42"
MIL-T-23648/19A



"RTH22"
MIL-T-23648/9A



ORDERING INFORMATION

RTH42ES 33 2 K

Style
1st & 2nd Resistance Digit
Zeroes following
Resistance Tolerance

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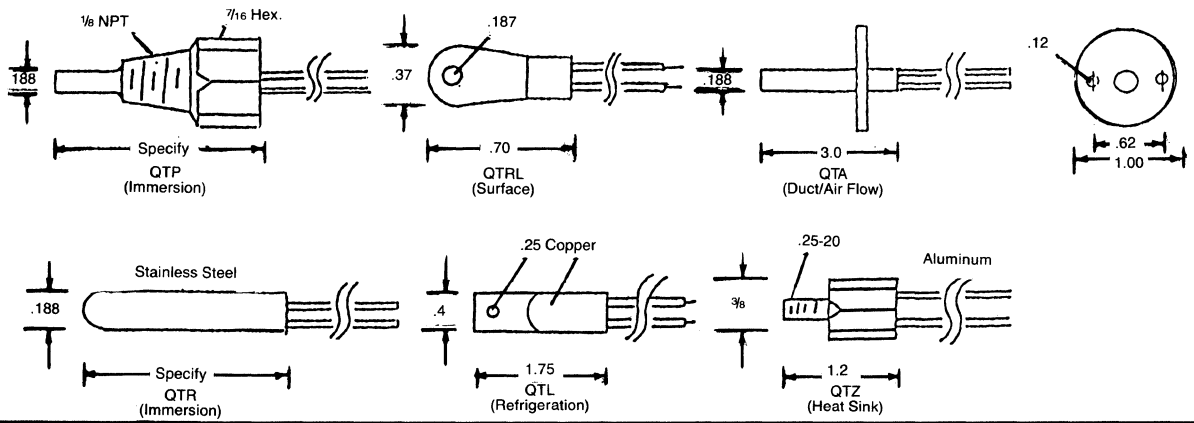
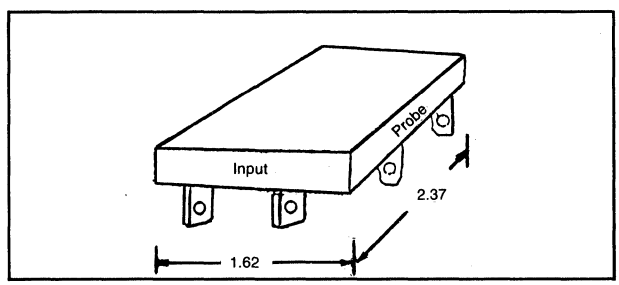
TEMPERATURE SPECIALTY PRODUCTS & SERVICES

THERMISTOR PROBE ASSEMBLIES



THERMISTOR DIRECT CURRENT MUFFIN FAN CONTROLLER "DC-100"

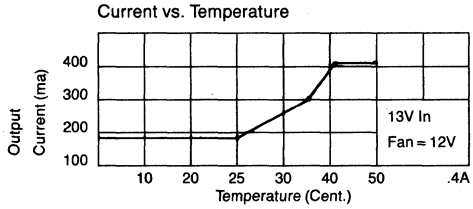
Designed for speed control of D.C. muffin fans, the versatile DC-100 can be used in any application where a biased output voltage is required as a function of temperature.



SPECIFICATIONS
Electrical Characteristics at 25C.

Parameter	Min.	Max.
Input Voltage	—	18V
Output Voltage	—	17V
Output Current	—	2A
Output Power	—	10W
Operating Temp.	0C	70C

Current vs. Temperature



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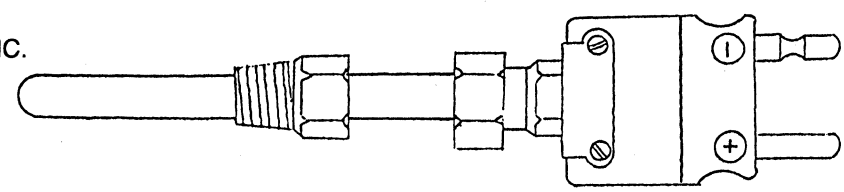

Elements: All Industry Standard ANSI Calibrations Available

Type	Max. Temp.	Error	Wire Gauges (AWG)
J	1400 F	+/– 4 F	#16 to #30
K	2300 F	+/– 4 F	#16 to #30
T	700 F	+/– 4 F	#16 to #30
E	1600 F	+/– 3 F	#16 to #30
R	3000 F	+/– 5 F	#16 to #30
S	3000 F	+/– 5 F	#16 to #30

COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

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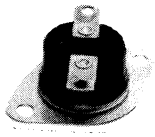
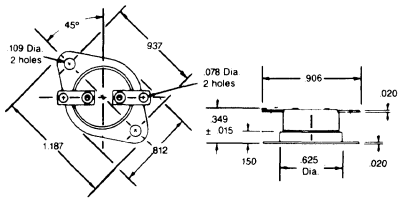
STOCK ½" DISC THERMOSTATS

SC/SO



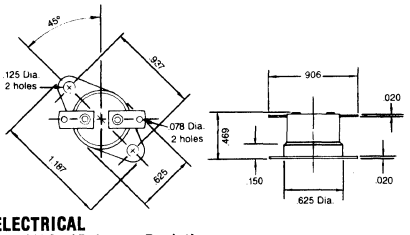
These compact thermostats are the industry standard. As with all of our snap-action thermostats, a C in the part number means the circuit will close when the temperature rises and an O in the part number means the circuit will open when the temperature rises. Snap-action means reliability. A high-force bimetallic disc inside these thermostats keeps the circuit the way you want it. The thermostats respond instantly to temperature change—not shock, vibration or anything else.



ELECTRICAL
120 VAC, 8 Amps, Resistive
100,000 Cycles
1/16" clearance through air and over surface
TEMPERATURE RANGE
60 Degrees F. to 325 Degrees F.
APPROVALS
UL File no. E36103, Guide XAPX2
CSA File No. 21048, Guide 400-E-0

SC-A/SO-A

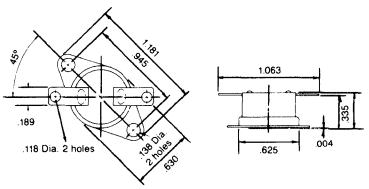
Designed for applications requiring a higher electrical rating, our newest thermostats have the same dimensions as SC and SO thermostats, except they are .12" taller, the mounting holes are .016" larger and the bracket is .187" narrower. The slightly taller thermostat puts more space between the terminals and the base, giving the A model its higher electrical rating and all International Specification Approvals.



ELECTRICAL
120 VAC, 15 Amps, Resistive
240 VAC, 8.3 Amps, Resistive
100,000 Cycles
1/4" clearance through air and over surface
TEMPERATURE RANGE
60 Degrees F. to 350 Degrees F.
APPROVALS
UL File No. MH8267, Guide MBPR2
CSA File No. 21048, Guide 400-E-0
Also has VDE and all other International Approvals

CA/OA

A breakthrough in price and technology, these thermostats perform under a wide range of operating conditions. One-piece contact construction makes the CA and OA models the most reliable in the industry. They are about the same size as the SC and SO models and are manufactured in a high-tech clean room in Japan. In fact, the CA and OA might just set a new industry standard.



ELECTRICAL
125 VAC, 10 Amp, Resistive
30,000 Cycles
1/16" clearance through air and over surface
TEMPERATURE RANGE
100 Degrees F. to 284 Degrees F.
APPROVALS
UL File No. E52529 (S) Guide XAPX2
CSA Applied for.

MODELS AVAILABLE FROM STOCK

SC AND OA	SC-A AND SO-A	CA AND OA	SET POINT	ACTION AT SET POINT	DIFFERENTIAL
SO-35(1)	—	—	35F. ±5F.	open	15F.
SO-60(2)	—	—	60F. ±5F.	open	20F.
SO-60-PCB(3)	—	—	60F. ±5F.	open	20F.
—	SC-60-A	—	60F. ±7F.	closes	20F.
SO-85	—	—	85F. ±5F.	open	15F.
SO-100	SO-100-A	—	100F. ±5F.	open	30F.
SC-100	SC-100-A	—	100F. ±7F.	closes	30F.
SO-110	—	OA-110	110F. ±5F.	open	30F.
—	SC-110-A	—	110F. ±7F.	closes	30F.
SO-120	SO-120-A	—	120F. ±5F.	open	30F.
SC-120	SC-120-A	CA-120	120F. ±7F.	closes	30F.
—	SO-130-A	—	130F. ±5F.	open	30F.
SO-140	SO-140-A	OA-140	140F. ±5F.	open	30F.
—	SO-140-AX(4)	—	140F. ±5F.	open	25F.
SC-140	SC-140-A	CA-140	140F. ±7F.	closes	30F.
SO-150	SO-150-A	OA-150	150F. ±5F.	open	30F.
SO-150-WOB(5)	—	—	150F. ±5F.	open	25F.
—	SO-150-AM	—	150F. ±8F.	open	manual-reset
SO-150-QC(6)	—	—	150F. ±5F.	open	30F.
SO-160	SO-160-A	OA-160	160F. ±5F.	open	30F.
SC-160	SC-160-A	—	160F. ±7F.	closes	30F.
SO-170	SO-170-A	OA-170	170F. ±5F.	open	30F.
SC-170	SC-170-A	—	170F. ±7F.	closes	30F.
SO-175	SO-175-A	OA-175	175F. ±5F.	open	15F.
SO-175-QC(6)	—	—	175F. ±5F.	open	30F.
SO-175-ST(7)	—	—	175F. ±5F.	open	30F.
SO-180	SO-180-A	OA-180	180F. ±5F.	open	30F.
SO-180-QC(8)	—	—	180F. ±5F.	open	30F.
SC-180	SC-180-A	CA-180	180F. ±7F.	closes	30F.
SO-190	SO-190-A	OA-190	190F. ±5F.	open	30F.
SO-190-TPZ(9)	—	—	190F. ±6F.	open	30F.
SO-194-PT(4)	—	—	194F. ±5F.	open	41F.
—	—	OA-190-QC(4)	190F. ±5F.	open	18F.
—	—	OAM-194	194F. ±7F.	open	manual-reset
—	—	CA-194-QC(10)	194F. ±7F.	closes	30F.
—	SO-200-A	—	200F. ±5F.	open	30F.
SC-200	SC-200-A	CA-200	200F. ±7F.	closes	30F.
—	—	CA-205	205F. ±8F.	closes	30F.
SO-210	SO-210-A	OA-210	210F. ±6F.	open	30F.
SO-220	—	OA-220	220F. ±6F.	open	30F.
SC-225	SC-225-A	CA-225	225F. ±8F.	closes	30F.
SO-230	—	OA-230	230F. ±6F.	open	30F.
SC-240	—	CA-240	240F. ±10F.	closes	100F.
SO-250	SO-250-A	OA-250	250F. ±7F.	open	30F.
—	SO-250-AM	OAM-250	250F. ±10F.	open	manual-reset
—	SO-280-A	—	280F. ±7F.	open	30F.
—	SO-300-A	—	300F. ±7F.	open	30F.
SO-325	SO-325-A	—	325F. ±7F.	open	50F.
—	SO-350-A	—	350F. ±10F.	open	60F.

(1.) Has .250 turned up quick connects, no bracket.
(2.) Freeze point thermostat—closes before 32F. on drop.
(3.) Printed circuit board mount.
(4.) Has .250 turned up quick connects 90° to mounting hole centerline.
(5.) No bracket.
(6.) Has .250 turned up quick connects 45° to mounting hole centerline.
(7.) Has .250 turned up quick connects—6/32" stud, ¼" length.
(8.) Has 3/16" horiz. quick connects—45° to mounting hole centerline.
(9.) Has .250 turned up quick connects in line with mounting holes, open slot on one mounting hole.
(10.) Has 3/16" turned up quick connects 90° to mounting hole centerline.

Sensor Scientific, inc.

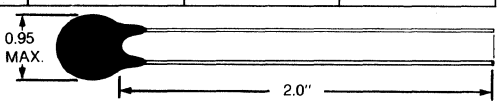
NTC THERMISTORS

INTERCHANGEABLE WAFER THERMISTORS 0-70°C

Resistance vs. Temperature Conversion Chart

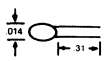
TEMP °	MATERIAL C OHMS				MATERIAL D OHMS		
	2,252	3,000	5,000	10,000	30,000	50,000	100,000
-50	151424	201720	336200	672400			
-40	75982	101220	168700	337400	1204500	2007500	4015000
-30	39928	53190	88650	177300	618900	1031500	2063000
-20	21883	29151	48585	97170	330900	551500	1103000
-10	12474	16617	27695	55390	183510	305850	611700
0	7357	9801	16335	32670	105300	175500	351000
10	4481	5970	9950	19900	62310	103850	207700
20	2813	3747	6245	12490	38010	63350	126700
25	2252	3000	5000	10000	30000	50000	100000
30	1814	2417	4029	8057	23826	39710	79420
40	1200	1598	2664	5327	15309	25515	51030
50	812	1081	1802	3604	10077	16795	33590
60	560	746	1243	2486	6777	11295	22590
70	394	525	875	1749	4647	7745	15490
80	282	376	627	1253	3243	5405	10810
90	206	274	457	913	2307	3845	7690
100	153	203	339	677	1665	2775	5550
110	115	153	255	509	1221	2035	4070
125	77	102	170	340	786	1310	2620
130	68	90	150	300	678	1130	2260
140	53	70	117	234	513	855	1710
150	42	56	93	185	396	660	1320

Sensor Scientific has developed a low cost interchangeable wafer thermistor product line. These highly reliable units provide a resistance temperature curve that can be matched within ±.2°C over a range of 0° to 70°C. This means that a matched replacement thermistor can be purchased several years from now with the identical R/T curve as the original thermistor.

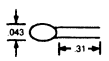


EPOXY COATED

SENSORBEADS



S14 GLASS BEAD

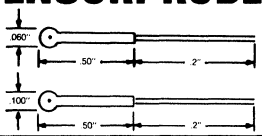


S43 GLASS BEAD

PART #	R @ 25°C	DIA	25/125°C
S14A102	1,000	.014	13.7
S14A502	5,000	.014	15.1
S14A103	10,000	.014	19.6
S14A104	100,000	.014	30.2
S14A105	1,000,000	.014	39.8
S43A102	1,000	0.43	18.6
S43A502	5,000	0.43	20.7
S43A103	10,000	0.43	27.8
S43A104	100,000	0.43	34.1
S43A105	1,000,000	0.43	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms.

SENSORPROBES



PART #	R @ 25°C	DIA	25/125°C
SP60A	1,000	.060	18.6
SP60A	10,000	.060	27.8
SP60A	100,000	.060	34.1
SP100A	1,000	.100	18.6
SP100A	5,000	.100	20.7
SP100A	10,000	.100	27.8
SP100A	100,000	.100	34.1
SP100A	1,000,000	.100	51.6

These are typical units. Resistance values are available at 25°C from 100 ohms to 5 meg ohms. Glass encapsulations are available from 1/8" to 1" in length.

CUSTOM ASSEMBLIES

Sensor Scientific recognizes the growing demand of diversified mounting and assembly requirements. Our engineers are responsive to your design criteria and will work with you to fulfill your application needs.

GENERAL APPLICATIONS

- Air temperature sensing
- Medical probes
- Corrosive solution testing
- Surface temperature probes
- Pipe and plug fitting probes
- Gas temperature measurements
- Armored cable assemblies

Sensor Scientific, inc.

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Sensor Scientific, inc.

NTC THERMISTORS

TEMPERATURE ASSEMBLIES

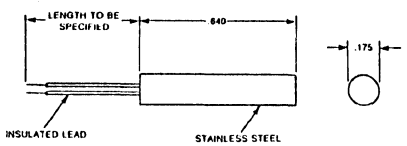
Sensor Scientific manufactures many different types of termistor assemblies. The housing drawings in this section are offered as a guide to assist the engineer in designing a complete thermistor assembly that meets his project needs best.

The housing material specified in most of the drawings is stainless steel. If the requirements are such that other material would be preferable, brass and aluminum are also available.

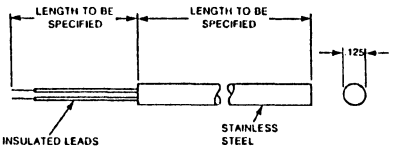
The basic element in these assemblies is the thermistor. Sensor Scientific manufactures a complete line of thermistors. The glass bead and probe thermistor and the wafer or disc type thermistor are units that are typically used in these assemblies.

Sensor Scientific has trained application engineers who will assist you in the design and selection of the thermistor assembly that meets your needs best. Our probes have been designed to maximize sensitivity and stability. They are also constructed to minimize the risk of damage due to operation and handling.

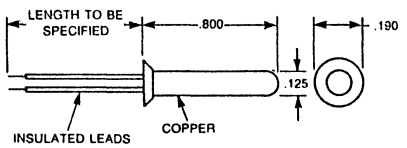
All assembly work is performed by carefully trained and supervised individuals. All units are extensively tested throughout the manufacturing process to insure that customers receive the highest quality thermistor assemblies.



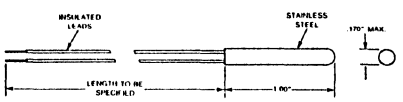
Series 100



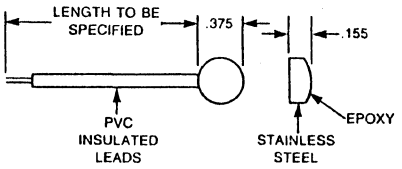
Series 110



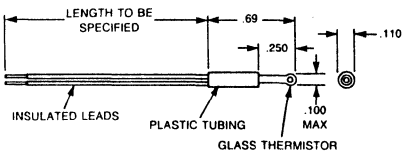
Series 200



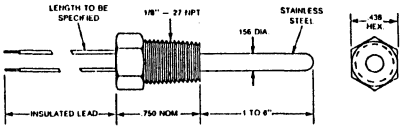
Series 210



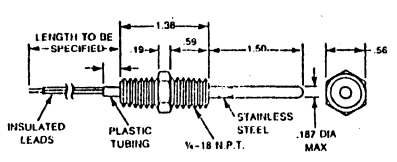
Series 300



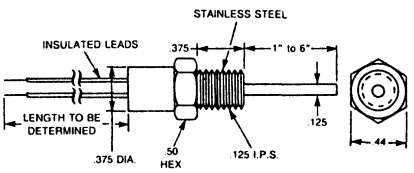
Series 400



Series 500



Series 501



Series 510

The quality control at Sensor Scientific is qualified to Mil-Q-9858A. All units are tested in carefully calibrated sensitive temperature control baths and all calibrations are traceable to the National Bureau of Standards.

Sensor Scientific, inc.

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Van Nuys, CA 91405
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NTC thermistors

B - Series Thermistors
2.5 to 500 Ω

D - Series Thermistors
25 to 5,000 Ω

J - Series Thermistors
200 to 30,000 Ω

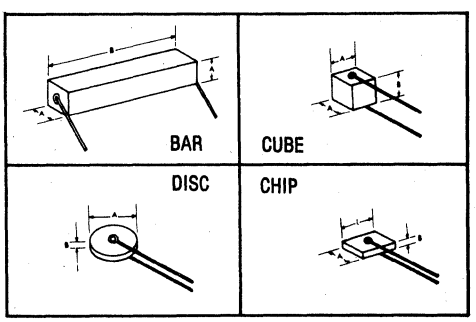
Military Qualified To MIL-T-23648

Techno Components thermistors conform to AQL and confidence levels specified in MIL-T-23648, tables V and VI.

Coatings, markings, special leads, probes, resistor/thermistor networks, resistance values from 1 ohm to 150 K Ω, and other product variations are produced to meet your design requirements.

Resistance tolerance of ± 1% through ± 20% are available and may be specified at 25°C or any temperature within the operating range. Maximum operating temperature with leads is 150°C.

CURVE B	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 12.95% ±10%
CURVE D	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 19.8% ±10%
CURVE J	Ratio $\frac{R\ @\ 25°C}{R\ @\ 125°C}$ = 29.85% ±10%



THERMISTOR SPECIFICATIONS

R @ 25°C Ω ±10%	Part Number	NTC %/°C @ 25°C	Nominal D.C.*	Nominal T.C.**	Max. Dimensions A	Max. Dimensions B	Leads AWG#	Type
100,000	2J05	−4.4	3	10	.06	.26	30	Bar
75,000	2J06	−4.4	3	8	.06	.20	30	Bar
50,000	2J07	−4.4	3	7	.06	.15	30	Bar
30,000	2J08	−4.4	2	6	.06	.08	30	Bar
25,000	2J09	−4.4	2	5	.06	.07	30	Bar
20,000	2J10	−4.4	2	5	.06	.06	30	Chip
15,000	2J11	−4.4	2	4	.06	.05	30	Chip
10,000	2J12	−4.4	2	4	.06	.04	30	Chip
10,000	1J112	−4.4	2	4	.08	.05	30	Disc
10,000	1J13	−4.4	4	12	.11	.10	28	Disc
8,000	1J14	−4.4	4	10	.11	.08	28	Disc
7,000	1J145	−4.4	4	10	.11	.07	28	Disc
6,000	1J147	−4.4	3	9	.11	.06	28	Disc
5,000	1J15	−4.4	3	8	.11	.05	28	Disc
5,000	2J15	−4.4	3	8	.10	.04	28	Chip
4,000	1J154	−4.4	5	23	.16	.10	28	Disc
4,000	2J165	−4.4	3	8	.10	.04	28	Chip
3,000	2J16	−4.4	3	—	.12	.04	28	Chip
3,000	1J155	−4.4	6	20	.16	.08	28	Disc
2,500	1J158	−4.4	5	19	.16	.07	28	Disc
2,000	2J17	−4.4	3	5	.10	.03	28	Chip
2,000	1J20	−4.4	7	25	.22	.09	24	Disc
2,000	1D10	−3.9	2	3	.06	.04	30	Disc
2,000	2D10	−3.9	2	4	.06	.04	30	Chip
1,500	1D111	−3.9	2	3	.08	.06	30	Disc
1,000	2J21	−4.4	6	15	.18	.04	24	Chip
1,000	1J24	−4.4	9	48	.32	.09	24	Disc
1,000	1D112	−3.9	2	4	.08	.04	30	Disc
1,000	1D13	−3.9	4	10	.11	.08	28	Disc
1,000	2D13	−3.9	2	3	.08	.04	28	Chip
800	1D14	−3.9	3	8	.11	.06	28	Disc
700	1D145	−3.9	3	7	.11	.06	28	Disc
600	1D147	−3.9	3	7	.11	.04	28	Disc
500	1D15	−3.9	3	6	.11	.04	28	Disc
500	2D15	−3.9	2	4	.10	.04	28	Chip
500	1D153	−3.9	7	20	.16	.08	28	Disc
400	2D165	−3.9	2	4	.11	.04	28	Chip
300	2D16	−3.9	3	5	.10	.03	28	Chip
300	1D19	−3.9	7	25	.22	.09	24	Disc
200	2D20	−3.9	6	—	.15	.04	—	Chip
100	2D21	−3.9	6	—	.18	.04	24	Chip
100	2B13	−3.3	2	4	.07	.04	28	Chip
80	2B14	−3.3	2	4	.08	.04	28	Chip
80	2D211	−3.9	5	—	.20	.04	24	Chip
50	2D24	−3.9	6	—	.32	.04	24	Chip
50	2B15	−3.3	2	4	.10	.04	28	Chip
30	2D31	−3.9	7	—	.35	.04	24	Chip
30	2B16	−3.3	2	4	.10	.03	28	Chip
25	2D33	−3.9	7	—	.36	.04	24	Chip
20	2D34	−3.9	7	—	.36	.04	24	Chip
20	2B17	−3.3	3	4	.16	.04	28	Chip
10	2B21	−3.3	5	—	.18	.04	28	Chip
5	2B24	−3.3	6	—	.30	.04	24	Chip

***DISSIPATION CONSTANT**
Dissipation Constant expressed in mw/°C, represents the amount of power required to raise the temperature of a thermistor 1°C.

****TIME CONSTANT**
Time Constant, expressed in seconds, is the time required for a thermistor dissipating zero power to change 63% of the difference between its initial temperature value and that of a new temperature environment.

"Soft-Start"
Inrush Current Suppressing Devices
- Over 50 std. types available.
- Up to 25 Amps. current handling.
- Resistance tolerances of ± 1% thru ± 20% are available and may be specified at 25°C or any temperature within the operating range.

Temperature Sensing Probes
- Temperature Range: - 60 to + 300°C.
- Sensors: NTC Thermistor (- 4.4%°C).
- Tolerances: 10% to 0.5% or better (interchangeable).
- Resistance Range: 50 Ohms or 350K Ohms @ 25°C.

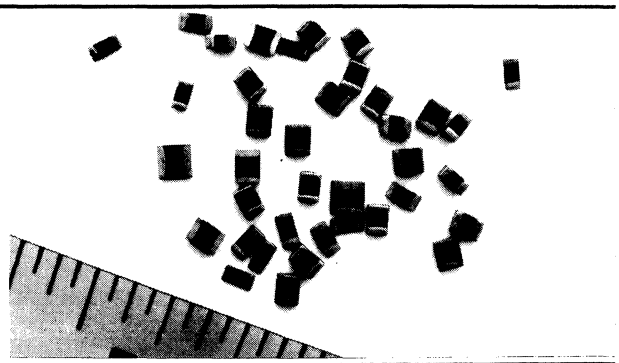
Techno Components engineers will design Temperature Sensing Probes for your special application. Outline your problem or specifications and send them to Techno Components Applications Engineering Department.

SFERNICE, INC.

TECHNO
7803 Lemona Avenue
Van Nuys, CA 91405
(818) 781-1642 FAX: 818-781-8647

NTC thermistors

Hybrid Chip Thermistors

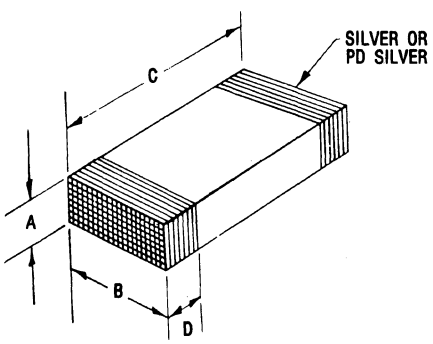


FEATURES:

- High Density Construction Ensures Long Life and Reliability.
- Wraparound Terminations.
- Flow Solderable.
- Can be Mounted with Conductive Epoxy.
- Automatic Placement Capability.
- Tape and Reel Available.
- Burn-in and Data Available.
- Meets Requirements of Mil-T-23648 Tables V and VI.

ELECTRICAL SPECIFICATIONS:

- Resistance Range: 1,000 Ohms to 5 Meg Ohms.
- Temperature Coefficient: From 3.3%/°C to 6.02%/°C.
- Tolerance: ± 10% @ 25°C standard. Tighter tolerances down to ± 2% or less are available.
- Special resistance values and temperature coefficients are available to meet your requirements.



R at 25°C ±10%	Part No.	TC %/°C	A (in) ±.010	B (in) ±.010	C (in) ±.010	D (in) ±.010
5,000,000	7S050	−6.02	.028	.061	.110	.020
2,500,000	7S255	−6.02	.040	.085	.110	.020
1,000,000	7M105	−5.06	.020	.040	.125	.020
750,000	7M754	−5.06	.020	.053	.125	.020
500,000	7M504	−5.06	.020	.079	.125	.020
300,000	7M304	−5.06	.028	.094	.125	.020
200,000	7M204	−5.06	.040	.072	.110	.020
100,000	7M104	−5.06	.048	.086	.100	.020
80,000	7J803	−4.4	.020	.049	.125	.020
60,000	7J603	−4.4	.020	.066	.125	.020
50,000	7J503	−4.4	.028	.056	.125	.020
40,000	7J403	−4.4	.028	.070	.125	.020
30,000	7J303	−4.4	.032	.082	.125	.020
20,000	7J203	−4.4	.040	.088	.125	.020
10,000	7J103	−4.4	.048	.086	.100	.020
8,000	7D802	−3.9	.028	.050	.125	.020
7,000	7D702	−3.9	.028	.057	.125	.020
6,000	7D602	−3.9	.028	.067	.125	.020
5,000	7D502	−3.9	.028	.080	.125	.020
4,000	7D402	−3.9	.028	.090	.125	.020
3,000	7D302	−3.9	.040	.069	.110	.020
2,500	7D252	−3.9	.040	.083	.110	.020
2,000	7D202	−3.9	.048	.074	.100	.020
1,500	7D152	−3.9	.048	.082	.100	.020
1,000	7B102	−3.9	.020	.056	.125	.020

"Thermo-Curve" Interchangeable Thermistors

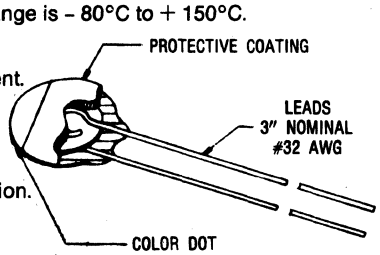
±0.2°C Interchangeability Tolerance 0°C to + 80°C

FEATURES:

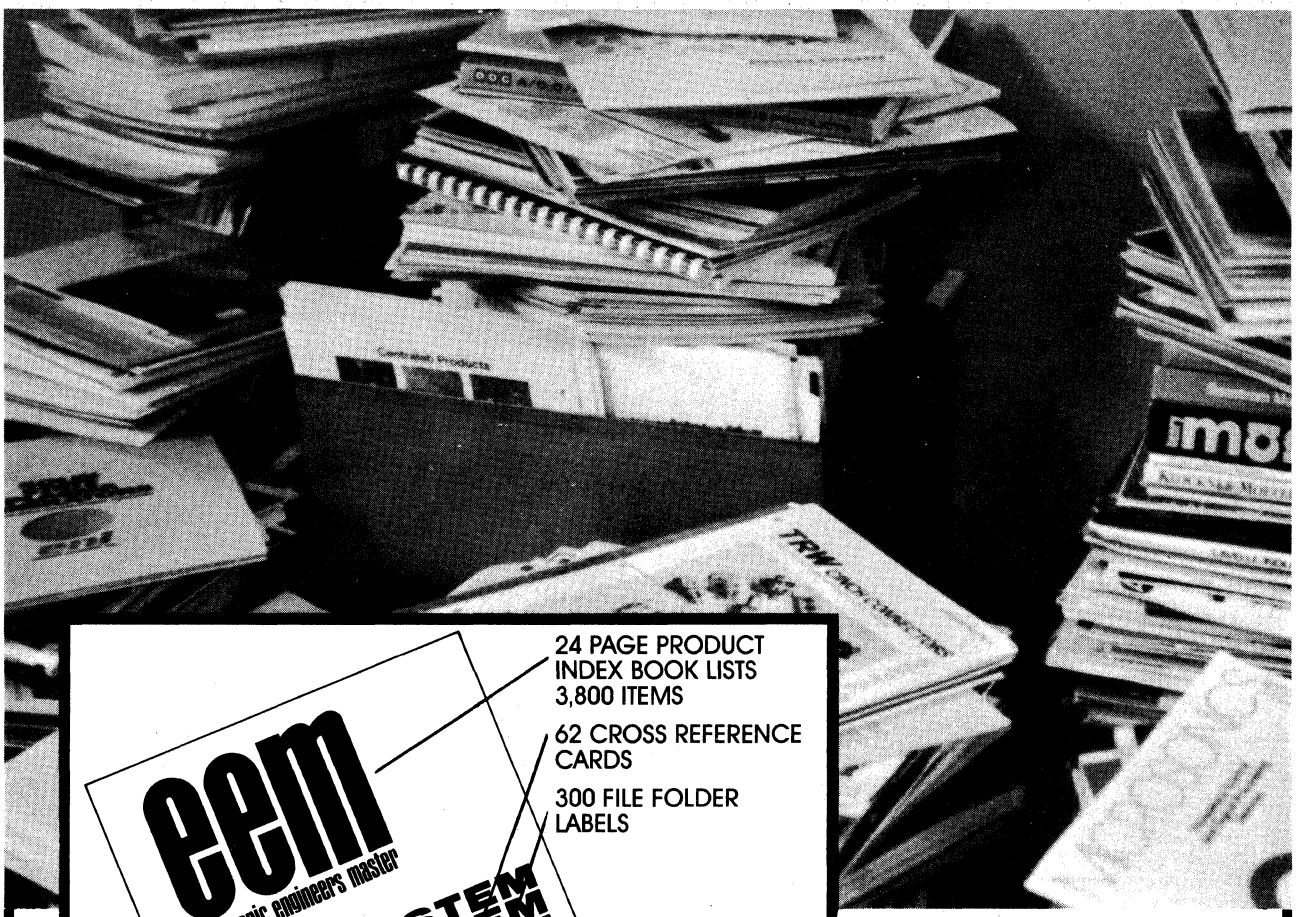
- Temperature coefficient of resistance is - 4.4% per degree centigrade.
- Standard accuracy is ± 0.2°C over the temperature range of 0°C to + 80°C.
- Protective coating is thermally conductive epoxy to ensure fast time response.
- Standard lead material is tinned copper alloy. Other material available upon request.
- Color coded for easy resistance value identification.
- Operating temperature range is - 80°C to + 150°C.

APPLICATIONS:

- Temperature Measurement.
- Temperature Control.
- Liquid Level Detection.
- Meter Compensation.
- Temperature Compensation.
- Flow Measurement.
- Temperature Indication.
- Excess Temperature Detection.



Part Number	Zero Power Resistance @ 25° (ohms)	Body Color	Dot
10TCJ202	2000	RED	—
10TCP222	2252	RED	ORANGE
10TCJ252	2500	RED	GREEN
10TCJ302	3000	ORANGE	—
10TCJ402	4000	YELLOW	—
10TCJ502	5000	GREEN	—
10TCJ602	6000	BLUE	—
10TCJ702	7000	VIOLET	—
10TCJ802	8000	GRAY	—
10TCJ902	9000	WHITE	—
10TCJ103	10000	BROWN	BLACK
10TCJ113	11000	BROWN	—
10TCJ123	12000	BROWN	RED
10TCJ133	13000	BROWN	ORANGE
10TCJ143	14000	BROWN	YELLOW
10TCJ153	15000	BROWN	GREEN
10TCJ163	16000	BROWN	BLUE
10TCJ173	17000	BROWN	VIOLET
10TCJ183	18000	BROWN	GRAY
10TCJ193	19000	BROWN	WHITE
10TCJ203	20000	RED	YELLOW
10TCJ253	25000	RED	WHITE
10TCJ303	30000	ORANGE	YELLOW



24 PAGE PRODUCT INDEX BOOK LISTS 3,800 ITEMS

62 CROSS REFERENCE CARDS

300 FILE FOLDER LABELS

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electronic engineers master
FILE SYSTEM

HARDWARE (ELECTRICAL/ELECTRONIC)
CROSS REFERENCE
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PRODUCTS | SEE ALPHA FILE — COMPANY NAME | PAGE NO.

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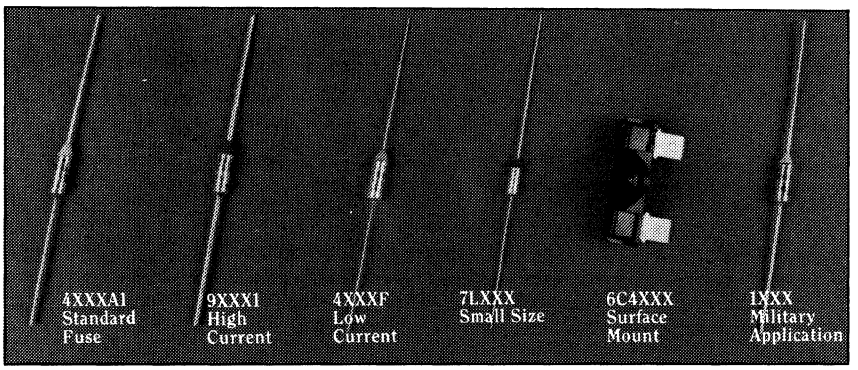
Don't waste any more time. Get organized now!

EEM FILE SYSTEM,
645 stewart ave., garden city, ny 11530

MICROTEMP® Thermal Cutoffs

MICROTEMP Thermal Cutoffs provide permanent over-temperature protection for motors, transformers, appliances, HVAC equipment and electronic equipment. Once a MICROTEMP Thermal Cutoff opens a circuit, it remains open until the fault is corrected and the fuse is replaced.



Thermal Cutoff Series Selection

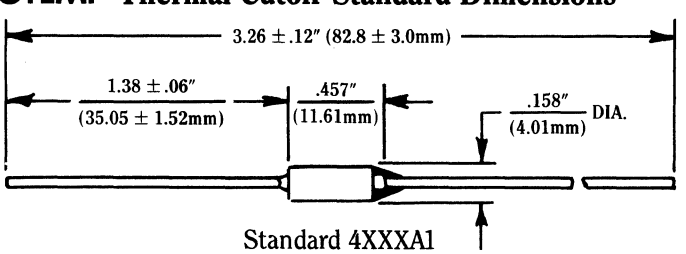
To determine which series is best for your application, remember:

- To consider the normal and abnormal electrical currents and voltages of your product.
- That the current passing through a MICROTEMP Thermal Cutoff can generate I^2R, self heating. This must be considered when selecting the proper series and opening temperature for your application.
- That the outer case of the MICROTEMP Thermal Cutoff is electrically live and may require insulation. Additionally, since insulation can reduce heat transfer, it also must be considered in selecting the final opening temperature.
- That custom configurations and packages are available.
- That a thermocoupled dummy should be installed in the product circuit to determine the correct temperature setting.

MICROTEMP® Thermal Cutoff Types

Type No.	Temp. (°C) Calibration Range	Wire Size AWG	Maximum Recommended Operating Current and Voltage (Resistive)
4XXXA1	60-240	18	15 Amp/240 VAC
9XXX1	60-240	15	25 Amp/240 VAC
4XXXF	60-240	23	5 Amp/240 VAC
7LXXX	72-184	23	6 Amp/240 VAC
6C4XXX	60-184	—	15 Amp/240 VAC
1XXX	60-240	18	15 Amp/240 VAC

MICROTEMP® Thermal Cutoff Standard Dimensions



Standard 4XXXA1

MICROTEMP® Thermal Cutoff Temperature Ratings

Reading the temperature chart.
All MICROTEMP Thermal Cutoffs are identified by their Type No. (4XXXA1, 9XXX1, etc.). The "XXX" digits are determined by the opening temperature you specify. For example: A 4136A1 is a MICROTEMP Thermal Cutoff with an opening temperature of 60°C.

Model # (XXX)	Max. Opening Temp. °C*
136	60
146	66
158	72
168	77
178	84
191	91
194	93
204	98
208	100
218	104
227	109
239	117
244	121
257	128
283	141
300	152
333	167
358	184
377	192
415	216
438	228
468	240

*Tolerance +0 -4°C

For further information on your specific design application, contact a Micro Devices Sales Engineer at our factory.

MICRO DEVICES PRODUCT GROUP
Therm-O-Disc, Inc.
1320 South Main Street • Mansfield, Ohio 44907
Phone: 419/756-5911
FAX: 419/525-8344
Therm-O-Disc, Inc. is a subsidiary of Emerson Electric Co.

EMERSON®

SENSORS/TRANSDUCERS

Manufacturer	Starting EEM Page No.	Magnitude	Current, DC		Current, AC		Power		Power Factor	Phase Angle	Frequency	Voltage		Other
			Level Sensing	Bidirectional	Ampl./RMS	Level Sensing	True (W)	Apparent (VAR)				DC	AC	
American	B•1878	¤	¤	¤	¤	¤	¤	¤			¤	¤	¤	MIL
Aerospace														
Bell, F. W.	B•1881													Hall Effect
Hamlin	B•1891		¤			¤								Proximity Sensors
Novotechnik, U.S.	B•1900											¤		Servo Mount Potentiometers
Ohio Semitronics	B•1902	¤		¤	¤		¤ ¤	¤			¤	¤	¤	Converter, Analog-to-Pulse (Integrator) Precision current Converter
Sensotec, Inc.	B•1918		¤											
Setra	B•1922													Transducers

ENCODERS, SHAFT ANGLE

Manufacturer	Starting EEM Page No.	Optical		Contact		Other
		Abs.	Diff.	Abs.	Diff.	
BEI Motion Systems	B•1880	¤	¤			
Computer Optical Prods.	B•1883	¤	¤			
Disc Instruments/Honeywell	B•1885		¤			Digital Potentiometers
Itek Encoder	B•1892	¤	¤	¤	¤	MIL Spec
IVO Industries	B•1894	¤	¤			Measuring wheels
Litton Encoder	B•1895	¤	¤	¤	¤	Trackballs
Lucas Ledex	B•1896	¤	¤			Modular
Micro Mo Elctrns.	B•1898		¤			
Omega Eng.	B•1932			¤	¤	
Sharp Electronics/Opto	B•1924	¤				
US Digital	B•1928		¤			
Vernitech	B•1929	¤	¤	¤	¤	Modular

TRANSDUCERS

Manufacturer	Starting EEM Page No.	Audio	Force/ Weight	Mag- netic Field	Pres- sure	Temp.	Position		Position Velocity	Velocity	Other
							ABS	Displace- mentt			
Airpax/Cheshire	B•1877									¤	
BEI Motion Systems	B•1880								¤	¤	
Blatek Industries	B•1882	¤									Transducers, Air Coupling Ultrasonic Test
Computer Optical Prods.	B•1883								¤		
Data Instruments/ Honeywell	B•1884				¤						Depth Sensors
Entran	B•1888				¤						Vibration
Hamlin, Inc.	B•1891			¤				¤			
Micro Mo	B•1898							¤	¤		Magnetic
Murata Erie	B•1899	¤									
Novotechnik U. S., Inc.	B•1900						¤	¤			
NTK Technical	B•1901	¤									Transducers, Ultrasonic
Ohio Semitronics	B•1902			¤							
Omega	B•1932		¤		¤	¤					
Sensotec	B•1918		¤		¤					¤	
Setra Systems	B•1922				¤				¤		Digital Barometers
Tokin	B•1926		¤					¤			
Transducers & Systems	B•1927		¤								
Vernitech	B•1929				¤			¤			
Vibra Metrics	B•1930		¤						¤	¤	Vibration

ACCELEROMETERS

Manufacturer	Starting EEM Page No.	Accel- eration	Vibration	Shock
Entran	B•1888	¤	¤	¤
Sensotec	B•1918	¤		
Setra Systems	B•1922	¤	¤	¤
Vibra•Metrics	B•1930	¤	¤	¤

MINIGLOSSARIES
FORMULAS • CHARTS
PRODUCT SELECTION GUIDES
FORMS
CODES

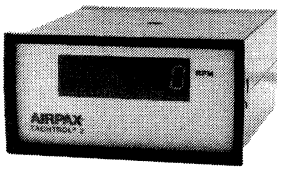
TECHNICAL INFORMATION

WHERE TO FIND THEM IN THE 88/89 EDITION OF EEM

Abbreviations/Acronyms ..... **A**•1134, **B**•1098, **C**•1082, **D**•1038
ASCII Code ..... **D**•1073
Batteries, Product Selection Guide ..... **D**•1428
Batteries & Fuel Cells, Characteristics ..... **D**•1454
Cabinets, Enclosures, Racks & Chassis, Product Selection Guide ..... **C**•1003
Capacitors, Basic Formulas ..... **A**•1030
Capacitors, Miniglossary ..... **A**•1027
Capacitors, Product Selection Guide .. **A**•1003
Coils, Chokes, Inductors, Product Selection Guide ..... **A**•1193
Conductors, Maximum Current Capacity of Copper & Aluminum ..... **C**•1760
Connectors, Miniglossary ..... **C**•1374
Connectors, Terminals & Sockets, Product Selection Guide ..... **C**•1127
Crystals, Oscillators, Crystal & Piezoelectric Filters, Product Selection Guide ..... **A**•1331
Delay Lines, Product Selection Guide ..... **A**•1495
Discrete Semiconductors, Product Selection Guide ..... **A**•2113
Displays, Readouts, & CRTs, Product Selection Guide ..... **B**•1033
EBCDIC Code ..... **D**•1162
Encapsulation, Miniglossary ..... **C**•1110
Fans, Blowers, Cooling Equipment & Heat Exchangers, Product Selection Guide ..... **C**•1643
Filters, Product Selection Guide ..... **A**•1633
IC Master ..... **A**•1718
Instruments, Panel Meters, Product Selection Guide ..... **D**•1350
Instruments, Test & Measuring, Product Selection Guide ..... **D**•1190
Interconnection Systems, Product Selection Guide ..... **C**•1719
Keyboards & Keypads, Product Selection Guide ..... **B**•1808
Lamps, Lights, & Inductors, Product Selection Guide ..... **B**•1104
Logofinder & Trademark Directories .... **C**•901
Microwave Components, Product Selection Guide ..... **A**•1761
Military Qualified Products List ..... **B**•1003
Motors, Drives, & Rotating Components, Product Selection Guide ..... **B**•1181
Opto Semiconductors, Miniglossary .. **B**•1262
Oscilloscopes, Product Selection Guide ..... **D**•1408
Panel Hardware, Product Selection Guide ..... **C**•1603
Potentiometers, Trimmers, Controls & Rheostats, Product Selection Guide ..... **A**•2057
Power Supplies, Miniglossary ..... **D**•1504
Power Supplies, AC, Product Selection Guide ..... **D**•2060
Power Supplies, DC, Product Selection Guide ..... **D**•1497
Protective Components (Fuses, Circuit Breakers, etc.), Product Selection Guide ..... **B**•1297
Relay Contact Forms ..... **B**•1371
Relays, Electromechanical, Miniglossary ..... **B**•1364
Relays, Product Selection Guide ..... **B**•1355
Resistor Color Codes ..... **A**•1911
Resistors, Product Selection Guide .... **A**•1849
Servo Components, Miniglossary ..... **B**•1238, **D**•2176
SI Units, Basic Guide To, ... **A**•1090, **B**•1050, **C**•1092, **D**•1048
Solenoids, Product Selection Guide .... **B**•1612
Switches, Product Selection Guide ..... **B**•1636
Thermal Components, Product Selection Guide ..... **B**•1834
Thermal Conductivity of Dielectrics at Room Temperature ..... **B**•1842
Thyristors/High Power Diodes, Miniglossary ..... **A**•2145
Trademark & Logofinder Directories .... **C**•901
Transducers & Encoders, Product Selection Guide ..... **B**•1874
Transformers, Product Selection Guide ..... **A**•2153
Voltage Drop Nomograph .. **C**•1912, **D**•2042
Wire & Cable, Product Selection Guide ..... **C**•1763
Wire Guages—Diameter, Area, Copper Weight ..... **C**•1864

TACHOMETERS AND MAGNETIC SPEED SENSORS

For accuracy, fast response time and reliable, long-lasting performance, specify Airpax tachometers and magnetic speed sensors. Contact Airpax Company, Cheshire Industrial Park, Cheshire, CT 06410. (203) 272-0301. A division of North American Philips Corporation.

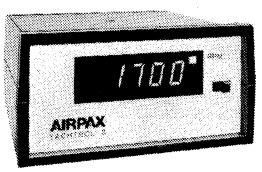


Tachtrol® 2 – Speed/Rate Monitor

A single input digital instrument, this speed/rate monitor offers fast-response, high-precision monitoring. Measured values are displayed in engineering/units: RPM, FPM, frequency or other values. Rugged, easy to set up, yet costs less than competitive models.

Features:

- Single-channel precision speed or rate monitoring.
- Period mode measuring system.
- Five-digit auto-ranging .56″ LED display; full or partial auto-ranging with leading zero suppression. Updates twice per second.
- Active or passive sensor input; accepts any pulse output device, magnetic digital speed sensor.
- Meets MIL-810C shock and vibration.

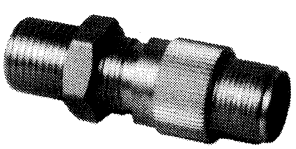


Tachtrol® 3 – Dual Input Digital Tachometer

Single or dual channel instrument, this computing tachometer measures input frequencies and displays the resulting quantities in RPM, FPM, % Draw and other rates. A unique method of setting conversion factors and instrument functions allows easy configuring or altering at any time.

Features:

- Measures speed or frequency (2 Hz to 30,000 Hz).
- Active or passive speed sensor inputs.
- Auto ranging LED display.
- Meets MIL-810C shock and vibration.



1-3111 – Low-Cost Molded Magnetic Speed Sensor

Stainless steel housing and one-piece construction, this speed sensor has interior section coated with epoxy resin to resist both oil and moisture.

Features:

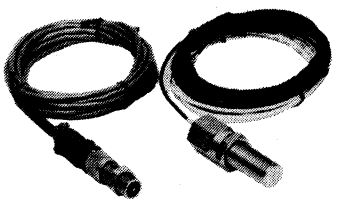
- Wide operating and storage temperature range: – 40°F to + 300°F.
- 190-volt minimum output (P-P).
- Mates with MS3106A-10SL-4S.

Tach-Pac® 3

The single channel, microcomputer-based Tach-Pak® 3 uses adaptive period averaging which permits a combination of fast response and high accuracy. It measures input frequency and converts the resulting quantities to a meter output, an analog output, and four relays. A unique method of setting instrument functions permits them to be easily configured or altered in the field at any time.

Features:

- Measures frequency from .0625 to 30,000 Hz.
- Active or passive sensor inputs: accepts input from any frequency source.
- Response time – 50 millisecond updates above 100 Hz.
- Field programmable.

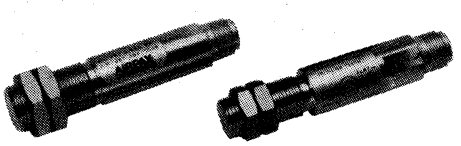


1-0001 and 1-0005 – Passive Magnetic Speed Sensors

Convert mechanical motion to AC voltage. The frequency of the AC signal is exactly proportional to the speed or RPM.

Features:

- No moving parts.
- Wide temperature range.
- Stainless steel housing.
- UL/CSA and FM listed sensors available. Intrinsically safe.

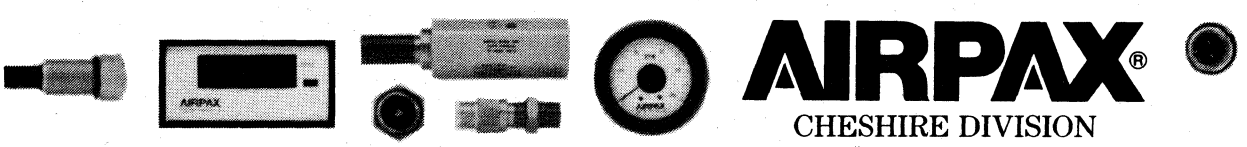


4-0070 and 4-0036 – Active Magnetic Speed Sensors/Zero Velocity

Either speed sensor can be used to sense the speed of any rotating machinery, including motors, generators, turbines, compressors, conveyors – wherever speed or RPMs need to be monitored.

Features:

- Low cost.
- 12V ± 2 VDC power supply.
- – 25°C to + 70°C operating temperature range.
- 4-0036 is UL listed.
- DC to 10K Hz frequency.
- UL/CSA listed sensors available.



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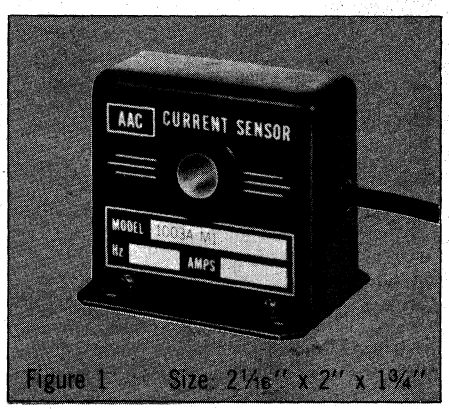

Figure 1 Size: 2 1/16" x 2" x 1 3/4"

AC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
1002M1	0.25, 0.5, 1, 5, 10, 20, 25, 50, 100, 150, 200, 250Aac	+5Vdc	0.5%FS	10ms	5
C	1, 2, 5, 10, 20Aac	+1mAdc	0.25%FS	400ms	6
C-X	1, 2, 5, 10, 20Aac	4-20mAdc	0.5%FS	400ms	6
S383	2, 5, 10, 15, 20, 30, 40, 50, 75, 100, 150, 200, 250Aac	4-20mAdc	0.5%FS	200ms	–
1004	2, 5, 10, 20, 50, 100, 150, 200, 250, 300Aac	+5Vdc	1%FS	150ms	5
1003AM1	2, 5, 10, 15, 20, 25, 30, 50, 100Aac	+5Vdc	1%FS	150ms	1
1003AM2	30, 50, 75, 100, 150, 200, 250Aac	+5Vdc	1%FS	150ms	–
1003AM3	150, 250, 350, 500, 600, 800, 1000, 1200, 1500Aac	+5Vdc	1%FS	150ms	–
1001	100, 250, 500, 750, 1000, 1500, 2000, 2500, 3000Aac	+5Vdc	1%FS	100ms	4

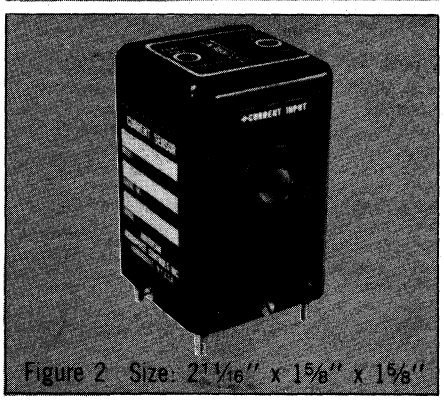
Figure 2 Size: 2 1/16" x 1 5/8" x 1 5/8"

DC CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
904B	0.1, 0.2, 0.5, 1, 2, 5mAdc	+5Vdc	1%FS	50ms	–
903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	5
S209-903B	5, 10, 20, 50, 100, 200, 500mAdc & 1, 2, 5Adc	+1mAdc	1%FS	50ms	5
936	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	3
S218-903	100, 200, 500mAdc & 1, 2, 5Adc	+5Vdc	1%FS	50ms	–
937	10, 20, 30, 50, 100Adc	+5Vdc	2%FS	200µs	–
913A	10, 20, 50, 100Adc	+5Vdc	1%FS	1ms	2
913B	10, 20, 50, 100Adc	+5Vdc	1%FS	1ms	5
S155-913B	10, 20, 35, 50, 75, 100Adc	+5Vdc	1%FS	1ms	5
950	10, 20, 30, 40, 50Adc	+5Vdc	0.5%FS	10ms	5
951	10, 20, 30, 40, 50Adc	+5Vdc	0.5%FS	30ms	–
952	100, 200, 300, 400, 500, 750, 1000, 1500, 2000Adc	+5Vdc	0.5%FS	50µs	5
934	100, 200, 250, 300, 500, 750, 1000Adc	+5Vdc	2%FS	200µs	5
S338-909	150, 250, 500, 750, 1000, 1500, 2000, 2500Adc	4-20mAdc	1%FS	200µs	4
S347-909	200, 250, 300, 500, 750, 1000, 1500, 2000, 2500Adc	+5Vdc	1%FS	200µs	4

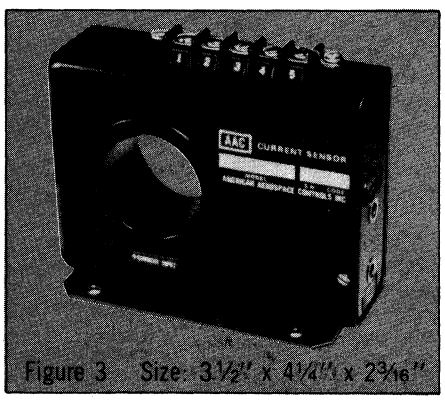

Figure 3 Size: 3 1/2" x 4 1/4" x 2 3/16"

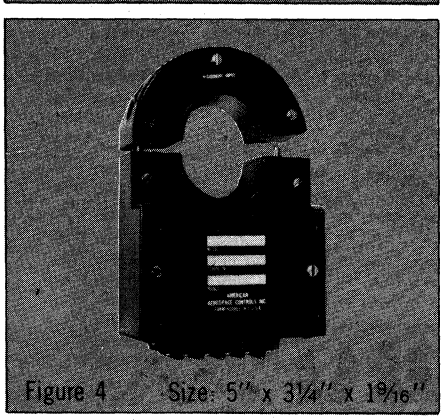
Figure 4 Size: 5" x 3 1/4" x 1 9/16"

BIDIRECTIONAL CURRENT SENSORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S263	±5, 10, 20, 50, 100, 200, 500mA & ±1, 2, 5A	±5V	2%FS	40µs	–
905B	±50, 100, 200, 500mA & ±1, 2, 5A	±5V	1%FS	50ms	5
925B	±10, 20, 50, 100A	±5V	1%FS	1ms	5
S273-925	±10, 20, 50, 100A	±5V	1%FS	1ms	5
910	±25, 50, 100, 150, 200, 250A	±250mV	2%FS	5µs	–
907	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	100µs	–
907A	±25, 50, 100, 150, 200, 250, 300A	±5V	2%FS	40µs	–
908	±25, 50, 100, 150, 200A	±250mV	2%FS	5µs	–
S164-908	±50, 100, 150, 200, 300A	±250mV	1%FS	20µs	–
927B	±150, 200, 250, 300, 500, 750, 1000A	±5V	1%FS	100µs	5
942A	±100, 200, 300, 400, 500, 600, 800, 1000, 1500, 2000A	±5V	1%FS	100µs	3
909	±100, 150, 250, 500, 750, 1000, 1500, 2500, 5000A	±250mV	1%FS	200µs	4
909M4	±150, 250, 500, 750, 1000, 1500, 2000, 2500A	±5V	1%FS	200µs	4
921	±250, 500, 750, 1000, 2000A	±250mV	2%FS	20µs	5

CURRENT, VOLTAGE AND POWER INSTRUMENTATION

CALL 516-694-5100

AC & DC CURRENT LEVEL DETECTORS

SERIES	FULL SCALE (FS) INPUT CURRENT RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
870	1, 2, 5, 10, 15, 20, 50, 100, 150, 200, 250, 300Aac	RELAY	0.5%FS	500ms	8
S212-850	500mAac (75Aac Overload)	RELAY	±75mAac	200ms	5
901B	20, 50, 100, 200, 250, 500mAdc & 1, 2, 5Adc	+5V & SW	1%FS	50ms	–
S204-800	100, 150mAdc & 2Adc (10Adc Overload)	RELAY	10%FS	3ms	5
S58-800	200mAdc (10Adc Overload)	SWITCH	N/A	1ms	–
S201-800	1Adc (100Adc Overload)	RELAY	±150mAdc	200ms	5

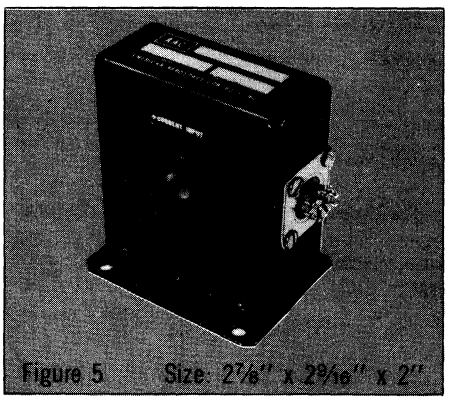

Figure 5 Size: 2⅞" x 2⁹⁄₁₆" x 2"

AC VOLTAGE SENSORS

SERIES	FULL SCALE (FS) INPUT VOLTAGE RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
108	130, 150, 270, 500, 600Vac @ 47-420Hz (0 to FS)	+5Vdc	2%FS	200ms	–
S190-108	130, 150, 270, 300, 600Vac @ 47-63Hz (0 to FS)	+10Vdc	2%FS	200ms	–
V	150, 300, 500Vac @ 47-1000Hz (0 to FS)	+1mAdc	0.25%FS	400ms	6
V-X	150, 300, 500Vac @ 47-1000Hz (0 to FS)	4-20mAdc	0.5%FS	400ms	6
101M3	90-150 Vac @ 60Hz (Suppressed Zero)	+5Vdc	0.5%FS	17ms	–
102M3	90-175 Vac @ 400Hz (Suppressed Zero)	+5Vdc	0.5%FS	3ms	–
105	390-490Vac or 430-530Vac @ 60Hz*	+5Vdc	0.5%FS	17ms	–
109	120, 125, 135, 240, 250, 270Vac @ 60Hz*	+1mAdc	0.5%Vmax	300ms	–
110	120, 125, 135, 240, 250, 270Vac @ 400Hz*	+1mAdc	0.5%Vmax	300ms	–

*Suppressed Zero

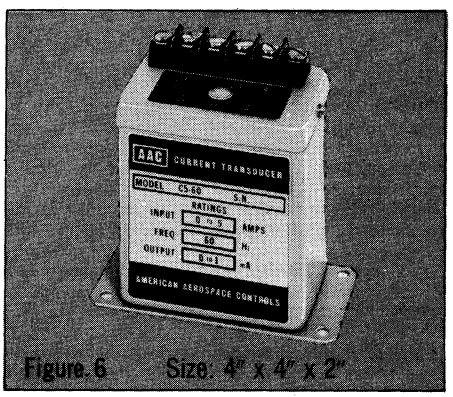

Figure 6 Size: 4" x 4" x 2"

WATT & VAR TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT POWER RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
415A/416A	1-200KW 120, 220 or 440Vac	+5Vdc	2%FS	400ms	8
S217	2-80KW 220 & 440Vac	+5Vdc	2%FS	400ms	8
S73-413	0-100KW (0 to 150Vac or 0 to 300Vac)	+5Vdc	2%FS	400ms	8
W106	0.5-2KW (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W206	1-4KW (2 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W256	1-4KW (2½ ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
W306	1-4KW (3 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
Q106	0.5-2K VAR (1 ele) 120, 220 or 440Vac	+1mAdc	0.25%FS	400ms	7
407	0.3-60KW dc 12-240Vdc & 25-250Adc	250mV	2%FS	5μs	–
401	2.7-150KW dc 18-150Vdc & 150-1000Adc	250mV	2.5%FS	200μs	4

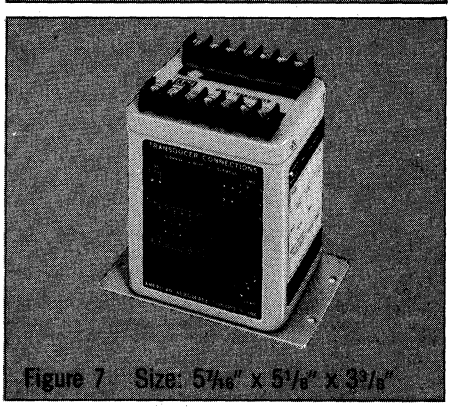

Figure 7 Size: 5¹³⁄₁₆" x 5¹⁄₈" x 3³⁄₈"

FREQUENCY TRANSDUCERS

SERIES	FULL SCALE (FS) INPUT FREQUENCY RANGES	FS OUTPUT	ACCURACY	RESP.	FIG.
S343	360 to 440Hz (102-127Vac or 200-250Vac)	+5Vdc	±0.8Hz	250ms	–
S350L	100, 200, 300, 500, 1K, 2K, 3K, 5K, 10K & 20K Hz	+5Vdc	0.25%FS	3-300ms	–

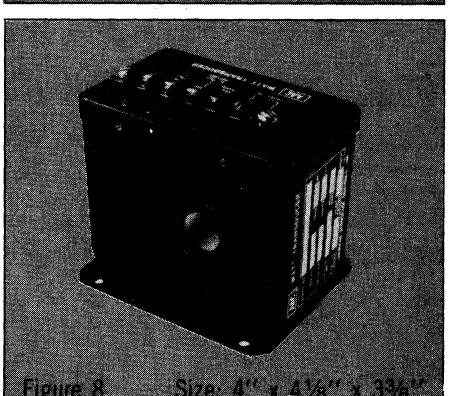

Figure 8 Size: 4" x 4⅛" x 3⅜"

***AAC** manufactures Current, Voltage and Power Sensing Instruments for Industrial, Military and Space Applications. Send for complete catalog. Our Application Engineering Staff is available to assist you.*

BEI... For All Your Motion Control Needs.

PRECISION SERVOS FOR MILITARY & AEROSPACE

Position and rate servo

Solid and hollow encoders

High accuracy optical rotary, absolute and incremental encoders. Standard resolutions to 2,097,152 bits-per-turn. Special resolutions to 16,777,216 (2^{24}) bits-per-turn.

Also Ultra-Loc®, a direct drive programmable rate and position control servo system.

Our long established systems and procedures are in compliance with quality criteria NHB-5300.4 (1B) and MIL-Q-9858A, and high reliability criterion MIL-STD-785.

Typical applications: Aerospace and military programs, precision servo systems, pointing/tracking and precision indexing.

DIGITAL PRODUCTS DIVISION
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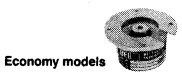
OPTICAL ENCODERS, INDUSTRIAL

Heavy-duty options



Economy models

Guaranteed 30-day delivery on standard model encoders. Over 160 resolutions in stock – up to 50,000 CPT incremental. A wide choice of mechanical and electrical options are available.

Designed for the abusive machine tool environment. Rugged cast housing, heavy-duty shaft and bearings. Available in models that are sealed against liquid entry and for shaft loads up to 200 lbs. and 200G shocks.

Typical applications: Process control, factory automation, machine tool, instrumentation, lumber and oil field machinery.

INDUSTRIAL ENCODER DIVISION
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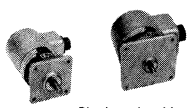
OPTICAL ENCODERS, ABSOLUTE, INDUSTRIAL

Absolute economy



Single and multi-turn

Six weeks delivery on optical absolute single and multi-turn encoders in the range of 512 to 65,536 bits-per-turn. Features the latest aerospace technologies in a convenient size 25 package.

Features include: single light source, heavy-duty shaft, housings and bearing assemblies. A wide range of output driver options and mounting configurations are available.

Typical applications: Robotics, process control, machine tool, antennas and telescopes.

POSITION CONTROLS DIVISION
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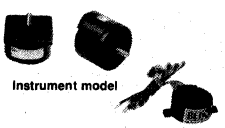
OPTICAL ENCODERS, FAST INSTALLATION MODELS FOR HIGH VOLUME OEMs



Instrument model

Small modular self-aligning

Self-contained

Small, high quality inexpensive optical encoders for high volume markets.

The product line includes our modular M15 which can be completely installed in seconds. Not a kit! Totally self-contained. Needs no alignment. The E113, E15 and E203 are 1.1″ miniature, 1.5″ and 2.0″ diameter enclosed encoders respectively. The mini E113 is capable of 1024 PPR and the E203 2540 PPR. Both contain quadrature outputs with index and complements as standard. The latest is the PM Series Panel Mount encoder. 256 PPR and priced in low $20s in volume.

Typical applications: Computer peripheral, medical electronics, robotics, and general instrumentation applications.

COMPUTER PRODUCTS DIVISION
1755B La Costa Meadows Dr.
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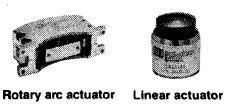
BRUSHLESS MOTORS, ACTUATORS, SPECIALTY ELECTROMAGNETICS

Housed motor Unhoused motor



Rotary arc actuator Linear actuator

Linear and rotary actuators, brushless DC motors, and specialty electromagnetic devices for aerospace, computer peripherals, instrumentation, military and industrial applications. Moving-coil actuators pack power, speed and precise control into short-stroke motion. Reliable, long-life brushless DC motors offer the performance characteristics and advantages of comparably sized PM DC servo motors. And Kimco's imaginative engineers can create specialty electromagnetic devices for your most challenging applications, including AC motors, magnetic bearings, clutches, brakes and solenoids.

Typical applications: disk and tape drive motors, optical system lens and mirror positioners, vibration dampers, magnetic levitators.

KIMCO MAGNETICS DIVISION
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BEI Motion Systems Company supplies precision electronic and electro-mechanical motion control components and systems for a wide range of applications including computer controlled machines, military, aerospace equipment and factory automation.

For more information on our wide range of products and services, call the division that matches your application, or contact our corporate offices listed below.

BEI MOTION SYSTEMS COMPANY
Corporate Office
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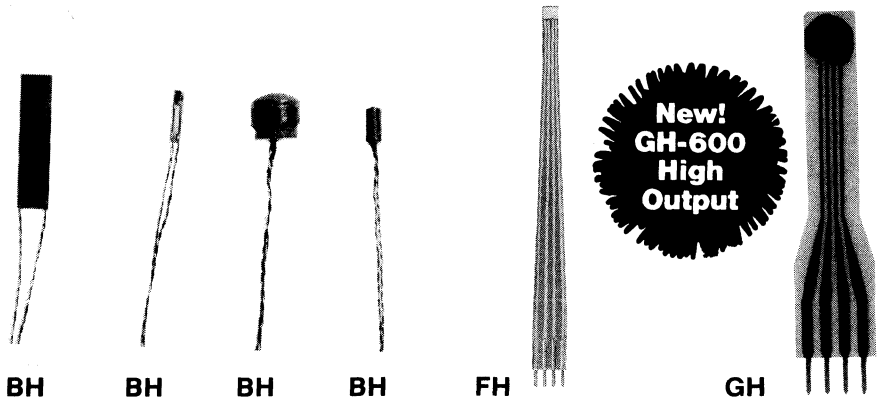
Hall Generators



BH BH BH BH FH GH

- Cryogenic/High Field
- Magnetic Field Measurements
- Electrical Power Measurements
- Guidance Systems
- Brushless dc Motors
- Proximity Sensors
- Watt-hour Meters

DESCRIPTION

The F.W. Bell series of Hall effect magnetic field sensors consists of 29 standard models designed to meet the requirements of most magnetic field measurement applications. The sensors are small, solid-state devices. They produce a voltage which is proportional to the product of the control current and the magnetic field component normal to the Hall active area. Each unit has four electrical connections. Two carry the control current (I_C) and the other two supply the Hall voltage.

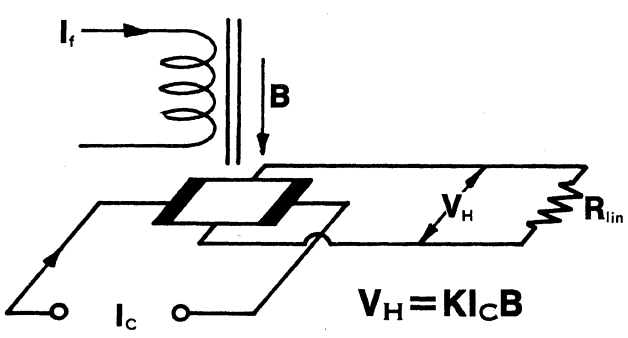
These models are built in various configurations to measure axial, transverse, and tangential magnetic field components. Their operating characteristics permit virtually any application: frequency, dc to MHz; magnetic flux density, milligauss to kilogauss; linearity to 0.1%; temperature, -269°C to +100°C.

MODELS

BH-200
General Purpose Transverse
BH-201
Ultra-Thin Transverse
BH-202
Small Axial
BH-203
General Purpose Axial
BH-204
Midget Axial
BH-205
Midget Transverse
BH-206
High Sensitivity Transverse
BH-207
High Resolution Tangential
BH-208
Ultra-Midget Axial
BH-700
Low Cost Transverse
BH-701
High Linearity Transverse
BH-702
Ferrite Imbedded
BH-703
3-Axis
FH-301, -302, -500
Thin Film
GH-600
High Output
BHT/BHA-900
High Field
BHT/BHA-910
High Linearity
BHT/BHA-921
High Field/ Cryogenic

SPECIFICATIONS

	BH	FH	GH
Control Current I_C	100-200 mA	15-30 mA	10 mA dc
Input Resistance, R_{in}	1-6 ohms	20-80 ohms	450-900 ohms
Output Resistance, R_{out}	1-6 ohms	50-200 ohms	1000 ohms
Magnetic Sensitivity, λB	6-16 mV/kG, standard 5 mV/kG, high sensitivity		50-120 mV



This schematic representation illustrates both the measuring and multiplying capabilities of a Hall generator. By holding I_C constant, V_H becomes a direct function of B, the magnetic flux density. If both, I_C and B are variable, V_H is proportional to the product of the two functions. Holding B and I_C constant, V_H becomes a function of the angle between B and the plane of the Hall-generator active area.

Special units are available to fit your application.

F.W. BELL
6120 Hanging Moss Road Orlando, FL 32807
Phone: 407-678-6900 TWX: 810-853-3115 Fax: 407-677-5765

BLATEK INDUSTRIES, INC.

Pine Street & Mill Road, P.O. Box 574/MC55
Bellefonte, PA 16823-0574 814-355-4910

BLATEK ULTRASONIC TRANSDUCERS

THE 9000 SERIES ULTRASONIC TRANSDUCERS:

- Available in frequencies from .5 MHz–1.0 MHz
- Designed for industrial controls, level sensing and proximity measurement
- Sealed housings that are leakproof
- Suitable for use in hostile environments

STANDARD LINE OF HIGH RESOLUTION OR HIGH PENETRATION ULTRASONIC TRANSDUCERS:

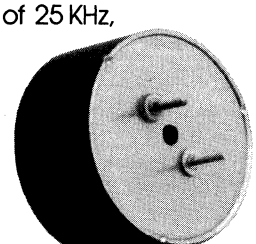
- Available in frequencies from .5 MHz to 25 MHz
- For contact, angle beam & immersion testing
- Technical & application assistance available

CUSTOM TRANSDUCERS TAILORED TO SOLVE PARTICULAR TEST REQUIREMENTS

BLATEK AIR TRANSDUCERS

THE 8000 SERIES AIR TRANSDUCERS:

- Standard frequencies of 25 KHz, 40 KHz,
- For applications requiring low power transducers
- Suitable for protected environments
- Operating distance dependent upon frequency and damping characteristics of transducer.
- Available in prototype or OEM quantities.



BLATEK SPECIAL PRODUCTS

Blatek also provides specific customer design assistance and/or assembles special product lines including:

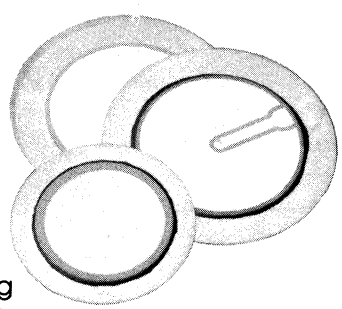
- **NDT TRANSDUCERS FOR SPECIAL TESTING APPLICATIONS**
- **TRANSDUCERS FOR ULTRASONIC CLEANING**
- **CUSTOM TRANSDUCERS FROM 25 KHz TO 25 MHz**

Contact Blatek's Sales Dept. for more specific information on any of the product lines outlined on this page.

BLATEK AUDIO TRANSDUCERS

THE 6000 SERIES OF AUDIO TRANSDUCERS:

- Available in 3 standard sizes—1.062, 1.250, 1.375 O.D.
- Frequency 3.0, 3.5, 4.8 KHz
- Long life due to no electrical contact construction
- Can produce a variety of tones depending upon electronics



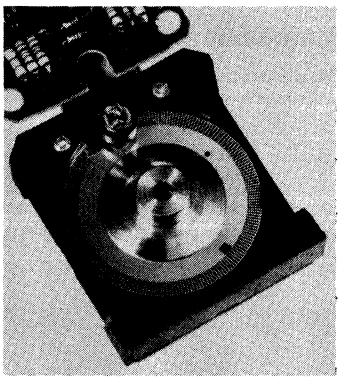
- With appropriate resonator, can emit up to 100 db at 10'
- Available with or without feedback tab
- Available with lead wires, stud mount and other special treatment.

COMPUTER OPTICAL PRODUCTS, INC.

Subsidiary of Hathaway Corp.

CP-200/250 Series

Incremental Integrated Encoder/Tachometer



FEATURES:

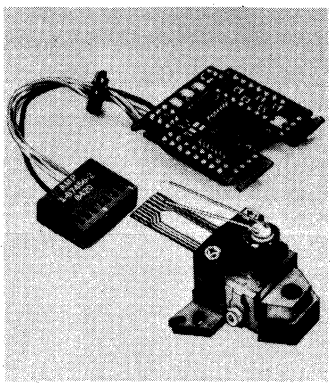
- Low cost/High performance
- Self-contained gap setting mechanism
- Self-contained centering mechanism
- Monolithic multi-output sensor
- Single, controlled output GaAlAs light source
- Collimated optics
- Push-pull readout system
- Low offset
- Extremely easy to install
- Up to 500 counts for metal disks, up to 1000 counts for glass disks.

APPLICATIONS:

- Incremental Motion Systems
- Daisy Wheel Printers
- Inkjet Printers
- Matrix Printers
- Winchester Disk Drives

CP 40/45 Series

Optical Linear or Semi-Linear Transducer



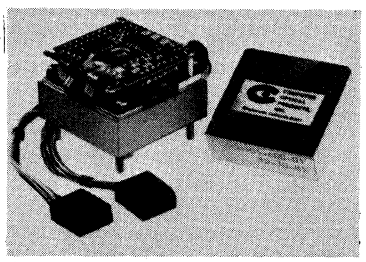
FEATURES:

- Full differential readout
- Monolithic multi-element sensor
- Single, controlled output GaAlAs light source
- Up to 1,000 lines/inch (Analog)
  Digital output CP-045-XXXX up to 1400 lines/inch
- Temperature compensation circuit
- Simple installation with one-screw gap adjustment
- Optional complementary outputs
- Single polarity power supply
- TTL index (second index optional)

- Copying Machines
- Medical Equipment
- Factory Automation Systems
- Robotics
- XY Plotters

CM300/350 Series

Brushless DC Motor or Torquer/Optical Encoder



FEATURES:

ENCODER:

- Full differential readout
- Monolithic Multi-Element Sensor
- Single, controlled output GaAlAs Light Source
- Up to 1,000 lines/turn (Analog)
- Digital output up to 1500 counts/turn
- Single Polarity Power Supply
- Replaces 39mm square stepper motors

APPLICATIONS:

- Disk Memory Systems (magnetic, 5.25″ half-high & 3.5″ formats)
- Optical Disk systems
- Incremental Motion systems

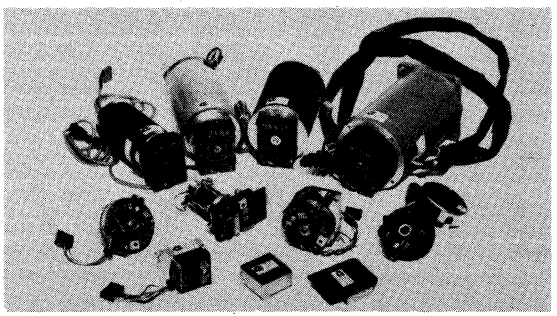
MOTOR:

- Rare-earth Magnets
- Excellent torque linearity
- Compact design
- Easy to use

OPTIONS

MOTOR
- –Two, three or four phase windings for full rotation
- –Wide choice of coil resistances
- –Different mounting configurations

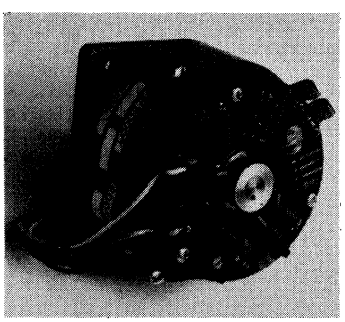
ENCODER
- –Index (TTL compatible)
- –Different connectors
- –Wide range of output voltages
- –Output waveform around zero volt



PROVEN PERFORMANCE IN HUNDREDS OF THOUSANDS OF WINCHESTER DISK DRIVES, PRINTERS, PLOTTERS, MEDICAL AND OTHER EQUIPMENT AND APPLIANCES

CM 400/450 Series

Encoder/Torquer



FEATURES:

ENCODER:

- Push-Pull Readout system
- Monolithic multi-element sensor
- Single, controlled output GaAlAs LED light source
- Outstanding repeatability
- Up to 2500 counts/turn, infinite resolution.

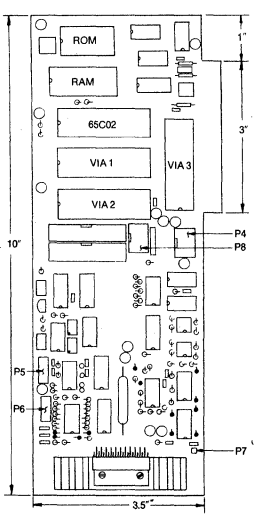
APPLICATIONS:

- Disk memory systems
- Robotics

MOTOR:

- Rare-earth Magnets (neodymium or samarium-cobalt)
- Excellent torque linearity
- Compact design
- Easy to use
- High torque/inertia ratio

CP 530 Motor Controller



FEATURES:

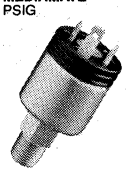
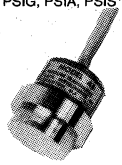
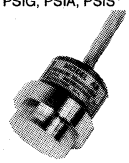
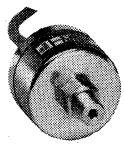
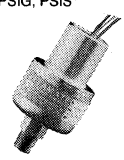
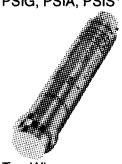
- Complete positioning system with constant velocity, deceleration ramp and analog position locking (detenting) and all necessary schematics and firmware listings
- 1200 baud RS 232 interface
- ROM based monitor and command interpreter
- 32 Kbytes RAM available to download positioning and test routines
- ±15 V, +5V power supplies, motor runs off +15 V only
- Smooth 128:1 speed range
- Simple, quadrature incremental optical encoder for full control
- Continuous velocity information (unavailable with strictly digital systems)
- True detenting (no "one bit jitter")
- No Hall switches needed for commutation of BDC motors
- Detent discrete position resolution is 512 times encoder resolution
- Current capacity: max 2 amps, short circuit protected

9321 Eton Ave., Chatsworth, CA 91311 • (818) 882-0424 • FAX (818) 882-0492 • Telex 183373

DATA INSTRUMENTS' PRESSURE TRANSDUCERS

Features

- Pressure ranges: 0–5 to 20,000 PSI
- Output: voltage, frequency, or current
- A unique design that puts stainless steel in contact with your pressure media
- Up to 2× rated pressure without damage; up to 10× rated pressure without bursting
- Full calibration and temperature compensation
- Unit-to-unit interchangeability: ± 1%
- Some models rated intrinsically safe

	MEDIAMATE PSIG	**Model AB/HP** PSIG, PSIA, PSIS[1]	**Model AB** PSIG, PSIA, PSIS[1]	**Models EA & EAF** PSIG	**Model SA** PSIA, PSIS[1]	**Model ES** PSIS[1]	**DATAMATE** PSIG, PSIS[1]	**Model BL** PSIG, PSIA, PSIS[1]
	 Compact Size	 High Performance[2]	 General Purpose[2]	Rugged OEM Style	 Sealed Absolute	Sealed	 Two-Wire Transmitter	 Two-Wire Transmitter[2]
Pressure Range	0–15, 25, 50, 100, 200, 500, 1000, 5000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–6, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 15,000, 20,000	0–6, 15, 25, 50, 100, 200, 300, 500, 1000, 2000, 5000	0–15, 25, 50, 100, 200, 500, 1000, 3000, 5000	0–100, 200, 300, 500	0–15, 25, 50, 100, 200, 500 1000, 3000, 5000	0–5, 15, 25, 50, 100, 200, 500, 1000, 2000, 3000, 5000, 10,000, 20,000
Accuracy[3]	± 1% span	To ± 0.25% span	± 1% span	± 1% span	± 1% span	± 1% span	± 1% span	± 1% span
Signal Output	0 to 50 mV	0 to 100 mV	0 to 100 mV	1 to 6 Vdc 1 to 6 kHz	1 to 6 Vdc	1 to 6 Vdc	4 to 20 mA	4 to 20 mA
Excitation Voltage	5 Vdc rec	5 Vdc rec 6 Vdc max	5 Vdc rec 6 Vdc max	8 to 20 Vdc 10 to 20 Vdc	9 to 20 Vdc	9 to 20 Vdc	12 to 45 Vdc	14 to 50 Vdc
Operating Temperature Range	−40°F to 257°F	−65°F to 200°F	−65°F to 200°F	−67°F to 257°F −40°F to 185°F	−67°F to 257°F	−67°F to 221°F	0°F to 212°F	0°F to 200°F
Compensated Temperature Range	30°F to 180°F	30°F to 160°F	30°F to 130°F	30°F to 185°F	30°F to 185°F	30°F to 185°F	30°F to 130°F	30°F to 130°F
Thermal Effect on Zero[4]	Less than ± 1% span	Less than ± 1% span	Less than ± 5% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 1% span	Less than ± 2% span
Thermal Effect on Span[4]	Less than ± 1%	Less than ± 1%	Less than ± 2%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%	Less than ± 1%

Transducer Instrumentation

Two meters are available: the versatile Intelligent Monitor/Control (IMC) and the low-cost PL-1.

IMC

Internal power supply ▪ Models available to match all transducers ▪ Two independent alarm circuits ▪ 4-digit/ self-calibration ▪ zero and span adjustments ▪ memory ▪ user access code ▪ voltage, current, or serial output

PL-1

Used with EA, ES, SA ▪ low cost ▪ zero and span adjustments

Talk to us about your special needs in the areas of:
▪ gaging ▪ specifications ▪ material ▪ mounting

We'll help you solve your pressure measurement problems.

[1] PSIS-pressure measured with reference to an internal chamber sealed at normal atmospheric pressure.

[2] Various adapters with threaded ports available for ease of installation.

[3] Includes effects of non-linearity, hysteresis, and repeatability.

[4] Specification applies to any 100°F range within the compensated temperature range.

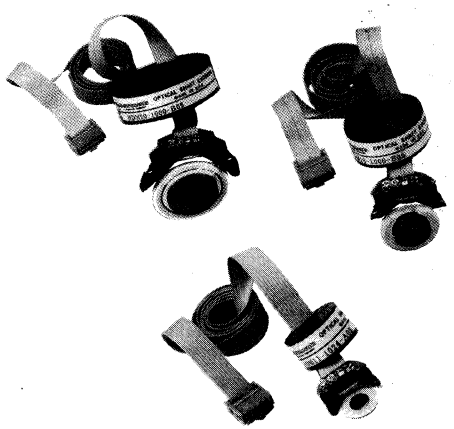
DATA INSTRUMENTS
100 Discovery Way, Acton, MA 01720 USA
Telex: 200081 Fax: (508) 263-0630

CALL: (508) 264-9550

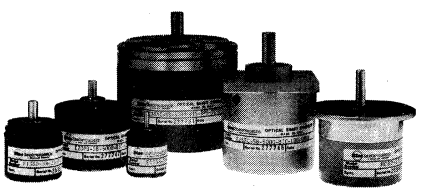
Honeywell

Disc Instruments Subsidiary

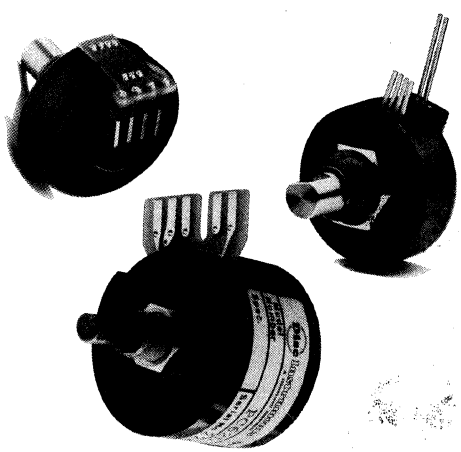
Leaders In Optical Encoder Technology



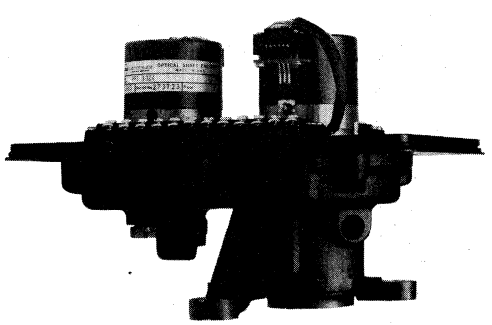
MODULAR ENCODERS



ENCLOSED ENCODERS



PANELCODERS



CUSTOM ENCODERS

HONEYWELL/DISC INSTRUMENTS
102 East Baker Street, Costa Mesa, California 92626
PHONE: (714) 979-5300 TWX 910-595-1987 DISC CSMA TELEX: 4722132 DISC CSMA FAX: (714) 432-7567

Honeywell
Disc Instruments Subsidiary

Optical Incremental Encoders

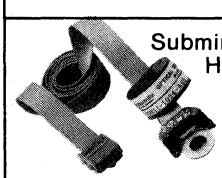
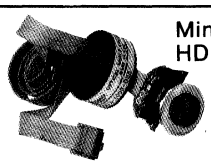
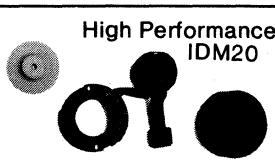
DISC INSTRUMENTS specializes in providing modular, enclosed, and panel mounted optical incremental encoders for position and velocity sensing applications. These encoders feature an exceptionally accurate quadrature output, minimal PM error, high frequency response, minimal edge jitter and low power consumption. These characteristics, combined with long term stability, makes these encoders ideal for a wide variety of motion control loop applications.

Keyed to the high performance and low cost features of these encoders is the incorporation of DISC's integrated optoelectronic technology. The sensor array and the optoelectronic signal processing integrated circuits are mounted on a .40" square hybrid circuit. All passive components are surface mounted on our printed wiring board.

High reliability and accuracy are assured by the use of state of the art robotic equipment to perform most of the encoder assembly and the use of resistor laser trimming for its calibration. Reduced component count due to the integrated optoelectronic circuitry also greatly enhances reliability.

Standard encoders do not always meet specific design requirements. For this reason, DISC INSTRUMENTS has developed an in-house optics shop, machine shop, prototype shop, and life testing lab in order to develop encoders to meet unique applications requirements.

Modular Encoders

	OUTPUT FORMATS	PULSES PER REVOLUTION	FREQ RANGE (kHz)	INPUT VOLTAGE (VDC)	INDEX OPTION	HUB SIZE (IN.)	OUTLINE DIMENSIONS INCHES
 Subminiature HDM-11	Squarewave Quadrature TTL compatible	Up to 1024	w/o index DC to 500 w/index DC to 100	5 12	Yes	.1248 in., .1562 in. .1875 in. 3mm, 4mm	1.10D x .60L
 Miniature HDM-15	Squarewave Quadrature TTL compatible	Up to 1024	w/o index DC to 500 w/index DC to 100	5 12	Yes	.1248 in., .1562 in. .1875 in., .2498 in. .3125 in., .3748 in. 4mm, 6mm 8mm	1.50D x .60L
General Purpose HDM-20	Squarewave Quadrature TTL compatible	Up to 2500	w/o index DC to 500 w/index DC to 100	5 12	Yes	.1562 in., .1875 in. .2498 in., .3125 in. .3748 in., .4373 in. .4998 in. 4mm, 6mm 8mm, 10mm	2.20D x .65L
Low Cost LDM20	Squarewave Quadrature TTL compatible	Up to 250	DC to 100	5	No	.2498 in., .3748 in. .4373 in., .4998 in. 4mm, 8mm	2.20D x .65L
 High Performance IDM20	Squarewave Quadrature TTL/CMOS Line Driver Option	Up to 2500	w/o index DC to 100 w/index DC to 50	5 12 15	Yes	.2498 in., .3748 in. .4373 in., .4998 in. 6mm, 8mm 10mm, 12mm	2.10D x .75L

Honeywell
Disc Instruments Subsidiary

102 East Baker Street, Costa Mesa, California 92626
PHONE: (714) 979-5300 TWX 910-595-1987 DISC CSMA
TELEX: 4722132 DISC CSMA FAX: (714) 432-7567

Panelcoder Series

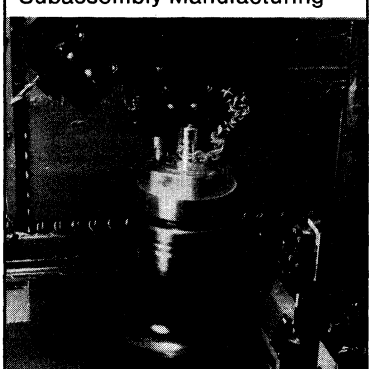
Designed specifically for applications requiring manual incrementing, the Panelcoder offers the engineer a digital alternative to the analog potentiometer. It replaces both the potentiometer and the analog-to-digital convertor. Typical applications include transceivers, oscilloscopes, factory automated equipment, medical equipment, and CAD/CAM/CAE equipment. The Panelcoder employs LED light sources, an optical disc, and photodetectors.

Available in a wide selection of resolutions and several configuration options, including low current drain for battery operation, the Panelcoder is the digital solution for eliminating noise and wear problems while providing continuous rotation in either direction with no discontinuation. For further information, or if you have an unusual requirement that necessitates a special unit, contact our Sales Engineers or our factory direct.

	OUPUT FORMATS	PULSES PER REVOLUTION	INPUT VOLTAGE (VDC)	OUTER DIAM. (IN.)	DEPTH BEHIND PANEL (IN.)	SHAFT DIAM. (IN.)	SHAFT LENGTH (IN.)
PC10C	Squarewave Quadrature TTL/CMOS compatible	5, 24, 64, 100, 120	5	1.0	.68	.2497	.25
PC10N	Squarewave Quadrature TTL/CMOS compatible	5, 24, 64, 100, 120	4.5 to 16	1.0	.50	.2497	.25
PC62	Squarewave Quadrature TTL/CMOS compatible	10, 40, 60, 100, 120, 127, 180, 200, 250, 256	5	1.5	1.08	.2497	.48

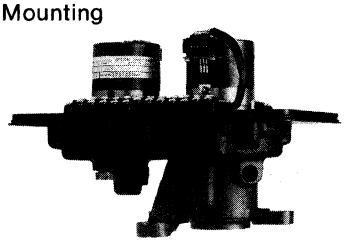
Custom Encoder Capabilities

Subassembly Manufacturing



Motor/Encoder Mounting

Encoder Subassembly Mounting



DISC INSTRUMENTS excels in designing unique encoders for new applications. Our Engineering Department has been designing encoders to meet tough performance requirements for over 20 years. Our computerized machine shop has the capability to fabricate the packaging of the encoder so that it fits easily into your product. Our optics shop can provide you with the disc that gives you the accuracy and precision your specifications require. Our extensive experience in optoelectronic circuit design can provide you with the feedback information your controller requires.

Even our assembly line is geared around manufacturing unique encoders. Not only can we build encoders in a large variety of sizes and shapes, we also have the ability to mount them on motors or subassemblies provided by you. In fact, for many customers we manufacture the subassemblies, as well.

The advantages of being tiny.

At Entran, we've solved most of the problems you might encounter with pressure transducers by making them tiny. And nowadays, tiny is the state-of-the-art.

Being tiny means you don't interfere with the integrity of the system being measured.

Being tiny means less measuring surface to bear loads, and a more compact solid state density with no moving parts.

Being tiny means being insensitive to acceleration, vibration and shock, so you get flat pressure readings, both static and dynamic.

And, being tiny means greater handling ease in hard-to-get-at places. Which adds up to more applications flexibility.

Entran pressure tranducers can usually be interfaced directly with scopes, recorders and milliammeters.

Our transducers come complete and ready to use. All you need supply is the excitation voltage on two leads and read output on the other two leads.

All units give you direct linear output in millivolts/psi and read both static and dynamic pressures. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, N.J. 07006 (201) 227-1002, Telex 130-361.

$360.00

Must not be used in water or corrosive medium.

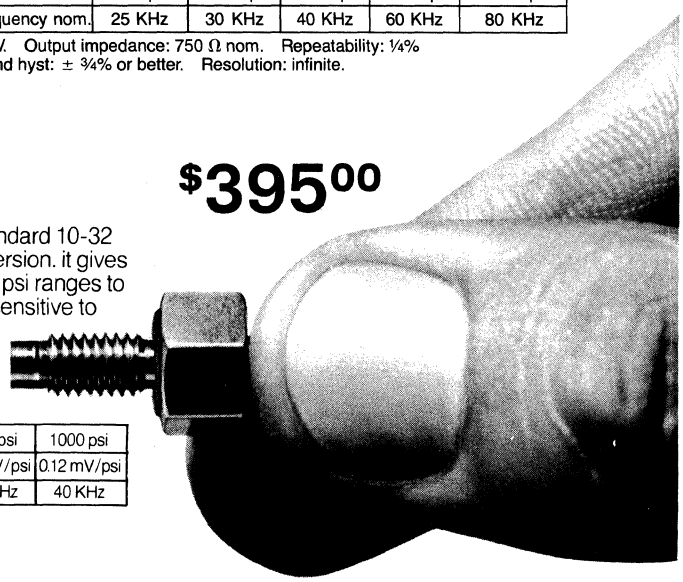
Only 0.080 in diameter (that's tiny), EPI-080.

This solid-state pressure transducer is 0.080" in diameter, 0.25" in length and occupies a volume of only 0.0013 cubic inches. Yet it gives accurate static and dynamic pressure readings like the big ones do. Its atomically bonded, diffused diaphragm with leads attached to the non-active area make this device virtually insensitive to acceleration, vibration and shock.

Typical ranges	25 psi	50 psi	100 psi	250 psi	500 psi
Sensitivity nom.	3mV/psi	1.8mV/psi	1.0mV/psi	0.4mV/psi	0.2mV/psi
Useful frequency nom.	25 KHz	30 KHz	40 KHz	60 KHz	80 KHz

Excitation: 5V. Output impedance: 750 Ω nom. Repeatability: ¼%
Non linear and hyst: ± ¾% or better. Resolution: infinite.

$395.00



Tiny but easy to handle, EPX-10

This easy to install pressure transducer is built with standard 10-32 UNF thread and is available in an optional M5 metric version. it gives flat pressure readings static and dynamic, in 5 to 5,000 psi ranges to as high as 90KHz. Has infinite resolution and is also insensitive to acceleration, vibration and shock. Made of stainless steel, and with its built-in "O" ring seal can be screwed in just about anywhere. However, for corrosive or water usage, order our "welded" version.

Typical ranges	5 psi	50 psi	100 psi	250 psi	1000 psi
Sensitivity nom.	3 mV/psi	1.5mV/psi	1.2 mV/psi	0.5 mV/psi	0.12 mV/psi
Useful frequency nom.	9 KHz	15 KHz	15 KHz	20 KHz	40 KHz

Combined non-linear and hyst: ± 1% below 100psi, ½% above 100 psi.
Excitation: 10V. Output impedance: 350 Ω nom.
Repeatability: 0.25%. Thread length: 7/16".

Entran® Pressure Transducers.

(Today, miniature makes sense.)

Call (201) 227-1002

FAX (201) 227-2865

For Technical Assistance & Customer Service Call 1-800-635-0650

Fast Delivery? Request Our New Off The Shelf Catalog

The advantages of being tiny.

At Entran we build a line of accelerometers that can best be described as tiny.

Being tiny means you don't interfere with the integrity of the system being measured.

Being tiny gives you greater handling ease in hard-to-get-at places, which adds up to more applications flexibility. And, being tiny means less mass to distort your test scale, more room for other instruments. All at no sacrifice in test data.

Entran accelerometers give you high output, low impedance readings, both static and dynamic. As a result they can usually be interfaced directly with scopes, recorders and milliammeters.

Entran accelerometers come complete and ready to use. All you supply is the excitation voltage on two leads and read output in millivolts on the other two leads.

All units give you direct linear output in millivolts/g and read both static and dynamic acceleration. There's no need for charge or voltage amplifiers. Calibrations are traceable to The National Bureau of Standards.

Write Entran Devices, Inc., 10 Washington Ave., Fairfield, NJ 07006 Phone 201/227-1002, Telex 130-361.

$379.00

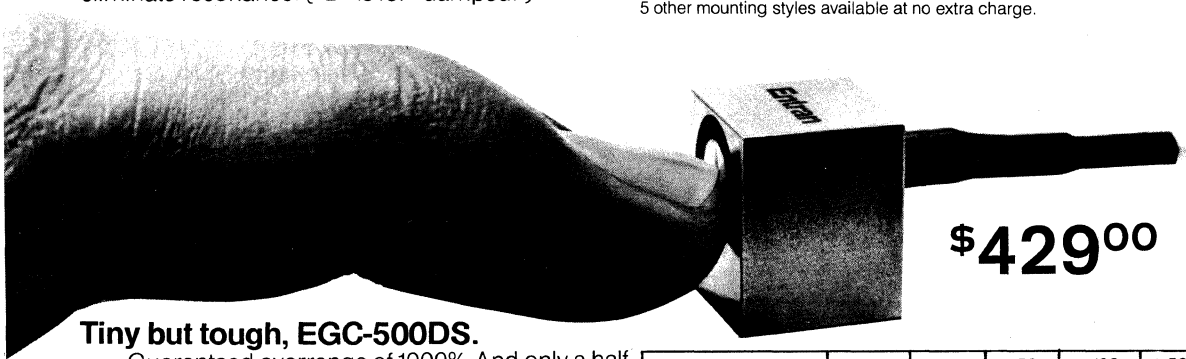
Tiny and feather-light, EGA-125-D.

This accelerometer weighs only one half a gram. Is less than 0.006 cu. inches in volume. Yet gives you static & dynamic readings of acceleration, vibration and shock. And comes with .7 critical damping to eliminate resonance. ("D" is for "damped.")

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	15 mV/g	12 mV/g	4 mV/g	2.5 mV/g	0.5 mV/g
Useful frequency nom.	150 Hz	200 Hz	500 Hz	600 Hz	1200 Hz

Excitation: 15V, Weight: ½ gram without leads, Non-linearity: ± 1%

5 other mounting styles available at no extra charge.



$429.00

Tiny but tough, EGC-500DS.

Guaranteed overrange of 1000%. And only a half inch cube to boot.

Static & dynamic measurements of acceleration, vibration and shock in ranges from 5 to 1,000 g. Fully damped to eliminate resonance and fitted with mechanical stops to impede overload response.

Typical ranges	± 5g	± 10g	± 50g	± 100g	± 500g
Sensitivity nom.	25 mV/g	20 mV/g	4 mV/g	2 mV/g	**0.4mV/g**
Useful frequency	150 Hz	200 Hz	600 Hz	1000 Hz	1500 Hz

Excitation: 15V, Weight: ½ gram without leads, Non-linearity: ± 1%

Output impedance: 450 Ω nom., Input impedance: 1000 nom.

Size: 0.5" × 0.5" 0.6" width, 10-32UNF tapped hole

Entran Accelerometers.

(Today, miniature makes sense.)

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FAX (201) 227-2865
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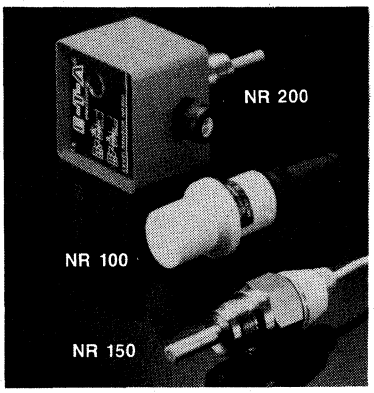
Fast Delivery? Request Our New Off The Shelf Catalog

E-T-A® electronic

LEVEL SENSORS



Level Sensors NR 150 and NR 200 are fully electronic and have no moving parts (except the output relay in model NR 200). Model NR 100, with Teflon® sensor head is also offered for food industry applications. The devices operate on the capacitance principle. A tunable oscillator circuit is ON when the probe is immersed, keeping the output conductive (relay output NR 200, transistor output NR 150). The indicator LED is now lit. When the level drops below the sensor position, the LED will extinguish and the output relay will drop out. Transistor output of model NR 150 is now non-conductive.

Technical Data

	NR 150	NR 200
Supply Voltage	DC 24V ± 15% reverse polarity protected	AC 115V + 10 – 15%

	NR 150	NR 200
Power Consumption	1 Watt max	4 VA max
Output	PNP transistor, DC 24V/0.3A Cont. load max., 1.5V drop approx. Integral suppression diode for short circuit protection.	Relay, SPDT contacts max 5A at AC240V or DC24V. Higher DC contact voltages up to DC100V are permissible but load must not exceed 120W
Ambient Temperature	–20°C to +85°C (–4°F to +185°F	–20°C to +85°C (–4°F to +185°C)
Medium Temperature	–20°C to +85°C (–4°F to +185°F) up to +100°C (+212°F) intermittent	–20°C to +85°C (–4°F to +185°F) up to 100°C (+212°F) intermittent
Environmental Protection	Electronic portion splash water/dust proof	Electronic portion splash water/dust proof
Probe Pressure Resistance	10 bar (147 PSI)	10 bar (147 PSI)
Terminations	Cable, 2m (6ft.)	Terminal block
Materials: probe fitting cover housing	 Tefzel V2A Delrin –	 Tefzel V2A Alu, black anodized ABS
Switch Point Hysteresis (probe mounted horizontally)	9mm (0.35in) max, equivalent to probe diameter	9mm (0.35in) max, equivalent to probe diameter
Fittings	Stainless Steel ¾" NPT	Stainless Steel ¾" NPT
Probe Diameter	9mm (0.35")	9mm (0.35")
Dimensions Overall length (incl. sensor) Housing	 133mm (5.24") –	 154.5mm (6.10") 82.5mm (3.25") x 80.5mm (3.17")

FLOW MONITORS

The E-T-A range of Electronic Flow Monitoring Systems has been designed to supervise the flow rate of gases and liquids in pipelines. There are no moving parts in the flow stream, thus these systems are particularly suitable for liquids of high viscosity or containing particles in suspension. Corrosion resistant monitoring heads are also available for aggressive liquids/gases.

Typical applications for E-T-A Flow Monitors include the control of lubricating, hydraulic and cooling systems and the requirements of the petrochemical, food processing and brewing industries when flow control is often associated with the correct dosage of ingredients.

The systems operate on the calorimetric principle i.e. heat transfer between two probes is detected as a function of flow rate.

	SFW 109	SLW 107	SFW 108	SLW 112
For liquids	●		●	
For air/gas	●	●		
For air only				●
Separate control unit and monitoring head	●			
Integral unit combining control unit and monitoring head		●	●	●
Miniaturized designed for mounting directly in flow stream				●
220/240 V.A.C. input	●	●	●	
115 V.A.C. input	●	●	●	
24 V.A.C. or D.C. input	●	●	●	●

E-T-A®
ELECTRONIC
PRODUCTS GROUP

7400 N. CRONAME RD.
CHICAGO, ILLINOIS 60648
TEL: (312) 647-8303
FAX: (312) 647-7494

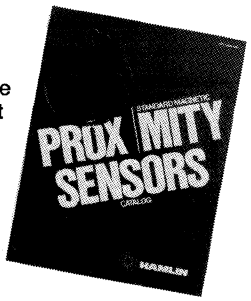
PROXIMITY SENSORS

HAMLIN

HAMLIN INC.
612 East Lake Street • Lake Mills, WI 53551
Phone 414/648-2361 • FAX 414/648-5244
TWX 910/260-3740

The heart of all Hamlin magnetic proximity sensors is a precious metal contact reed switch, sealed in a glass envelope for environmental integrity and dependability. When a magnetic actuator is placed within a prescribed proximity of the sensor, the switch contact changes state. Their cost is far below inductive or capacitive proximity sensors and they require no power to operate and provide a switch closure output.

For detailed product information request the Hamlin Magnetic Proximity Sensor Catalog. The 16 page brochure providescomplete data about Hamlin's broad family of standard Magnetic Proximity Sensors plus application and design recommendations. Also included are dimensions, electrical specifications and operation characteristics.



SPECIFICATIONS

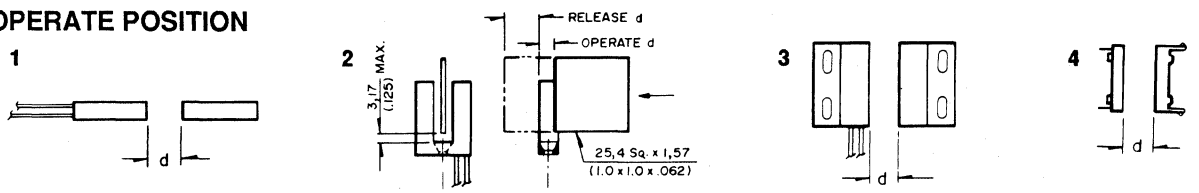
Initial Contact Resistance (Max.)... 0.200 Ohms (except 59045-010-0.250 Ohms)
Typical Operate Time.....1.000ms
Shock W/O False Operation.....100 G's, 11ms, 1/2 sine wave
Operate & Storage Temp.....-40°C to +105°C
Operation Life (Typical) .....50,000,000 @ 5Vdc, 10ma. 5,000,000 @ 120Vdc, 75ma.

ORDERING INFORMATION

SENSOR NUMBER	OPERATE POSITION	CONTACT RATING	SWITCHING VOLTAGE	MUST OPERATE DISTANCE	MUST RELEASE DISTANCE	TERMINATION OR WIRING	SENSOR LIST PRICE	MATCHING ACTUATOR	ACTUATOR LIST PRICE
59025-010	1	10W	200Vdc	.200	.550	12" PVC Leads	$3.50	57025-000	$2.80
59045-010	4	3W	150Vdc	.110	.275	PCB Pins	3.25	57045-000	2.60
59050-010	4	10W	200Vdc	.200	.450	PCB Pins	3.00	57050-000	2.40
59065-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57065-000	3.60
59070-010	1	10W	200Vdc	.200	.550	12" PVC Leads	4.50	57070-000	3.60
59085-010	2	10W	200Vdc	.060	1.100	12" PVC Leads	8.75	Vane	
59105-010	3	10W	200Vdc	.225	.500	Connector	4.15	57105-000	3.35
59125-010	3	10W	200Vdc	.225	.500	Pins	4.15	57125-000	3.35
59135-010	3	10W	200Vdc	.400	1.000	12" Teflon Leads	7.35	57135-000	5.80
59140-010	3	10W	200Vdc	.225	.500	12" PVC Leads	5.10	57140-000	4.85
59145-010	3	10W	200Vdc	.275	.600	12" PVC Leads	4.15	57145-000	3.35

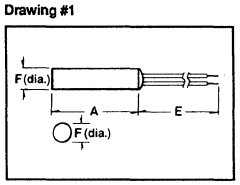
NOTE: All sensors listed are Contact Form A except for Model 59085-010 Vane Sensor.

OPERATE POSITION

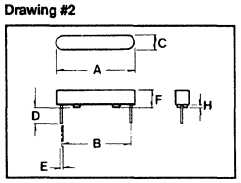


DIMENSIONS

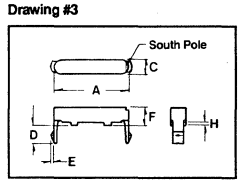
Drawing #1



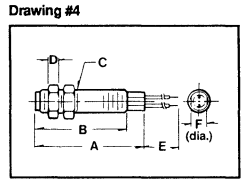
Drawing #2



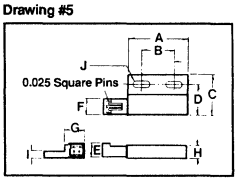
Drawing #3



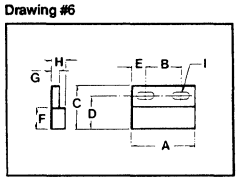
Drawing #4



Drawing #5



Drawing #6



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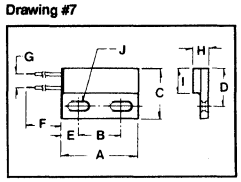
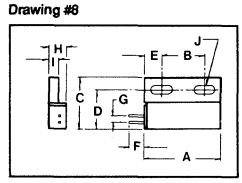
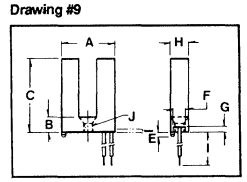


Drawing #8



Drawing #9



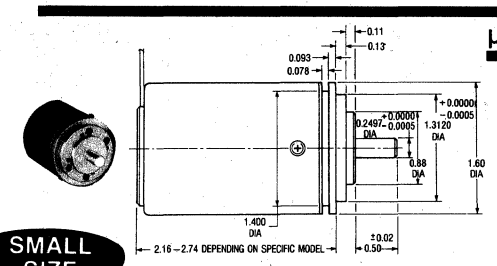
MODEL NUMBER	DESCRIPTION	DWG. NO.	A	B	C	D	E	F	G	H	I	J
59025-010	Sensor	1	1.000	—	—	—	12.0	0.245	—	—	—	—
57025-000	Actuator	1	1.000	—	—	—	—	0.245	—	—	—	—
59045-010	Sensor	2	0.700	0.600	0.130	0.115	0.017	0.170	—	0.025	—	—
57045-000	Actuator	3	0.700	—	0.130	0.160	0.250	0.170	—	0.025	—	—
59050-010	Sensor	2	0.900	0.800	0.180	0.115	0.020	0.200	—	0.025	—	—
57050-000	Actuator	3	0.900	—	0.180	0.160	—	0.200	—	0.025	—	—
59065-010	Sensor	4	1.500	1.250	5/16-24	0.187	12.0	7/32	—	—	—	—
57065-000	Actuator	4	1.500	1.250	5/16-24	0.187	—	7/32	—	—	—	—
59070-010	Sensor	4	1.500	1.250	M8x1,25	0.250	12.0	5,56mm	—	—	—	—
57070-000	Actuator	4	1.500	1.250	M8x1,25	0.250	—	5,56mm	—	—	—	—
59105-010	Sensor	5	1.125	0.625	0.750	0.562	0.260	0.288	0.375	0.250	0.135	0.125x0.308
57105-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59125-010	Sensor	8	1.125	0.625	0.750	0.562	0.250	0.236	0.100	0.250	0.135	0.125x0.308
57125-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	0.125x0.308	—
59135-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	0.200	0.250	0.375	0.125x0.312
57135-000	Actuator	6	1.125	0.625	0.750	0.500	0.250	0.375	0.135	0.250	—	0.312x0.125
59140-010	Sensor	7	0.906	0.551	0.551	0.430	0.177	12.0	—	0.236	0.296	0.126x0.150
57140-000	Actuator	6	0.906	0.551	0.551	0.430	0.177	0.296	0.118	0.236	0.126x.150	—
59145-010	Sensor	7	1.125	0.625	0.750	0.562	0.250	12.0	—	0.385	12.0	0.125x0.308
57145-000	Actuator	6	1.125	0.625	0.750	0.562	0.250	0.375	0.135	0.250	—	0.125x0.308
59085-010	Sensor	9	0.750	0.150	1.000	—	0.062	0.165	0.075	0.250	12.0	4-40 & C' Sink

ITEK LSI MICROSERIES® ENCODERS:

USED IN MORE AND MORE TACTICAL WEAPONS SYSTEMS.

FEATURES: Large Scale Integrated Circuits • Small Size • Absolute Whole Word Output • LED Illuminators • MIL Environment: Vibration 20g, Shock 1000g – 0.8ms • High Reliability.

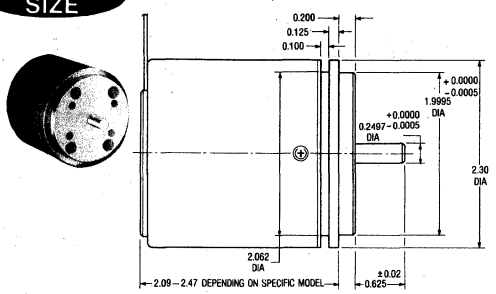
SMALL SIZE



HIGH ACCURACY

µS/16 FAMILY

L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS13/16	8192	2.0
µS14/16	16384	1.4
µS15/16	32768	1.0

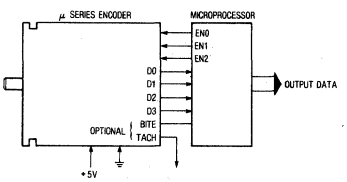


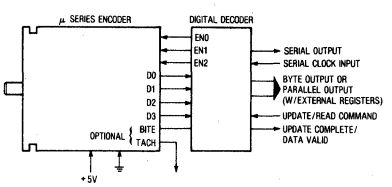
µS/23 FAMILY

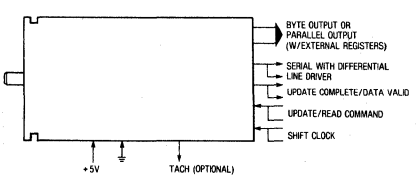
L, LS, LC Models	Quanta/ Revolution	Accuracy[1] (Arc Minutes)
µS14/23	16384	1.0
µS15/23	32768	0.7
µS16/23	65536	0.5 or 0.2
µS17/23	131072	0.2
K Model		
µS12/23	4096	2.6
µS13/23	8192	1.3

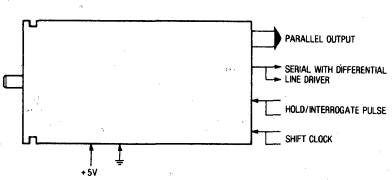
[1] Peak Transition Error of Transducer and Electronics, Excludes Quantizing Error of ½ LSB.

VERSATILE INTERFACE









L MODEL

The L model is the basic encoder configuration which outputs a 4 wire multiplexed, 3-State Logic Level MicroSeries Code Word. the encoder is addressed by 3 Enable Lines activated in a controlled sequence. This model is intended for direct interface with a user (or Itek) furnished microprocessor where the microprocessor can be programmed to perform the encoder's digital logic functions.

LS MODEL

The LS model consists of the basic L encoder (described above) and a separate Digital Decoder. The use of the external Digital Decoder is suggested when the user does not have a microprocessor available to perform the digital processing of the outputs of the L Model encoder or when the length of the LC encoder exceeds available space in the intended application. The external digital decoder also affords the user the flexibility to access the various input/output programming modes available with MicroSeries encoders. The Digital Decoder can be user programmed for three output modes: serial, 8 bit bytes, or parallel with strobe signals to latch user supplied external registers. Additionally, two data acquisition modes are possible: Update and Read.

LC MODEL

The LC Model contains an Integral MicroSeries Digital Decoder Chip. This model, essentially similar to the LS, is appropriate when an encoder without external processing circuits is desired. The same output and data acquisition modes as the LS Model are available but are built in at the factory for the LC Model.

K MODEL

The µS/23K Model encoders are *low cost* absolute encoders which provide 12 or 13 bits resolution with either parallel or serial output. In the parallel output mode all bits are continuously available. The HOLD pulse prevents any bit from changing state while the encoder is being read. In the serial output mode the user provides an interrogate pulse which provides the hold function and loads the shift register. Shift (clock) pulses provided by the user serially shift out the stored information.

Litton

Itek Encoder

27 Christina Street
Newton, Massachusetts 02164-1515

Telephone: 617-969-7300
TWX: 710-335-6783

ITEK PRECISION ENCODERS ON TARGET:

HIGH PERFORMANCE IN A SMALL PACKAGE.

Itek's precision encoders have substantially better accuracy than other shaft angle digitalizers of similar size and are designed for military or other demanding applications where high reliability is desired.

All Itek precision encoders are specifically designed for rugged military environments – tracked vehicles, shipboard, and airborne – and have been tested to corresponding vibration, shock, and temperature levels for these applications.

Digisec® Encoders–RA series

Rotary Absolute Encoders

SIZE (Inches) Model	O.D.	Shaft Diam.	Resolution (Quanta/Rev.) Binary (2^{xx})	BCD
SOLID SHAFT 15	1.5	.187	S 16, S 17, S 18, S 19, S 20	
23	2.3	.25	C 11, C 12, C 13, T 16, T 17, T 18, T 19, T 20	
35	3.5	.375	C 12, C 13, C,S 14, C,S 15, C,S 16, C,S 17, S 18	S 3.6K, S 36K
THRU-HOLE 55	5.5	.75	S 16, S 17, S 18, S 19, S 20	
60	6.0	2.25	S 16, S 17, S 18, S 19, S 20	
100	10.0	2.75	S 16, S 17, S 18, S 19, S 20, S 21	S 36K, S 360K
106	10.0	6.0	S 16, S 17, S 18, S 19, S 20, S 21	S 36K, S 360K
117	11.0	7.0	S 19, S 20, S 21	
158	15.0	8.0	S 20, S 21, S 22	

OD—Outside Diameter ID—Inside Diameter C—Self-contained Electronics

Features: • Parallel whole word unambiguous output • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Highest accuracies available anywhere • Operating temperature –40° to +71°C • Military Specification rated • Instant on-the-fly readout • LED light sources • Separate Electronics—no electronics in optical unit (thru-hole systems)

Available Options: • Serial readout • Line driver output • Redundancy • Chrome slit and disc (standard on size 23 and size 158) • Binary lamp display • Subtractor card for electronic zeroing

RI series

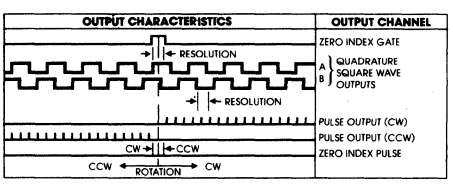
Rotary Incremental Encoders

Resolution (Quanta/Rev.) Binary (2^{xx})	Decimal
C 8, C 9, C 10, C 11, C 12, C 13	C 0.5K, C 1.0K, C 1.8K, C 2.0K, C 3.6K, C 4.0K, C 5.0K, C 6.4K, C 8.0K
C 13, C 14, C 15, C 16, C 17, C 18, C 19	C 20K, C 32K, C 36K, C 40K, C 50K, C 64K, C 72K, C 100K, C 128K, C 180K, C 200K, C 320K, C 360K, C 640K
C 16, C 17, C 18, C 19, S 20	
C 17, C 18, C 19, C 20, S 21	C 360K
C 17, C 18, C 19, C 20, S 21	C 360K
C 20, C 21, S 22	

S—Separate electronic enclosure T—2 speed geared paired configurations

Features: • Quadrature square wave or pulse output, zero index • T TL/DTL compatible • Resolution to 0.31 arc-seconds (22 bits) • Self-contained electronics • Operating temperature –40° to +71°C • Military Specification rated • LED light sources

Available Options: • Line driver output • Pigtail cable • Square wave or pulse output



Environmental Ratings. All DIGISEC® encoders are designed to meet rigid military specifications. The following environmental specifications are typical: Temperature: –40° to +71°C Vibration: 10-20g Humidity: 0 to 98% Shock: 50g, 11 milliseconds (higher on solid shaft models)

Spacecraft Encoders: Absolute & Incremental

Model	Type	Diam. (inches)	Resolution (Quanta/Rev.)	Accuracy	Weight (lbs.)	Power (watts)	Features
RA21/1510	Absolute	15.0	2^{21}	2.6 sec	20.0	3.0	10 Inch Thru-hole Electrical Redundancy.
RA18/60	Absolute	6.0	2^{18}	10.0 sec	8.5	3.0	Elect. & Mech. Redundancy.
RI13/35	Incremental	3.5	2^{13}	2.6 min	3.0	2.0	Commutator Outputs.
RI20/63	Incremental	6.3	2^{20}	1.5 sec	1.7	0.5	Unhoused. Commutator Outputs.
RI36K/40	Incremental	4.0	36,000	2.5 sec	3.0	0.3	Electrical Redundancy.
RI14.4K/23	Incremental	2.3	14,000	1.5 min	.75	0.4	Commutator Outputs.

Features: LED Illuminators • Resolution to 0.31 Arc Seconds (22 Bits) • Highest Accuracy Available Anywhere. Available with bearings (housed) or without (unhoused).

Litton

Itek Encoder

27 Christina Street
Newton, Massachusetts 02164-1515

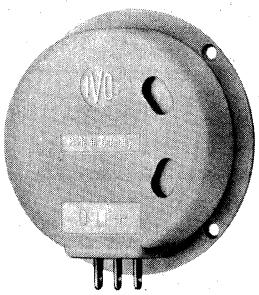
Telephone: 617-969-7300
TWX: 710-335-6783

Pulse generators

Product Group G

Low-cost optoelectronic kit encoder — G 313

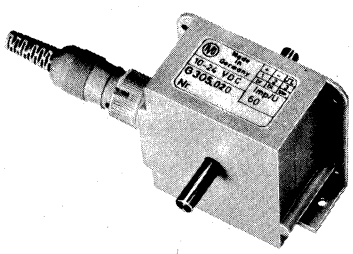
Mounts directly to motor shaft and housing
No critical mechanical alignment necessary
Up to 90 pulses per revolution
5 VDC operation
Open collector output
Max. switching rate 5000 ips



NEW

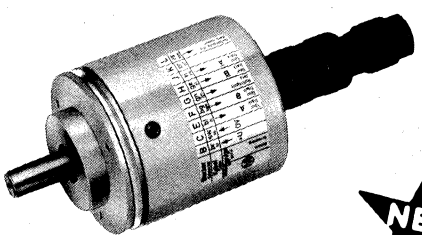
Low-cost optoelectronic shaft encoder — G 305

Rectangular housing with intergral mounting flanges
Single or dual pulse track output
Up to 120 pulses per revolution
Operating voltage 10-30 VDC, or 5 VDC with TTL output
Max. speed 6000 rpm or 10000 ips
Precision ball bearings
Supplied with connector or optional cable assembly



Optoelectronic shaft encoder — G 317

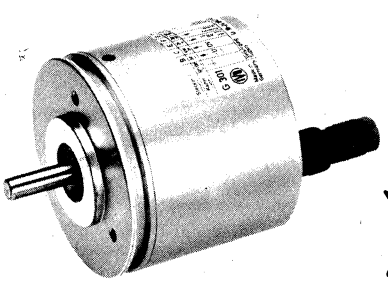
State-of-the-art SMD circuit technology
Uni- or bidirectional operation
UP/DOWN output or quadrature mode
Optional zero-pulse output
Up to 2000 pulses per revolution
Max. speed 6000 rpm or 10000 ips
Precision ball bearings
Supplied with connector or optional cable assembly



NEW

Optoelectronic shaft encoder — G 306

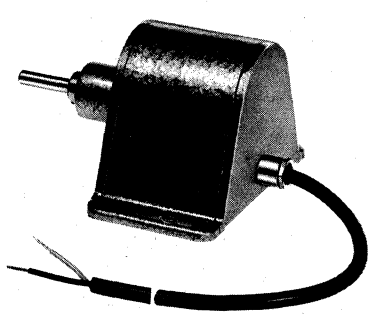
Uni- or bidirectional operation
UP/DOWN output or quadrature mode
Optional zero-pulse output
Up to 5000 pulses per revolution
Max. speed 6000 rpm or 80000 ips
Precision ball bearings
Supplied with connector or optional cable assembly



NEW

Mechanical rotary pulse generator — G 080

Converts shaft rotation to switch contact closures
Rugged die-cast housing with mounting flanges
Available ratios include 1, 2, 5, 10 rev. = 1 pulse; or 2, 3, 4, 5 pulses = 1 rev.
SPST Normally open contact standard
Max. speed 1500 rpm or 25 ips



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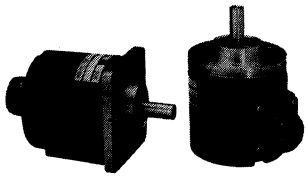
From robotics, computers, and machine tools to aerospace . . .

Use the Litton Encoder lineup to build a better product.

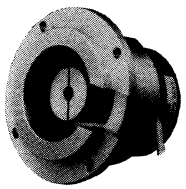
INCREMENTAL



MODEL 80
Optical
Industrial
2.5″ dia.

HYBRID TECHNOLOGY

NEW!

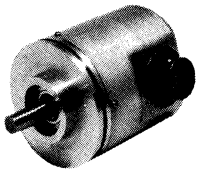


MODEL EHC25
Housed Unit with Integral Coupling
2.5″ dia.

MODEL 83
Optical
1.5″ dia.

MODEL 84A
Optical
2.2″ dia.
HYBRID TECHNOLOGY

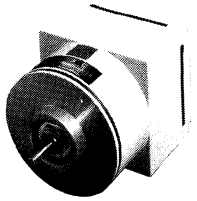
ABSOLUTE



MODEL 76
Low Cost Optical
2.65″ dia.

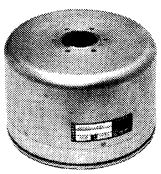
MODEL 22
Commercial & Industrial
2.187″ dia.

MODEL 23/35
Optical
Commercial & Military

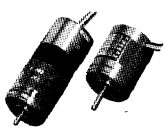


MODEL 43
Multi-Turn
4.3″ dia.

ABSOLUTE / INCREMENTAL

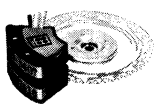


MODEL 60
Optical
6″ dia.



MODEL 11
Pin Contact/Optical

MODULAR



MODEL MGC
Absolute
Optical
2″ dia.

NEW!

MODEL 815
Incremental
Optical
1.5″ dia.

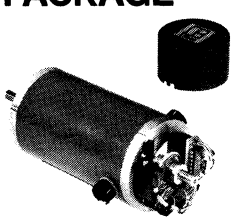
MODEL 721
Incremental
Optical
2.2″ dia.

MODEL 820A
Incremental
Digital
2.1″ dia.

MODEL 920
Incremental
Analog
2.1″ dia.

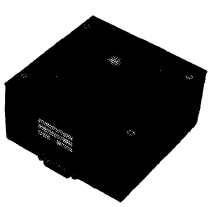
HYBRID TECHNOLOGY

MOTOR/ ENCODER PACKAGE



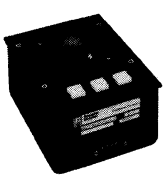
TRACKBALL SYSTEMS

NEW!



Commercial & Military
4″ sq.

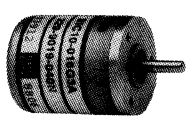
Commercial
3″ sq.
RS232 Interface Option



Special Push Button Model

SPECIALS/CUSTOM DESIGN

Incremental
Military



Optical Detented Switch

The Litton Encoder team leads the way with encoders and special products that help you build more reliable, higher quality, cost-effective products with the precision you need.

Our product lineup is the broadest in the industry and meets a wide range of requirements in applications from robotics, computer peripherals, medical equipment, and industrial controls to specialized, high-reliability designs for aerospace and defense.

For anything from simple modular kits to sophisticated custom designs, put Litton Encoder on *your* design team. For complete data and specifications, contact —

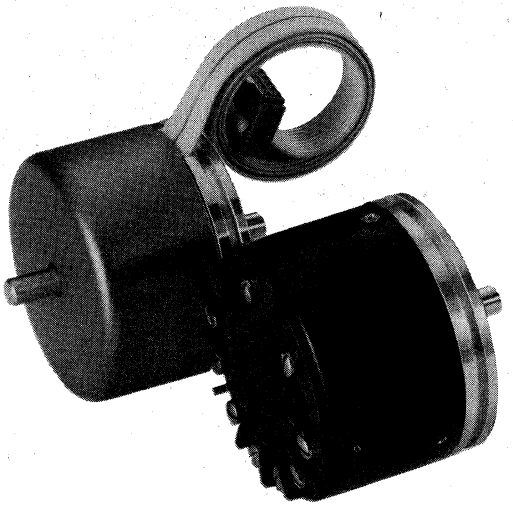
Litton
Encoder

The Marketing Department
Litton Encoder Division
20745 Nordhoff Street
Chatsworth, California 91311-5979
Telephone (818) 341-6161 TWX 910-494-1229

Optical Shaft Encoders

Incremental Encoders manufactured by Lucas Ledex Inc.

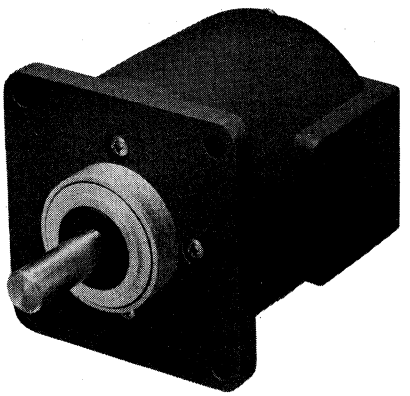
RC-23 Instrument Encoder



Low cost, high performance self-contained encoder which meets OEM requirements for high quality and offers features of more expensive units. LED light source, single or dual channel complementary outputs and optional marker pulse.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
50 to 2500	5 to 15	TTL, CMOS, sine wave, line driver	0 to 100	¼	2.25 DIA x 1.45 L

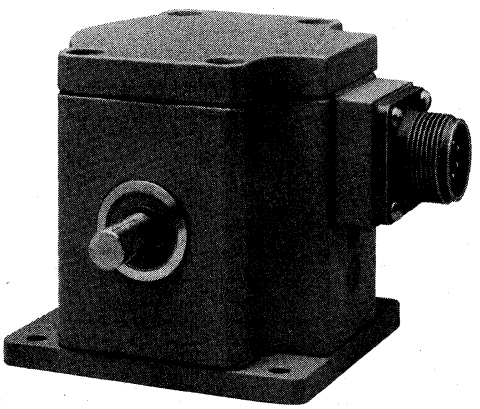
Tru-Mite Industrial Encoder



High performance, industrial duty, incremental encoder with ⅜" diameter shaft and sealed bearings. Cast aluminum housing with flange or servo mount. Side or end-mounted MS connector. LED light source. English/ Metric combinations available.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
140 to 5000	5 to 15	TTL, HTL, CMOS, sine wave, line driver	0 to 100	⅜	2½ DIA x 2½ L

Tru-Tac Industrial Encoder



Economical, industrial duty, incremental encoder with double-ended, ⅜" diameter shaft and sealed bearings. Foot or face mounting and MS connector. LED light source.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHz)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
10 to 600	5 to 24	TTL, HTL CMOS, line driver	0 to 30	⅜	.3L x 3¼W x 3⅛H

Request catalogs.

Lucas Ledex

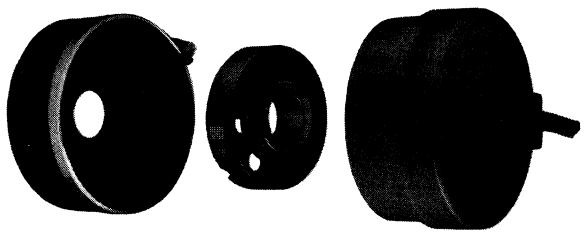
Lucas Ledex Inc.
P.O. Box 427
Vandalia, Ohio 45377-0427 U.S.A.

Phone: 513-898-3621
TWX/Telex: 6874241, 6874243
FAX: 513-898-8624

Optical Shaft Encoders

Incremental Encoders manufactured by Lucas Ledex Inc.

Trim-Step® Modular Encoder

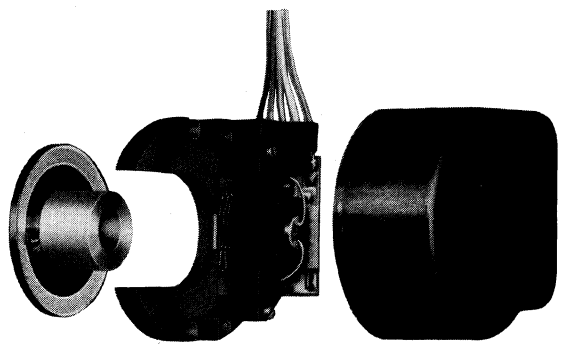


Rugged, modular, incremental encoder designed to be integrally mounted on a stepper motor. Consists of a cylindrical slotted rotor and concentric stator. High shaft end play tolerance (.020"). Easy to install.

Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
50 to 250	5	TTL, HTL, CMOS, sine wave	0 to 25	N/A	2¼ DIA x 1⅜ L

Trim-Step is a registered trademark of Lucas Ledex Inc.

K Series Modular Encoders

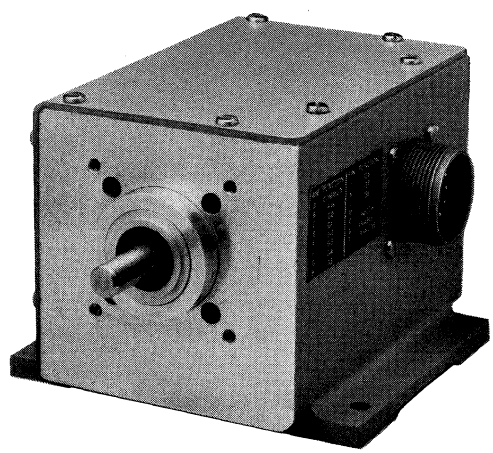


Two sizes of low cost, modular encoders designed for integral mounting on servo or stepper motors. Consists of a low inertia disc, photohead, and dust cover. Units are prealigned to minimize user installation time.

	Pulses Per Rev.	Input Voltage (VDC)	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
K3	50 to 2500	5 to 12	TTL, CMOS, sine wave	0 to 50	N/A	2.1 DIA x .8 L
K15	50 to 1000	5 to 12	TTL	0 to 50	N/A	1.5 DIA x .75 L

Absolute Encoder

Model LR



Industrial duty, absolute encoder. Heavy duty cast aluminum housing with ⅜" or ⅝" diameter shaft, and sealed bearings. Foot or face mounting and MS connector. LED light source. Non-ambiguous output.

Resolution (Single Turn)	Input Voltage (VDC)	Output Codes	Output Formats	Frequency Range (KHZ)	Shaft Dia. (Inches)	Outline Dimensions (Inches)
9 Bit	5 to 24	BCD, gray, natural binary	TTL, HTL, CMOS	0 to 50	⅜ or ⅝	5L x 3½W x 3⅝H

Request Catalogs.

Lucas Ledex

Lucas Ledex Inc.
P.O. Box 427
Vandalia, Ohio 45377-0427 U.S.A.

Phone: 513-898-3621
TWX/Telex: 6874241, 6874243
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MINIATURE ELECTRIC DRIVE SYSTEMS AND ROTARY
POWER TRANSMISSION COMPONENTS UP TO 1 H.P.

- Special resolutions & integrated motor-encoder packages available.
- Built-in circuitry available on most models.

INCREMENTAL ENCODER STYLE SELECTOR

SERIES	CASE (mm)	DIAMETER (in.)	OPERATION	STD. RESOLUTION (PPR)	OUTPUT
02A	22	.866	OPTICAL	15	2 CHANNEL QUASISINUSOIDAL
09A	22	.866	OPTICAL	180	2 CHANNEL QUASISINUSOIDAL
10A	22	.866	OPTICAL	100	2 CHANNEL QUASISINUSOIDAL
HE	15 OR 16	.591/.630	MAGNETIC	15, 16	2 CHANNEL; SINE OR SQUARE
PREX	40	1.575	OPTICAL	100,200,250,300 360,400,500,600	2 CHANNEL + INDEX; SQUARE
HEDS-5000	28	1.102	OPTICAL	100,192,200,256, 360,400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-5500	30x41.1	1.18x1.62	OPTICAL	96,100,192, 400,500,512	2 CHANNEL + INDEX; SQUARE
HEDS-6000	56	2.205	OPTICAL	192,200,400,500, 512,1000,1024	2 CHANNEL + INDEX; SQUARE

ASK ABOUT OUR NEW MCX-02 MOTOR CONTROLLER AND CONTROL SYSTEM ACCESSORIES

- Position/Velocity Control of DC Servo, PMDC, Brushless, & Stepping Motors with Extensive Interfacing Capabilities.
- 2 Axes Simultaneous Control Standard (up to 32 Possible with Plug-in Modules).
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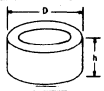
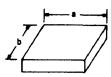
Piezoelectric Ceramics and Transducers

MURATA ERIE NORTH AMERICA

External Appearance		Description	How to Denote Type Number
Disk		Electrodes are provided at the both sides of the disk to generate radial mode and thickness mode (also with column type).	(Example) 3 ① D ② – 100 ③ – 200 ④ ①Signifies material, P-3 (expressed as 5 if P-5). ②Disk shape ③Diameter, D (mm) ④Resonant frequency (KHz)
Cylinder		Electrodes are provided on the interior and exterior surfaces of the cylinder to generate hoop mode, thickness mode and length mode.	(Example) 5 ① T ② – 38 ③ – 30 ④ – 400 ⑤ ①Signifies material, P-5. ②Cylindrical shape. ③Diameter, D (mm). ④Height, h (mm). ⑤Resonant frequency or desired mode (KHz).
Square plate		Electrodes are opposingly provided on the both sides of the plate to generate thickness mode and length mode (also with square pillar type).	(Example) 7 ① R ② – 12 ③ – 6 ④ – 3000 ⑤ ①Signifies material, P-7. ②Square plate shape. ③Lengthwise size, a (mm). ④Widthwise size, b (mm). ⑤Resonant frequency or desired mode (KHz).
Annular shape		Electrodes are provided on the both ends of the ring to mainly generate thickness mode.	(Example) 3 ① C ② – 50 ③ – 6 ④ – 200 ⑤ ①Signifies material, P-3. ②Annular shape. ③Outer diameter, D (mm). ④Inner diameter, d (mm). ⑤Resonant frequency (KHz).

1. Bimorph Type Actuator

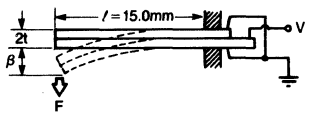


Fig. 1
Width: a = 10.0 mm
Thickness: 2t = 0.6 mm
Material: P-5D

2. Multilayer Type Actuator

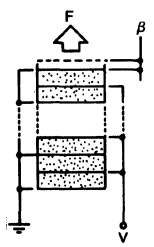
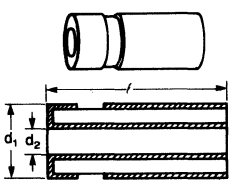


Fig. 2
Area: S = 25 mm
Thickness: t = 0.5 mm
No. of layers: a = 20
Material: P-7

3. Ink-Jet Actuator



(Sectional View)

Fig. 3
Shaded Section: Electrode
$d_1 > 1.5$ mm
$d_2 > 1.0$ mm
l: 10~20 mm

PHYSICAL CONSTANTS OF PIEZOTITE®

Constant		Symbol	Unit	P-3	P-5	P-6E	P-7
Frequency Constant	Thickness mode	f·t	Hz·m	2560	1960	2000	1800
	Length mode	f·l		2280	1680	1700	1450
	Radial mode	f·D		3100	2220	2320	2000
Electro-mechanical Coupling Coefficient	Thickness mode	k_{33}	—	0.49	0.68	0.59	0.70
	Length mode	k_{31}		0.19	0.30	0.26	0.30
	Radial mode	k_p		0.32	0.52	0.45	0.60
Piezoelectric Strain Coefficient	Thickness mode	d_{33}	10^{-12} m/V	172	317	234	412
	Length mode	d_{31}		58	105	100	194
Voltage Output Coefficient	Thickness mode	g_{33}	10^{-3} V·m/N	15.2	28.9	19.0	24.0
	Length mode	g_{31}		5.3	10.2	8.3	11.0
Dielectric Constant		ε	—	1150	1300	1350	1900
Young's Modulus		E	10^{10} N/m^2	11.4	8.2	8.5	6.2
Density		ρ	10^3 kg/m^3	5.3	7.2	7.4	7.4
Mechanical Q		Qm	—	400	230	420	80
Curie Point		Tc	°C	110	260	275	320
Poisson's Ratio		σ	—	0.31	0.32	0.31	0.37
Thermal Expansion		α	10^{-6}/°C	15.0 (20~90°C)	2.0 (0~300°C)	1.5 (0~300°C)	5.0 (0~300°C)

CLASSIFICATION AND MAIN APPLICATIONS OF PIEZOTITE®

Material	Outstanding Feature	Main Application
P-3	A most broadly used material having barium titanate as a main constituent mixing other components to improve temperature characteristics around normal temperature.	For powerful ultrasonic oscillation such as cleaner, processing equipment, etc., fish finder, underwater sounding equipment, etc.
P-5	Titanate-zirconate is used as main constituent. Electromechanical transformation efficiency is great. This material resists against a high temperature of 200°C and has an excellent aging resistivity.	Powerful ultrasonic oscillation and high pressure generation such as for high-performance and high temperature cleaner or processing equipment, etc.
P-7	Like P-5, titanate-zirconate is used as a main constituent. P-7 has a greater electromechanical transformation efficiency than P-5. Especially, this material is suitable for application into nonoscillating system for its low mechanical Q.	Record player pickup, microphone, aerial ultrasonic equipment, high band resonator, etc.

MURATA ERIE NORTH AMERICA 2200 Lake Park Dr., Smyrna, Georgia 30080 Tel: (404) 436-1300 Telex: 54-2329 TWX: 810-766-1531

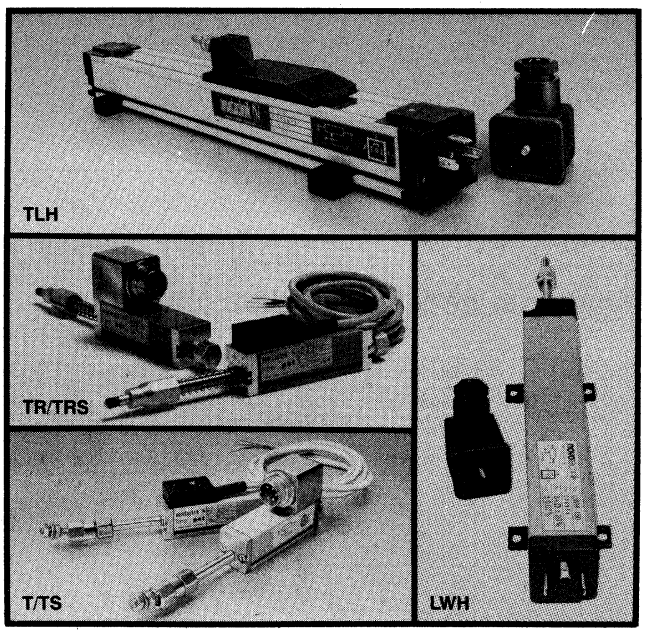
Displacement Transducers • Rotary and Rectilinear

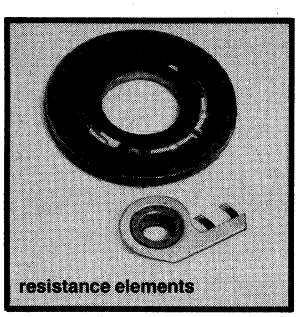
Novotechnik U.S.'s family of rotary and rectilinear displacement transducers features outstanding linearities, high tolerance to environmental extremes, and long operating lifetimes (typically 100 × 10^6 operations).

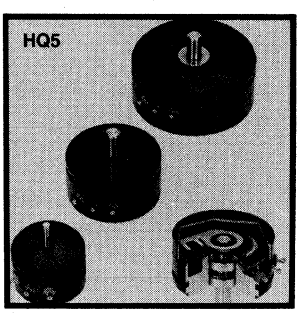
The position transducers and rotary potentiometers have conductive plastic resistance and collector tracks, and use multi-fingered elastometer-damped precious metal wipers.

The linear transducers offer a range of electrical strokes from 25mm to 3000mm, with resolution better than .01mm and linearities as low as 0.01%. Operational speeds are typically as high as 10 m/s.

The rotary potentiometers give 360° of mechanical rotation, linearities to 0.025% and resolution better than 0.01°.







Linear Position/Displacement Transducers

TLH Series Features side actuation and ball coupling to eliminate offset errors, and eighteen stroke lengths from 100–3000mm. Independent linearity is between ±.07% and ±.01%; resolution is .01mm.

LWH Series Features pivoting front bearing and range of connectors: DIN, Binder, or Amphenol. Ten stroke lengths are available from 75 to 1200mm, with independent linearity between ±.07% and ±.01% and resolution of .01mm.

TR/TRS Series Displacement transducer with stroke length of 25, 50, 75 or 100mm, return spring and double bearings. Linearities range from ±.2% to ±.15%; 3-core cable or plug-and-socket connections are available.

T/TS Series Features double precision bearings and anti-rotation mechanism for load-free operation, five stroke lengths from 25 to 150mm, and linearities from ±.2% to ±.075%. Two alternate electrical connections are available: via 3-core cable (type T) or plug-and-socket (type TS).

Resistance Elements Novotechnik U.S. offers resistance elements with stroke lengths between 25 and 3000mm and wipers for integration into a customer's system or device. Special customized versions are available.

Rotary Potentiometers

HQ5 Series Novotechnik's standard units for machinery and instrumentation. Linearities of ±.05% (servo sizes 9, 11 and 13) and ±.025% (size 20) are achieved through final stage trimming of fully assembled potentiometer. Max. operational speed 10,000 rpm; acceleration 50,000 rad/s^2.

Resistance Elements Rotary potentiometer elements are available with wipers for incorporation into customers' devices as integral potentiometers.

Special-Purpose Potentiometers Novotechnik U.S. offers rotary potentiometers for a wide spectrum of applications:

- Low Torque Potentiometers...for angular measurement without loading
- Industrialized Potentiometers...for use in harsh environments
- Sensor Potentiometers...specially developed for the automobile industry
- Geared Potentiometers...for use in harsh environments with backlash-free gearing for 3, 5 or 10 turns
- Motorized Potentiometers...self-contained units with speeds from 120°/s to 360°/s and output torque from 10Ncm to 100Ncm.

Custom-designed Transducers

Novotechnik U.S. welcomes inquiries from design engineers with special needs for sensing and transmitting motion, position and displacement. We welcome custom designs and the opportunity to quote on any unique requirement you may have. For more information call us at (617) 485-2244 (fax: (617) 485-2430).

novotechnik

Novotechnik U.S., Inc.
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488 Boston Post Road
Route 20 East
Marlborough, MA 01752
Tel: (617) 485-2244
FAX: (617) 485-2430

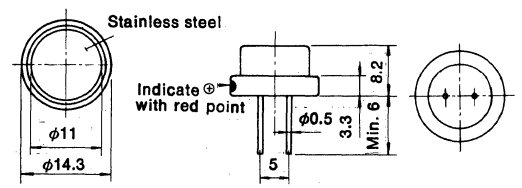
TECHNICAL CERAMICS

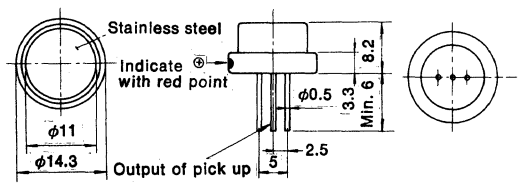
NGK SPARK PLUGS (U.S.A.), INC.
99 Morris Ave., Springfield, NJ 07081
Phone: (201) 376-6070
1701 North Greenville Ave., #205 Richardson, TX 75081,
Phone: (214) 235-8332. TELEX: 170547UT

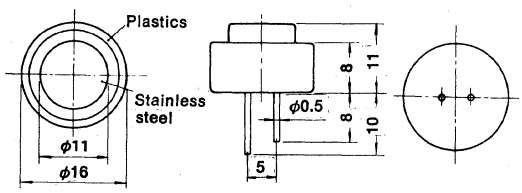
NTK ULTRASONIC SENSOR

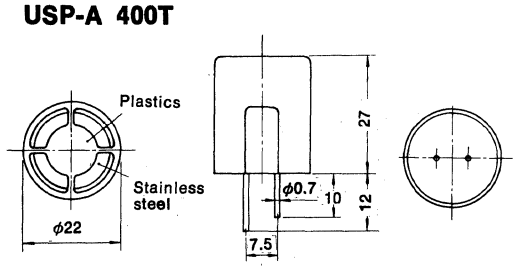
EVERY TYPE IS HERMETIC SEALED AND MOISTURE-PROOFED.

Dimension (Unit: mm)	Model Number	Center Frequency KHz	Transmit Sound Pressure (dB)	Receiving Sensitivity (dB/V/μbar)	Directional Angle (Deg.)	Input Voltage (Vp-p)	Temperature Range (°C)
EDS-A, EDS-B TYPE	A335	33.5 ±0.2	95 Min.	—	40	30	−20 ~ +70
	B335	33.5 ±0.2	—	−72 Min.	40	—	
	C335	33.5 ±0.2	95 Min.	—	40	12	
EDS-C TYPE	A250	25.0 ±0.2	95 Min.	—	45	30	
	B250	25.0 ±0.2	—	−72 Min.	45	—	
	C250	25.0 ±0.2	95 Min.	—	45	12	
UCM-S200-	S200T	220 ±5	—	—	8	40	−10 ~ +60
	S200R	210 ±5	—	—	8	—	
	S300	300 ±10	—	—	10	40	
USP-A 400T	A400T	40 ±0.2	105 Min.	—	15	50	−10 ~ +60
	A400R	40 ±0.2	—	−65 Min.	15	—	
	B400T	40 ±0.2	100 Min.	—	25	40	
	B400R	40 ±0.2	—	−65 Min.	25	—	





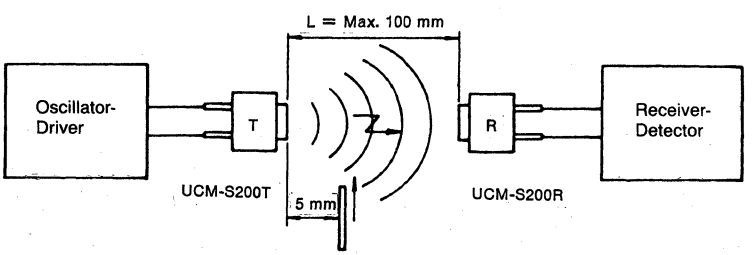




APPLICATIONS

- Proximity Sensor
- Burglar Alarm
- Remote Control
- Level Meter

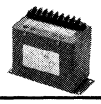
EXAMPLE OF APPLICATION



AC WATT TRANSDUCER PC5 SERIES

SINGLE PHASE 50/60 Hz MODELS

SUPPLIED WITH INTERNAL SENSOR

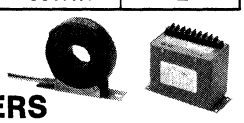


MODEL NUMBER PC5-	EFFECTIVE RANGE		WATTS AT RATED OUTPUT 1mA	CURRENT SENSOR
	VOLTS	AMPS		
1B	0 to 150	0 to 5	500W	Internal
2B	0 to 300	0 to 5	1KW	Internal
3B	0 to 600	0 to 5	2KW	Internal
10B	0 to 150	0 to 10	1KW	Internal
11B	0 to 300	0 to 10	2KW	Internal
12B	0 to 600	0 to 10	4KW	Internal
19B	0 to 150	0 to 15	1.5KW	Internal
20B	0 to 300	0 to 15	3KW	Internal
21B	0 to 600	0 to 15	6KW	Internal
103B	0 to 150	0 to 1	100W	Internal
104B	0 to 300	0 to 1	200W	Internal
105B	0 to 600	0 to 1	500W	Internal
106B	0 to 150	0 to 2.5	250W	Internal
107B	0 to 300	0 to 2.5	500W	Internal
108B	0 to 600	0 to 2.5	1000W	Internal

SUPPLIED WITH CURRENT TRANSDUCERS

28B	0 to 150	0 to 50	5KW	C†
29B	0 to 300	0 to 50	10KW	C†
30B	0 to 600	0 to 50	20KW	C†
31B	0 to 150	0 to 100	10KW	C
32B	0 to 300	0 to 100	20KW	C
33B	0 to 600	0 to 100	40KW	C
34B	0 to 150	0 to 200	20KW	D
35B	0 to 300	0 to 200	40KW	D
36B	0 to 600	0 to 200	80KW	D
37B	0 to 150	0 to 400	40KW	D
38B	0 to 300	0 to 400	80KW	D
39B	0 to 600	0 to 400	160KW	D
40B	0 to 150	0 to 600	60KW	E
41B	0 to 300	0 to 600	120KW	E
42B	0 to 600	0 to 600	240KW	E
43B	0 to 150	0 to 1K	100KW	E
44B	0 to 300	0 to 1K	200KW	E
45B	0 to 600	0 to 1K	400KW	E
46B	0 to 150	0 to 2K	200KW	E
47B	0 to 300	0 to 2K	400KW	E
48B	0 to 600	0 to 2K	800KW	E

SUPPLIED WITH CURRENT TRANSFORMERS



49B	0 to 150	0 to 50	5KW	W†
50B	0 to 300	0 to 50	10KW	W†
51B	0 to 600	0 to 50	20KW	W†
58B	0 to 150	0 to 100	10KW	W
59B	0 to 300	0 to 100	20KW	W
60B	0 to 600	0 to 100	40KW	W
67B	0 to 150	0 to 200	20KW	W
68B	0 to 300	0 to 200	40KW	W
69B	0 to 600	0 to 200	80KW	W
76B	0 to 150	0 to 400	40KW	X
77B	0 to 300	0 to 400	80KW	X
78B	0 to 600	0 to 400	160KW	X
85B	0 to 150	0 to 600	60KW	X
86B	0 to 300	0 to 600	120KW	X
87B	0 to 600	0 to 600	240KW	X
94B	0 to 150	0 to 1K	100KW	Y
95B	0 to 300	0 to 1K	200KW	Y
96B	0 to 600	0 to 1K	400KW	Y

NOTE: † indicates 2 turns thru the external transducer or transformer window.

FOR DIMENSIONS REQUEST CATALOG #288

FEATURES AND APPLICATIONS:

- Accurate measurement of electric power consumed by equipment
- Accurate for any conditions of phase, voltage unbalance, current unbalance and power factor
- Output is proportional to true power delivered to the load
- Transducers using internal sensors or sensors C, D, or E provide excellent current transient response for measuring SCR controls, chopped waveforms or application where harmonics are present
- Highly-accurate, without worrying about the inaccuracies of current transformers and potential transformers
- Split sensors available
- Current sensors are included and are calibrated with the watt transducer (where required)
- For interface with meters, recorders, data loggers, computer or other instrumentation, select options "A" through "E"
- Wide frequency range: 48 to 70 Hz
- Standard 1 mA output, other options available

PC5 SERIES SPECIFICATIONS:

INPUT:

Voltage: See Tables. .

Current: See Tables

Frequency Range: 48 to 70 Hz

Power Factor Range: Any

Response (Transient 90%): <100 microseconds with models using internal sensors or sensors C, D, or E
1 millisecond with models using current sensors W, X, and Y

Burden:
Voltage: 1.25 VA
Current: 1.25 VA
Option Amplifier: 2 Watts

Current Overload:
1 thru 15 Ampere models and those using current sensors W, X, and Y
2 times rating (continuous)
6 times rating (10 sec)
Models using external current sensors C, D and E
50 times rating (continuous)

Dielectric Test: (Input/Output/Case): 1500 VAC (RMS)

Surge: Withstands IEEE SWC Test

Specifications continued on next page

OHIO SEMITRONICS, INC. 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE (614) 486-9561 • FAX 614-486-0743

SPECIFICATIONS (cont.):

OUTPUT:

Output is proportional to real power delivered to the load. $P = EI \cos \phi$
Standard B: 1 mA DC at Rated Output
(Requires 115 VAC instrument power)
Option A: 1 mA DC at Rated Output (See Note 1)
Option C: 10 VDC at Rated Output (See Note 1)
Option D: 10 VDC at Rated Output (Requires 115 VAC instrument power)
Option E: 4-20 mA DC. 20 mA DC at Rated Output, 4 mA DC at Zero
Millivolt Options Available Consult Factory
Output Ripple: <1% of R.O.
Response Time: 250 milliseconds to 90%
Output Loading:
Standard Model B: 0-10K ohms
Options A: 0-10K ohms
Options C & D: >2K ohms
Option E: 0-1500 ohms
Calibration Adjustment Range: ±10% Min.
Temperature Effect (−10°C to +60°C): ±1% of Reading, ±0.1% R.O.

ACCURACY:

±0.5% at Rated Output
(including power factor, linearity, repeatability, initial set point, and current sensor).

NOTE (1) Self powered input voltage ranges for models with options A and C are limited as follows: 85 to 135V for 0 to 150V models 200 to 280V for 0 to 300V models, and 380 to 550V for 0 to 600V models.

3 PHASE 3 WIRE 50/60 Hz MODELS

SUPPLIED WITH INTERNAL SENSOR

MODEL NUMBER PC5-	EFFECTIVE RANGE VOLTS	EFFECTIVE RANGE AMPS	WATTS AT RATED OUTPUT 1mA	CURRENT SENSOR*
4B‡	0 to 150	0 to 5	1KW	Internal
5B	0 to 300	0 to 5	2KW	Internal
6B	0 to 600	0 to 5	4KW	Internal
13B‡	0 to 150	0 to 10	2KW	Internal
14B	0 to 300	0 to 10	4KW	Internal
15B	0 to 600	0 to 10	8KW	Internal
22B‡	0 to 150	0 to 15	3KW	Internal
23B	0 to 300	0 to 15	6KW	Internal
24B	0 to 600	0 to 15	12KW	Internal

SUPPLIED WITH CURRENT TRANSDUCERS

31-2B‡	0 to 150	0 to 100	20KW	C
32-2B	0 to 300	0 to 100	40KW	C
33-2B	0 to 600	0 to 100	80KW	C
34-2B‡	0 to 150	0 to 200	20KW	D
35-2B	0 to 300	0 to 200	40KW	D
36-2B	0 to 600	0 to 200	80KW	D
37-2B‡	0 to 150	0 to 400	40KW	D
38-2B	0 to 300	0 to 400	80KW	D
39-2B	0 to 600	0 to 400	160KW	D

SUPPLIED WITH CURRENT TRANSFORMERS

52B‡	0 to 150	0 to 50	10KW	W†
53B	0 to 300	0 to 50	20KW	W†
54B	0 to 600	0 to 50	40KW	W†
61B‡	0 to 150	0 to 100	20KW	W
62B	0 to 300	0 to 100	40KW	W
63B	0 to 600	0 to 100	80KW	W
70B‡	0 to 150	0 to 200	40KW	W
71B	0 to 300	0 to 200	80KW	W
72B	0 to 600	0 to 200	160KW	W
79B‡	0 to 150	0 to 400	80KW	X
80B	0 to 300	0 to 400	160KW	X
81B	0 to 600	0 to 400	320KW	X
88B‡	0 to 150	0 to 600	120KW	X
89B	0 to 300	0 to 600	240KW	X
90B	0 to 600	0 to 600	480KW	X
97B‡	0 to 150	0 to 1K	200KW	Y
98B	0 to 300	0 to 1K	400KW	Y
99B	0 to 600	0 to 1K	800KW	Y

* 50 Amps and above, 2 External Sensors supplied.
‡ May be used in 120V, 1ϕ, 3 Wire Edison Systems.
† Indicates 2 turns thru the external transducer or transformer window.

3 PHASE 4 WIRE 50/60 Hz MODELS

SUPPLIED WITH INTERNAL SENSOR

MODEL NUMBER PC5-	EFFECTIVE RANGE VOLTS (Line to Neutral)	EFFECTIVE RANGE AMPS	WATTS AT RATED OUTPUT 1mA	CURRENT SENSOR**
7B	0 to 150	0 to 5	1.5KW	Internal
8B	0 to 300	0 to 5	3KW	Internal
16B	0 to 150	0 to 10	3KW	Internal
17B	0 to 300	0 to 10	6KW	Internal
25B	0 to 150	0 to 15	4.5KW	Internal
26B	0 to 300	0 to 15	9KW	Internal

** 50 Amps and above, 3 External Sensors supplied.
† Indicates 2 turns through external transformer window.

SUPPLIED WITH CURRENT TRANSFORMERS

MODEL NUMBER PC5-	EFFECTIVE RANGE VOLTS (Line to Neutral)	EFFECTIVE RANGE AMPS	WATTS AT RATED OUTPUT 1mA	CURRENT SENSOR**
55B	0 to 150	0 to 50	15KW	W†
56B	0 to 300	0 to 50	30KW	W†
64B	0 to 150	0 to 100	30KW	W
65B	0 to 300	0 to 100	60KW	W
73B	0 to 150	0 to 200	60KW	W
74B	0 to 300	0 to 200	120KW	W
82B	0 to 150	0 to 400	120KW	X
83B	0 to 300	0 to 400	240KW	X
91B	0 to 150	0 to 600	180KW	X
92B	0 to 300	0 to 600	360KW	X
100B	0 to 150	0 to 1K	300KW	Y
101B	0 to 300	0 to 1K	600KW	Y

FOR DIMENSIONS REQUEST CATALOG #288

OHIO SEMITRONICS, INC. 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
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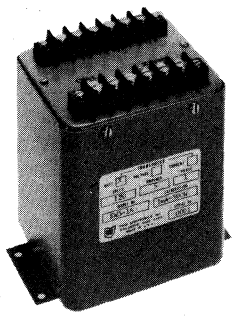
ELECTRONIC PRECISION AC VAR TRANSDUCER EV5 SERIES

ACCURACY ±0.2% OF READING



FEATURES AND APPLICATIONS:

- Provides ±0.2% of reading accuracy and 0 to 1 mA current output proportional to reactive power
- Models available in 1, 2, 2½, and 3 element configurations to meet monitoring and control needs
- Measures forward or reverse reactive power flow
- Each unit is calibrated at the factory to provide 1 mA at the Rated Output (RO) against standards which are traceable to NBS
- Accuracy specifications include influences of variation in voltage, current, power factor and load changes
- Temperature effects are less than ±0.005% per degree C over the range of −20°C to +65°C

SINGLE PHASE 60 Hz MODELS

MODEL NO. EV5-	EFFECTIVE RANGE		VARs AT RATED OUTPUT (1 mA)	CONNECTION	ELEMENTS
	VOLTS	AMPS			
1B	0 to 150	0 to 6.25	500	1φ2W	1
2B	0 to 300	0 to 6.25	1K	1φ2W	1
3B	0 to 600	0 to 6.25	2K	1φ2W	1
10B	0 to 150	0 to 10	1K	1φ2W	1
11B	0 to 300	0 to 10	2K	1φ2W	1
12B	0 to 600	0 to 10	4K	1φ2W	1
19B	0 to 150	0 to 20	2K	1φ2W	1
20B	0 to 300	0 to 20	4K	1φ2W	1
21B	0 to 600	0 to 20	8K	1φ2W	1

3 PHASE 3 WIRE 60 Hz MODELS

4B	0 to 150	0 to 6.25	1K	3φ3W	2
5B	0 to 300	0 to 6.25	2K	3φ3W	2
6B	0 to 600	0 to 6.25	4K	3φ3W	2
13B	0 to 150	0 to 10	2K	3φ3W	2
14B	0 to 300	0 to 10	4K	3φ3W	2
15B	0 to 600	0 to 10	8K	3φ3W	2
22B	0 to 150	0 to 20	4K	3φ3W	2
23B	0 to 300	0 to 20	8K	3φ3W	2
24B	0 to 600	0 to 20	16K	3φ3W	2

3 PHASE 4 WIRE 60 Hz MODELS

7B	0 to 150	0 to 6.25	1.5K	3φ4W	3
8B	0 to 300	0 to 6.25	3K	3φ4W	3
16B	0 to 150	0 to 10	3K	3φ4W	3
17B	0 to 300	0 to 10	6K	3φ4W	3
25B	0 to 150	0 to 20	6K	3φ4W	3
26B	0 to 300	0 to 20	12K	3φ4W	3
7½B	0 to 150	0 to 6.25	1.5K	3φ4W	2½

NOTE: On 3 phase 4 wire models, phase to neutral voltage is specified.
Optional for 50 Hz operation add "X-127" to model number.

EV5 AND EW5 SERIES SPECIFICATIONS:

INPUT:

VOLTAGE

Effective Range: See Tables
Burden: Less than 0.1 VA at 120V, 240V, or 480V
Overload: Max continuous 175V, 350V, or 600V

CURRENT

Effective Range: See Tables
Burden (max.): 0.28 VA per element
Overload: (continuous) 2X rating for 6.25A or 10A, 1X rating for 20A
(Transient) 50A for 10 sec. per hour, 250A for 1 sec. per hour

OUTPUT:

Rated Output (RO): ±1 mA DC
Output Loading: 0 to 10K ohms
Compliance: 12.0 volts DC minimum
Open circuit output voltage limited to ±15 VDC
Response Time (99%): Less than 400 milliseconds

ACCURACY:

(±0.2% of reading, ±0.05% of RO)
Includes the effects of voltage, current, load and power factor within the effective ranges

Specifications continued on next page

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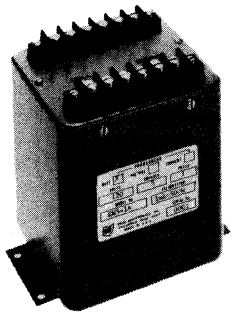
ELECTRONIC PRECISION AC WATT TRANSDUCER EW5 SERIES

ACCURACY ±0.2% OF READING



FEATURES AND APPLICATIONS:

- Provides ±0.2% of reading accuracy and 0 to 1 mA current output proportional to electrical power delivered to a load
- Models available in 1, 2, 2½, and 3 element configurations to meet monitoring and control needs
- Measures forward or reverse power flow
- Each unit is calibrated at the factory to provide 1 mA at the Rated Output (RO) against standards which are traceable to NBS
- Accuracy specifications include influences of variation in voltage, current, power factor and frequency, and load changes
- Temperature effects are less than ±0.005% per degree C over the range of −20°C to +65°C

SPECIFICATONS (cont.):

Frequency, VAR Only: 60 Hz, 50 Hz Models (optional)
Frequency, Watt Only: 58 to 62 Hz, 48 to 52 Hz on 50 Hz Models (optional)
Power Factor: Any
Temperature Range: −20°C to +65°C
Temperature Effect: ±0.005% per degree C
Operating Humidity: 0 to 95% non-condensing
Dielectric Test: Input/Output/Instrument Power/Case — 1500 VAC (RMS)
Surge: Withstands IEEE SWC Test
Calibration Adjustment: ±2% minimum
Instrument Power: 90 to 135 VAC, 50 to 70 Hz Burden less than 2 VA at 115 VAC
Weight: 3.1 lbs. Maximum

FOR DIMENSIONS REQUEST CATALOG #288

SINGLE PHASE 60 Hz MODELS

MODEL NO. EW5	EFFECTIVE RANGE VOLTS	EFFECTIVE RANGE AMPS	WATTS AT OUTPUT RATED (1 mA)	CONNECTION	ELEMENTS
1B	0 to 150	0 to 6.25	500	1φ2W	1
2B	0 to 300	0 to 6.25	1K	1φ2W	1
3B	0 to 600	0 to 6.25	2K	1φ2W	1
10B	0 to 150	0 to 10	1K	1φ2W	1
11B	0 to 300	0 to 10	2K	1φ2W	1
12B	0 to 600	0 to 10	4K	1φ2W	1
19B	0 to 150	0 to 20	2K	1φ2W	1
20B	0 to 300	0 to 20	4K	1φ2W	1
21B	0 to 600	0 to 20	8K	1φ2W	1

3 PHASE 3 WIRE 60 Hz MODELS

4B	0 to 150	0 to 6.25	1K	3φ3W	2
5B	0 to 300	0 to 6.25	2K	3φ3W	2
6B	0 to 600	0 to 6.25	4K	3φ3W	2
13B	0 to 150	0 to 10	2K	3φ3W	2
14B	0 to 300	0 to 10	4K	3φ3W	2
15B	0 to 600	0 to 10	8K	3φ3W	2
22B	0 to 150	0 to 20	4K	3φ3W	2
23B	0 to 300	0 to 20	8K	3φ3W	2
24B	0 to 600	0 to 20	16K	3φ3W	2

3 PHASE 4 WIRE 60 Hz MODELS

7B	0 to 150	0 to 6.25	1.5K	3φ4W	3
8B	0 to 300	0 to 6.25	3K	3φ4W	3
16B	0 to 150	0 to 10	3K	3φ4W	3
17B	0 to 300	0 to 10	6K	3φ4W	3
25B	0 to 150	0 to 20	6K	3φ4W	3
26B	0 to 300	0 to 20	12K	3φ4W	3
7½B	0 to 150	0 to 6.25	1.5K	3φ4W	2½

NOTE: On 3 phase 4 wire models, phase to neutral voltage is specified.
Optional for 50 Hz operation add "X-127" to model number.

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WATT WATT-HOUR TRANSDUCER W SERIES

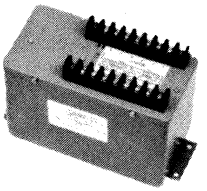
SINGLE PHASE 50/60 Hz MODELS

MODEL NUMBER W	VOLTAGE RANGE	CURRENT RANGE	WATTS at RATED OUTPUT	W-H PER COUNT	EXTERNAL CURRENT SENSOR*
1	0 to 150	0 to 5	500W	0.1	Internal
2	0 to 300	0 to 5	1KW	1	Internal
3	0 to 600	0 to 5	2KW	1	Internal
10	0 to 150	0 to 10	1KW	1	Internal
11	0 to 300	0 to 10	2KW	1	Internal
12	0 to 600	0 to 10	4KW	1	Internal
19	0 to 150	0 to 15	1.5KW	1	Internal
20	0 to 300	0 to 15	3KW	1	Internal
21	0 to 600	0 to 15	6KW	1	Internal
28	0 to 150	0 to 50	5KW	1	C†
29	0 to 300	0 to 50	10KW	1	C†
30	0 to 600	0 to 50	20KW	10	C†
31	0 to 150	0 to 100	10KW	10	C
32	0 to 300	0 to 100	20KW	10	C
33	0 to 600	0 to 100	40KW	10	C
34	0 to 150	0 to 200	20KW	10	D
35	0 to 300	0 to 200	40KW	10	D
36	0 to 600	0 to 200	80KW	10	D
37	0 to 150	0 to 400	40KW	10	D
38	0 to 300	0 to 400	80KW	10	D
39	0 to 600	0 to 400	160KW	100	D
40	0 to 150	0 to 600	60KW	10	E
41	0 to 300	0 to 600	120KW	100	E
42	0 to 600	0 to 600	240KW	100	E
43	0 to 150	0 to 1K	100KW	100	E
44	0 to 300	0 to 1K	200KW	100	E
45	0 to 600	0 to 1K	400KW	100	E
46	0 to 150	0 to 2K	200KW	100	E
47	0 to 300	0 to 2K	400KW	100	E
48	0 to 600	0 to 2K	800KW	100	E
49	0 to 150	0 to 50	5KW	1	C†
50	0 to 300	0 to 50	10KW	1	C†
51	0 to 600	0 to 50	20KW	10	C†
58	0 to 150	0 to 100	10KW	1	W
59	0 to 300	0 to 100	20KW	10	W
60	0 to 600	0 to 100	40K	10	W
67	0 to 150	0 to 200	20KW	10	W
68	0 to 300	0 to 200	40KW	10	W
69	0 to 600	0 to 200	80KW	10	W
76	0 to 150	0 to 400	40KW	10	X
77	0 to 300	0 to 400	80KW	10	X
78	0 to 600	0 to 400	160KW	100	X
85	0 to 150	0 to 600	60KW	10	X
86	0 to 300	0 to 600	120KW	100	X
87	0 to 600	0 to 600	240KW	100	X
94	0 to 150	0 to 1K	100KW	100	Y
95	0 to 300	0 to 1K	200KW	100	Y
96	0 to 600	0 to 1K	400KW	100	Y
103	0 to 150	0 to 1	100W	1	-
104	0 to 300	0 to 1	200W	1	-
105	0 to 600	0 to 1	500W	1	-
106	0 to 150	0 to 2.5	250W	1	-
107	0 to 300	0 to 2.5	500W	1	-
108	0 to 600	0 to 2.5	1000W	1	-

*50 Amps and above, External Sensors are supplied.

NOTE: † indicates 2 turns thru the external transducer or transformer window.

MODEL W-21



DESCRIPTION

OSI Watt Watt-Hour Transducers provide accurate measurement of electric power consumed in equipment, apparatus, or facilities. Accuracy for all conditions of phase, voltage unbalance, and current unbalance is assured through the use of one element for single phase, two elements for 3 phase 3 wire, and three elements for 3 phase 4 wire applications. The output is proportional to real power delivered to the load.

Direct connected models or models utilizing OSI Current Sensors C, D & E provide the excellent current transient response necessary where **SCR control, chopped waveforms, or any application where harmonics are present.** The DC to 5 kilohertz response of these current sensors insures accurate computation of power with high harmonic content in current waveforms.

All models include current sensors that are calibrated with the watt transducer. In this way a highly-accurate, calibrated kilowatt or megawatt measuring unit is readily available for incorporation without the necessity of worrying about the inaccuracies current transformers and potential transformers may introduce in measurements.

Standard models provide an output proportional to instantaneous power and should be used where observation of time-department power is desired.

SPECIFICATIONS

INPUT:

Voltage: See Tables
Current: See Tables
Frequency Range: 50 to 70 Hz
Power Factor Range: Unity to Lead or Lag 0.
Response (Transient 90%):
  < 100 microseconds with models using internal sensors
  or sensors C, D or E.
  1 millisecond with models using current sensors W, X and Y
Burden:
  Voltage: 1.25VA
  Current: 1.25VA
  Option Amplifier: 2 Watts
Current Overload
  1 thru 15 Ampere models and those using current sensors W, Xand Y
  2 times rating (continuous)
  6 times rating (10 sec)
  Models using external current sensors C, D and E
  50 times rating (continuous)

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WATT WATT-HOUR TRANSDUCER

SPECIFICATIONS [cont.]

Dielectric Test:
(Input/Output/Case): 1500VAC
Surge:
Withstands IEEE SWC Test

OUTPUT:

Watt-Hour
Relay: Normally open, SPST
Rating: 10VA Max., 150VAC, 0.5 A Max.
Relay closed period: 100 M sec
Count Rated: Listed in W-H per count column
Note (1)

ACCURACY:

± 0.5% at R.O.
(Including power factor, linearity, repeatability and set point)
Temperature Effect:
(-10°C to 60°C)
± 1.0% of reading 0.1% RO
Response Time: 250 M sec
Instrument power: 115 VAC ± 10%
50 to 400 Hz

OPTIONS:

(Add letter to Model No. for desired Options)

Option "H"	Instrument Power 220 VAC/50 Hz
Option "G"	Internal Instrument Power Note (2)
Option "T"	For TTL output for Watt-Hours
Option "B"	Watt output 1 Ma dc at R.O.
Option "D"	Watt output 10 Vdc at R.O.

Note [1]
Standard W-H counts are listed, other count rates up to 12K per hour for relay output and 100K for TTL output are optional.

Note [2]
Input Voltage Ranges for Models with Option "G" are limited as follows:
103V to 135V for 150V models, 215V to 280V for 300V models, 395V to 550V for 600 models.

FOR DIMENSIONS REQUEST CATALOG #288

3 PHASE 3 WIRE 50/60 Hz MODELS

MODEL NUMBER W	VOLTAGE RANGE	CURRENT RANGE	WATTS at RATED OUTPUT	W-H PER COUNT	EXTERNAL CURRENT SENSOR*
4**	0 to 150	0 to 5	1KW	1	Internal
5	0 to 300	0 to 5	2KW	1	Internal
6	0 to 600	0 to 5	4KW	1	Internal
13**	0 to 150	0 to 10	2KW	1	Internal
14	0 to 300	0 to 10	4KW	1	Internal
15	0 to 600	0 to 10	8KW	1	Internal
22**	0 to 150	0 to 15	3KW	1	Internal
23	0 to 300	0 to 15	6KW	1	Internal
24	0 to 600	0 to 15	12KW	1	Internal
31-2**	0 to 150	0 to 100	20K	10	C†
32-2	0 to 300	0 to 100	40K	10	C†
33-2	0 to 600	0 to 100	80K	10	C†
52**	0 to 150	0 to 50	10KW	1	W†
53	0 to 300	0 to 50	20KW	10	W†
54	0 to 600	0 to 50	40KW	10	W†
61**	0 to 150	0 to 100	20KW	10	W
62	0 to 300	0 to 100	40KW	10	W
63	0 to 600	0 to 100	80KW	10	W
70**	0 to 150	0 to 200	40KW	10	W
71	0 to 300	0 to 200	80KW	10	W
72	0 to 600	0 to 200	160KW	100	W
79**	0 to 150	0 to 400	80KW	10	X
80	0 to 300	0 to 400	160KW	100	X
81	0 to 600	0 to 400	320KW	100	X
88**	0 to 150	0 to 600	120KW	100	X
89	0 to 300	0 to 600	240KW	100	X
90	0 to 600	0 to 600	480KW	100	X
97**	0 to 150	0 to 1K	200KW	100	Y
98	0 to 300	0 to 1K	400KW	100	Y
99	0 to 600	0 to 1K	800KW	100	Y

*50 Amps and above, 2 External Sensors supplied, see drawings.
**May be used in 120V, 1ø, 3 wire Edison Systems.
† Indicates 2 turns thru the external transducer or transformer window.

3 PHASE 4 WIRE 50/60 Hz MODELS

MODEL NUMBER W-	VOLTAGE RANGE	CURRENT RANGE	WATTS at RATED OUTPUT	W-H PER COUNT	EXTERNAL CURRENT SENSOR*
7	0 to 150	0 to 5	1.5KW	1	Internal
8	0 to 300	0 to 5	3KW	1	Internal
16	0 to 150	0 to 10	3KW	1	Internal
17	0 to 300	0 to 10	6KW	1	Internal
25	0 to 150	0 to 15	4.5KW	1	Internal
26	0 to 300	0 to 15	9KW	1	Internal
55	0 to 150	0 to 50	15KW	10	W†
56	0 to 300	0 to 50	30KW	10	W†
64	0 to 150	0 to 100	30KW	10	W
65	0 to 300	0 to 100	60KW	10	W
73	0 to 150	0 to 200	60KW	10	W
74	0 to 300	0 to 200	120KW	100	W
82	0 to 150	0 to 400	120KW	100	X
83	0 to 300	0 to 400	240KW	100	X
91	0 to 150	0 to 600	180KW	100	X
92	0 to 300	0 to 600	360KW	100	X
100	0 to 150	0 to 1K	300KW	100	Y
101	0 to 300	0 to 1K	600KW	100	Y

*50 Amps and above, 3 External Sensors supplied, See Attached Drawings

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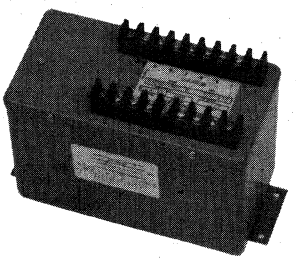
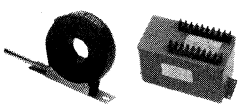
AC POWER FACTOR, AND WATT TRANSDUCER PC11 SERIES



FEATURES:

- True power and power factor measurements for distorted sine wave inputs
- Two separate output signals of 0 to 1 milliampere corresponding to watts and power factor
- Direct reading of power factor, not phase angle for sinusoidal waveforms or distorted waveforms
- Power factor computed by dividing real power by apparent power
- Current sensors are included and are calibrated with the watt transducer (where required)

SPECIFICATIONS:



INPUT:

Voltage: See Tables

Current: See Tables

Frequency Range: 50 to 70 Hz

Power Factor Range: Unity to Lead or Lag 0

Response: 100 microseconds to 90%

Burden: Voltage: 1.25 VA
Current: 1.5 VA

Current Overload:
2 times continuous
6 times for 10 Sec.

Dielectric Test: (Input/Output/Case) 1500 VAC

Instrument Power Required: 115 VAC ±10% 50/60 Hz

OUTPUT:

Watts: 1 mA at Rated Output

Power Factor: +1 mA at Unity PF, 0 mA at Lead or Lag 0

Response Time: 250 mSec. to 90%

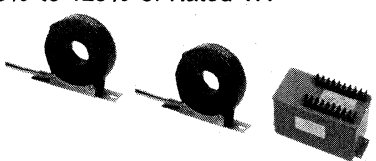
Output Loading: 0 to 10KΩ

Temperature Effects (−10°C to +60°C): ±1%

ACCURACY:

Watts: ±0.5% RO

Power Factor: From 10% to 120% of Rated VA
±0.01 PF



FOR DIMENSIONS REQUEST CATALOG #288

SINGLE PHASE 50/60 Hz

MODEL NO. PC11-	EFFECTIVE RANGE VOLTS	EFFECTIVE RANGE AMPS	WATTS AT RATED OUTPUT	CURRENT SENSOR
1	0 to 150	0 to 5	500	Internal
2	0 to 300	0 to 5	1K	Internal
3	0 to 600	0 to 5	2K	Internal
10	0 to 150	0 to 10	1K	Internal
11	0 to 300	0 to 10	2K	Internal
12	0 to 600	0 to 10	4K	Internal
19	0 to 150	0 to 15	1.5K	Internal
20	0 to 300	0 to 15	3K	Internal
21	0 to 600	0 to 15	6K	Internal
103	0 to 150	0 to 1	100	Internal
104	0 to 300	0 to 1	200	Internal
105	0 to 600	0 to 1	500	Internal
106	0 to 150	0 to 2.5	250	Internal
107	0 to 300	0 to 2.5	500	Internal
108	0 to 600	0 to 2.5	1000	Internal
49	0 to 150	0 to 50	5K	W†
50	0 to 300	0 to 50	10K	W†
51	0 to 600	0 to 50	20K	W†
58	0 to 150	0 to 100	10K	W
59	0 to 300	0 to 100	20K	W
60	0 to 600	0 to 100	40K	W
67	0 to 150	0 to 200	20K	W
68	0 to 300	0 to 200	40K	W
69	0 to 600	0 to 200	80K	W
76	0 to 150	0 to 400	40K	X
77	0 to 300	0 to 400	80K	X
78	0 to 600	0 to 400	160K	X
85	0 to 150	0 to 600	60K	X
86	0 to 300	0 to 600	120K	X
87	0 to 600	0 to 600	240K	X
94	0 to 150	0 to 1K	100K	Y
95	0 to 300	0 to 1K	200K	Y
96	0 to 600	0 to 1K	400K	Y

3 PHASE 3 WIRE

4	0 to 150	0 to 5	1K	Internal
5	0 to 300	0 to 5	2K	Internal
6	0 to 600	0 to 5	4K	Internal
13	0 to 150	0 to 10	2K	Internal
14	0 to 300	0 to 10	4K	Internal
15	0 to 600	0 to 10	8K	Internal
22	0 to 150	0 to 15	3K	Internal
23	0 to 300	0 to 15	6K	Internal
24	0 to 600	0 to 15	12K	Internal
52	0 to 150	0 to 50	10K	W†
53	0 to 300	0 to 50	20K	W†
54	0 to 600	0 to 50	40K	W†
61	0 to 150	0 to 100	20K	W
62	0 to 300	0 to 100	40K	W
63	0 to 600	0 to 100	80K	W
70	0 to 150	0 to 200	40K	W
71	0 to 300	0 to 200	80K	W
72	0 to 600	0 to 200	160K	W
79	0 to 150	0 to 400	80K	X
80	0 to 300	0 to 400	160K	X
81	0 to 600	0 to 400	320K	X
88	0 to 150	0 to 600	120K	X
89	0 to 300	0 to 600	240K	X
90	0 to 600	0 to 600	480K	X
97	0 to 150	0 to 1K	200K	Y
98	0 to 300	0 to 1K	400K	Y
99	0 to 600	0 to 1K	800K	Y

NOTE: 50 Amps and above, External Sensors supplied.
† Indicates 2 turns thru the external transformer window.
Power Factor is determined from the ratio of real power to apparent power, therefore leading or lagging power factor is not indicated.

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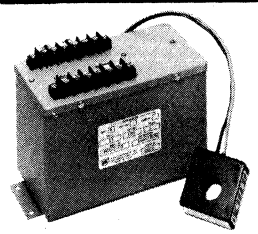
DC TO 400 Hz WATT TRANSDUCER PC8 SERIES

FEATURES AND APPLICATIONS:

- DC to 400 Hertz
- Ideal for variable frequency applications
- Accurate monitoring of power that contains dc, AC and non-sinusoidal waveforms
- Response less than 50 microseconds
- Ideal for use in SCR and other AC or dc switching circuits
- Output isolated from input



ORDERING INFORMATION:

The part numbers listed in the selection tables are incomplete. The voltage and current designation code must be added.

Part Number PC8- * — △

Example: PC8-3-01, which would be a PC8 transducer with 125VDC @ 100 amperes.

"*" Voltage Designation "△" Current Designation

CODE	FS VOLTS	RANGE
1	25	0 to 30
2	50	0 to 60
3	125	0 to 135
4	250	0 to 275
5	400	0 to 450
6	500	0 to 550
7	600	0 to 650

CODE	FS CURRENT	RANGE	CURRENT SENSOR
01	100	0 to 100	C
02	200	0 to 200	D
03	300	0 to 300	D
04	400	0 to 400	D
05	600	0 to 600	E
06	1000	0 to 1000	E
07	2000	0 to 2000	E

SPECIFICATIONS:

INPUT:

Voltage: Check code designation for FS voltage ranges from 25 to 600 volts (peak AC or dc)
Burden: >1 megohm
Current: Check code designation (specify FS range from 100 ampere to 2000 ampere, lower range uses 100 ampere transducer with ampere turns)
DC Insertion Loss: None
Overrange Without Damage: 10 times rating
Frequency Range: DC to 400 Hz
Response Time: <50 microseconds

OUTPUT:

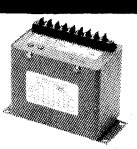
Full Scale Output: 1 mA dc (0 to 10K ohm)
Response: 250 milliseconds
Ripple: <1% Full Scale at 60 Hz
Accuracy: (FS Voltage X FS Current) ±1.0% FS
Temperature Effect: (0 to 40°C) ±0.1% of FS ±1% of Reading
Isolation: Input/Output/Case 1000 Vdc
Instrument Power: 115 VAC ±10% 50/400 Hz

FOR DIMENSIONS REQUEST CATALOG #288

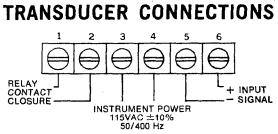
PRECISION INTEGRATOR VFC SERIES ANALOG TO PULSE CONVERTER

FEATURES:

- Output is a switch closure for activating external circuits
- Switch closure can be directly related to a specific integrated quantity
- Output can be preset at the factory



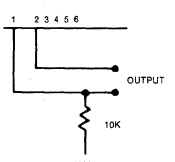
TRANSDUCER CONNECTIONS



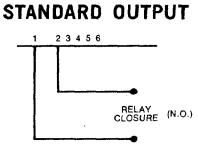
Calibration and zero adjustments are provided through recess holes in the top of the case.

USE WITH ELECTRO MECHANICAL COUNTER

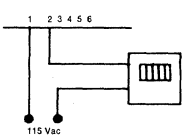
OUTPUT TO TTL CIRCUIT



STANDARD OUTPUT



USE WITH ELECTRO MECHANICAL COUNTER



SPECIFICATIONS:
(common to all)

INPUT:

Impedance: >1 megohm except VFC-50, 100 ohms
Usable Range: Up to 1.25 x FS
Frequency: DC with up to 100% ripple at 120 Hz or higher

OUTPUTS:

Linearity: ±0.1% FS Accuracy: ±0.25% FS
Relay: Normally open, SPST
Relay Contact Rating: 10 VA Max., 120V Max., 0.3A Max.
Relay Closed Period: 100 milliseconds, typ.
Temperature Effect: (−10°C to +60°C) ±0.5%
Instrument Power: 115 VAC ±10%, 50/400 Hz
Isolation (Input/Output/Case): 1000 Volts dc

MODEL	INPUT	OUTPUT RELAY CLOSURE RATE*
VFC-10	0 to +50 mV	0 to 10,000 per hour
VFC-20	0 to +100 mV	0 to 10,000 per hour
VFC-30	0 to +150 mV	0 to 10,000 per hour
VFC-50	0 to +1 mA	0 to 10,000 per hour
VFC-60	0 to +10V	0 to 10,000 per hour

* NOTE: Output closure rate can be set between 1K and 12K counts per hour at no charge.

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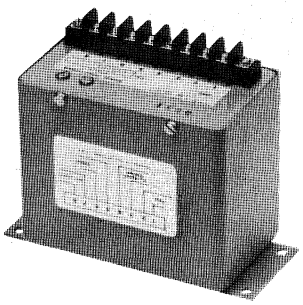
DC & RMS SIGNAL CONDITIONERS CTA SERIES



FEATURES AND APPLICATIONS:

- Designed for use with OSI current transducers
- Suitable for monitoring or control purposes
- CTA113 through CTA215E provide an output directly proportional to the true RMS value
- Calibration and zero adjustments provided

SPECIFICATIONS:

AMPLIFIER:

Linearity: 0.1% RO
Frequency Range: DC to 5 KHz
Output Response: to 90% 40 μsec.
(RMS Models) 200 msec.
Ripple: <0.25% RO
Crest Factor: 3 within rating
7 within 1%
Short Circuit Protected: Yes
Isolation: Input/Output isolated from case

EXCITATION CURRENT:

Regulation: Line/Load ±0.01%
Output Voltage at Full Load: 6 VDC

TEMPERATURE EFFECTS:

(0-70°C) ±0.005%/°C

INSTRUMENT POWER:

115 VAC ±10%, 5W, 50-400 Hz
24/28 VDC ±10%, 8W, DC
(Positive to Terminal 8)

FOR DIMENSIONS REQUEST CATALOG #288

NO CHARGE FOR CALIBRATION OF CTA WITH CT-L SERIES TRANSDUCERS

MODEL	RATED INPUT SIGNAL	RATED OUTPUT SIGNAL	EXCITATION CURRENT OUTPUT	CAL ADJUSTMENT		LOAD ON OUTPUT	INSTR. POWER
				AMPLIFIER GAIN	EXCITATION CURRENT		
ANALOG MODELS, AC IN AC OUT, dc IN dc OUT							
CTA101	±50 mV	±10V	100 mA	Fixed	±30%	>2KΩ	115VAC
CTA201	±50 mV	±10V	200 mA	Fixed	±10%	>2KΩ	115VAC
CTA112	±50 mV	4-20 mA	100 mA	±20%	Fixed	0-500Ω	115VAC
CTA212	±50 mV	4-20 mA	200 mA	±20%	Fixed	0-500Ω	115VAC
CTA124	±50 mV	±10V	100 mA	Fixed	±30%	>2KΩ	24VDC‡
CTA224	±50 mV	±10V	200 mA	Fixed	±10%	>2KΩ	24VDC‡
CTA128	±50 mV	±10V	100 mA	Fixed	±30%	>2KΩ	28VDC‡
CTA228	±50 mV	±10V	200 mA	Fixed	±10%	>2KΩ	28VDC‡
CTA1173	±50 mV	±4 mA	200 mA	Fixed	±30%	0-2.5K	115VAC
RMS MODELS, AC AND/OR dc OUT							
CTA113	50 mV RMS	+10VDC	100 mA	±20%	Fixed	>2KΩ	115VAC
CTA213	50 mV RMS	+10VDC	200 mA	±20%	Fixed	>2KΩ	115VAC
CTA114	50 mV RMS	+1 mA DC	100 mA	±20%	Fixed	0-10KΩ	115VAC
CTA214	50 mV RMS	+1 mA DC	200 mA	±20%	Fixed	0-10KΩ	115VAC
CTA115E	50 mV RMS	4-20 mA DC	100 mA	±20%	Fixed	0-500Ω	115VAC
CTA215E	50 mV RMS	4-20 mA DC	200 mA	±20%	Fixed	0-500Ω	115VAC

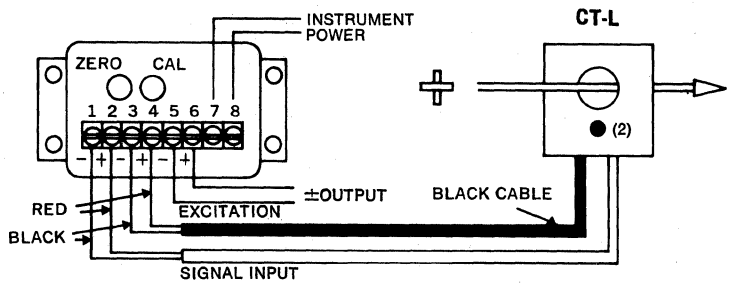
INPUT OPTIONS: (OPTION LETTER INDICATES A NON STANDARD INPUT)

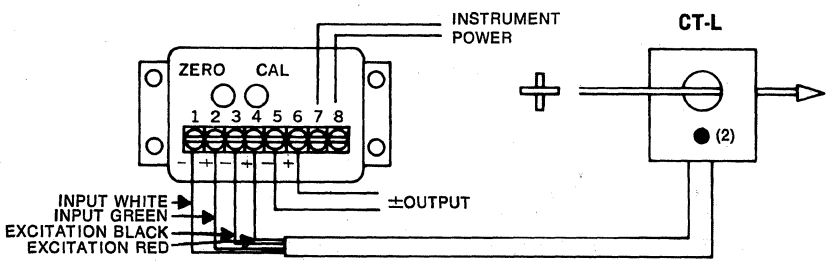
Option (H) 75 mV Input
Option (P) 100 mV Input
Option (K) 150 mV Input

APPLICATION NOTES:

(1) When using an OSI current transducer, the output shield should be tied to terminal 3 on the signal conditioner.
(2) For a positive amplified output, connect the current transducer with the red polarity dot toward the most positive voltage terminal. See connections below.
(3) All RMS models provide a DC output proportional to the true RMS value of the input.
(4) All Analog models provide an output proportional to magnitude and direction.

CONNECTIONS





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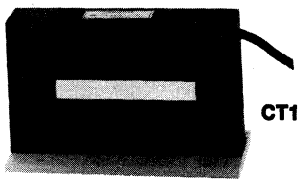
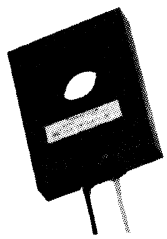
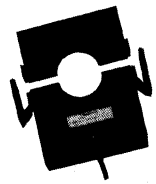
CURRENT TRANSDUCERS CT-L SERIES

DC TO 5 KILOHERTZ RESPONSE


CT1KHT

CT50LT


CT200LT


CT1KLTS SPLIT-CORE OPTION

FEATURES AND APPLICATIONS:

- 5000 Volt line-to-output isolation
- DC to 5 kilohertz response
- Bi-directional operation
- Linearly 0.5%
- ±1% change over temperature range
- Less than 50 microsecond response time
- Output is proportional in direction and magnitude to the current flow through the window
- Sustained overload capability to 50 times rating
- Stable during severe vibration
- Easy installation
- Split-core models available
- Suited for variable frequency AC systems with DC components or chopped waveforms,
- Replace shunts
- No insertion loss

SPECIFICATIONS FOR CIRCULAR WINDOW MODELS

MODEL	ENCLOSED CURRENT AMPS	EXCITATION CURRENT mA (NOM.)	OUTPUT mV (TYP.)	LINEARITY % FS	OUTPUT CHANGE OVER TEMP. RANGE	TEMPERATURE RANGE °C	RESISTANCE TYP. IN Ω	RESISTANCE TYP. OUT Ω	TRANSDUCER DRAWING See Cat. Pg. 27
CT50L	50 RMS	100	30	0.5	−0.15%°/C	−40 +65	4	3	A
CT50LTT	50 RMS	100	20	0.5	±1%	0 +40	4	25	A
CT50LT	50 RMS	100	20	0.5	±1%	−40 +65	4	25	A
CT100L	100 RMS	100	50	0.5	−0.15%°/C	−40 +65	4	3	C
CT100LTT	100 RMS	100	50	0.5	±1%	0 +40	4	25	C
CT100LT	100 RMS	100	50	0.5	±1%	−40 +65	4	25	C
CT200L	200 RMS	100	75	0.5	−0.15%°/C	−40 +65	4	3	D
CT200LTT	200 RMS	100	50	0.5	±1%	0 +40	4	25	D
CT200LT	200 RMS	100	50	0.5	±1%	−40 +65	4	25	D
CT400L	400 RMS	100	50	0.5	−0.15%°/C	−40 +65	4	3	D
CT400LTT	400 RMS	100	50	0.5	±1%	0 +40	4	25	D
CT400LT	400 RMS	100	50	0.5	±1%	−40 +65	4	25	D
CT600L	600 RMS	100	75	0.5	−0.15%°/C	−40 +65	4	3	E
CT600LTT	600 RMS	100	50	0.5	±1%	0 +40	4	25	E
CT600LT	600 RMS	100	50	0.5	±1%	−40 +65	4	25	E
CT1KL	1000 RMS	200	75	0.5	−0.15%°/C	−40 +65	25	6	E
CT1KLTT	1000 RMS	200	50	0.5	±1%	0 +40	25	25	E
CT1KLT	1000 RMS	200	50	0.5	±1%	−40 +65	25	25	E
CT2KL	2000 RMS	200	150	0.5	−0.15%°/C	−40 +65	25	6	E
CT2KLTT	2000 RMS	200	100	0.5	±1%	0 +40	25	25	E
CT2KLT	2000 RMS	200	100	0.5	±1%	−40 +65	25	25	E

TRANSDUCERS FOR BUSS BAR APPLICATIONS (RECTANGULAR WINDOW)

CT4KLT	4000 peak	200	150	1.0	±1%	−40 +65	25	25	G
CT5KLT	5000 peak	200	150	1.0	±1%	−40 +65	25	25	G
CT8KLT	8000 peak	200	75	1.0	±1%	−40 +65	12	25	H
CT1KHT	1KA peak	100	75	1.0	±1%	−40 +65	25	25	Z
CT1.2KHT	1.2KA peak	100	75	1.0	±1%	−40 +65	25	25	Z
CT2KHT	2KA peak	100	100	1.0	±1%	−40 +65	25	25	Z
CT2.2KHT	2.2KA peak	100	100	1.0	±1%	−40 +65	25	25	Z
CT3KHT	3KA peak	100	100	1.0	±1%	−40 +65	25	25	Z
CT4KHT	4KA peak	100	100	1.0	±1%	−40 +65	25	25	Z
CT5KHT	5KA peak	100	75	1.0	±1%	−40 +65	25	25	Z

NOTES: The split core option is available on all Models except the 50 Ampere size. To order, add the letter "S" to the Model Number.
The electrical isolation (line to output) is at least 5000 volts for all Models, except the 50 Ampere size which is rated at 600 volts.

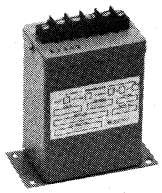
FOR DIMENSIONS REQUEST CATALOG #288

OHIO SEMITRONICS, INC. 1205 CHESAPEAKE AVENUE, COLUMBUS, OHIO 43212-2287
PHONE (614) 486-9561 • FAX 614-486-0743

AC VOLTAGE AND CURRENT TRANSDUCERS VT SERIES CT SERIES

FEATURES AND APPLICATIONS:

- Inexpensive
- Accurate
- Self powered
- Wide frequency range
- Isolated Output
- Reliable



VOLTAGE TRANSDUCERS

MODEL	VOLTAGE (VAC) RANGE	OUTPUT CAL
VT120	0 to 150	1 mA @ 150V
VT240	0 to 300	1 mA @ 300V
VT480*	0 to 575	1 mA @575V

* Includes OSI 226-145 Potential Transformer

SPECIFICATIONS (common to all):

Accuracy (Calibration, linearity @ 25°C): ±0.5% FS

Frequency Range: 50 to 500 Hz

Response Time: 400 msec.

Temperature Effect (from calibrated value):
−20°C to +60°C ±1% of Reading

Ripple: <1% FS

Full Scale Output: 1 mA dc

Output Loading: 0-10K ohms

Overload (Continuous):
Voltage: Full Scale Rating
Current: 2X Rating except CT10-1 & CT20-1,
1.25 Rating —
1 Second Transients, 50 X Rated Input

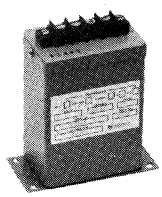
Burden:
Voltage: 2.8 VA FS
Current: 1 VA FS

Operating Range (Extended):
Voltage: Full Scale
Current: 1.2 X Rating

Dielectric Test (Input/Output/Case): 1500 VAC

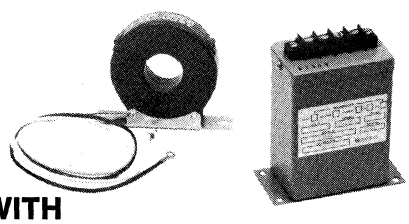
NOTE: For 2 or 3 Transducers in 1 enclosure add the number required to the front of model number. Typical number 3 CTS-1 or 2 VT 120. Multiple input units have separate isolated 0-1 mA outputs corresponding to each input.

FOR DIMENSIONS REQUEST CATALOG #288



CURRENT TRANSDUCERS DIRECT CONNECTED

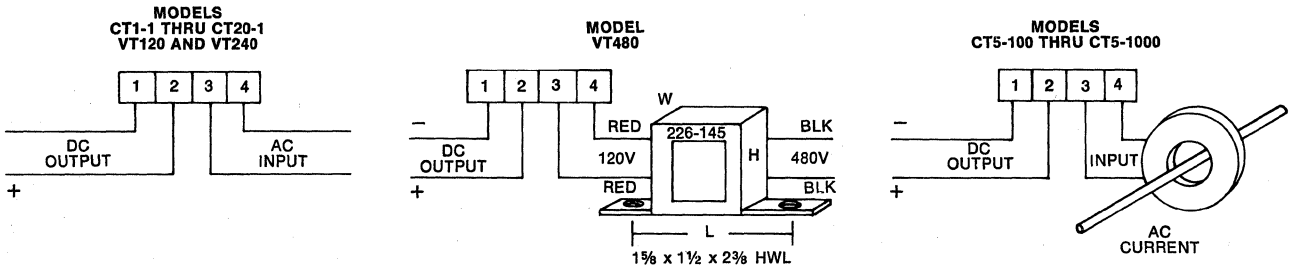
MODEL	CURRENT (AMPS AC) RANGE	OUTPUT CAL	CURRENT SENSOR
CT1-1	0 to 1	1 mA @ 1A	Internal
CT5-1	0 to 5	1 mA @ 5A	Internal
CT10-1	0 to 10	1 mA @ 10A	Internal
CT20-1	0 to 20	1 mA @ 20A	Internal



SUPPLIED WITH CURRENT TRANSFORMER

CT5-100	0 to 100	1 mA @ 100A	W
CT5-200	0 to 200	1 mA @ 200A	W
CT5-300	0 to 300	1 mA @ 300A	W
CT5-400	0 to 400	1 mA @ 400A	X
CT5-500	0 to 500	1 mA @ 600A	X
CT5-600	0 to 600	1 mA @ 600A	X
CT5-800	0 to 800	1 mA @ 800A	Y
CT5-1000	0 to 1000	1 mA @1000A	Y

VOLTAGE AND CURRENT TRANSDUCER CONNECTIONS



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PHONE (614) 486-9561 • FAX 614-486-0743

RMS VOLTAGE & CURRENT TRANSDUCERS CT-R SERIES VT-R & CT-RT SERIES

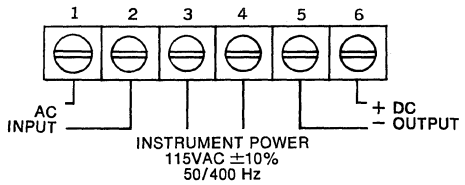
FEATURES AND APPLICATIONS:

- Accuracy 0.25%
- Output directly proportional to the RMS value of input
- Can be overranged 20% with accuracy
- Current Transducers: 20 to 2000 Hertz range
- Voltage Transducers: 50 to 400 Hertz range
- CT1R and CT1RV, DC to 2 KHz

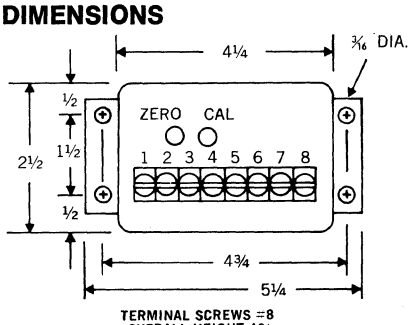
SPECIFICATIONS:

Accuracy and Linearity: ±0.25% FS at 60 Hz
Accuracy & Linearity: ±0.5% over frequency range
Frequency Range: 48 to 420 Hz
CT1R and CT1RV only DC or 20 to 2 KHz
Inputs:
Voltage: See Tables
Current: See Tables
Overload:
Voltage: See Table
Current: (Transient) 50A for 10 Sec. Per Hour, 250 A for 1 Sec. Per Hour, excluding CT1R and CT1RV
Input Signal Burden:
Voltage: 0.12 VA FS
Current: 0.28 VA FS
CT1R and CT1RV: 0.5 VA FS
Dielectric Test (Input/Output/Case): 1500 VAC RMS
Voltage: 1500 VAC RMS
CT1R and CT1RV only not isolated
Output Response: 200 milliseconds to 90%
Ripple: <1% FS
Output Short Circuit Protected
Temperature Effect: ±0.5% (−10°C to +60°C)
External Power: 115 VAC ±10%, 50 to 400 Hz

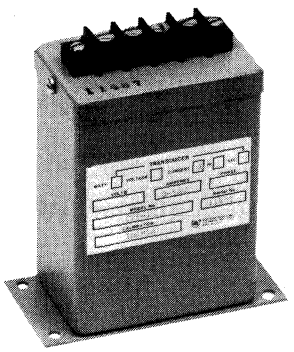
VOLTAGE AND CURRENT TRANSDUCER CONNECTIONS



CASE DIMENSIONS



TERMINAL SCREWS =8
OVERALL HEIGHT 4⅜



VOLTAGE TRANSDUCERS

MODEL	INPUT SIGNAL	CALIBRATION OUTPUT	LOAD OHMS
VT1R	0 to 150V	1 mA DC @ 120V	0-10K
VT2R	0 to 300V	1 mA DC @ 240V	0-10K
VT4R	0 to 600V	1 mA DC @ 480V	0-10K
VT1RV	0 to 150V	10 VDC @ 120V	>2K
VT2RV	0 to 300V	10 VDC @ 240V	>2K
VT4RV	0 to 600V	10 VDC @480V	>2K

CURRENT TRANSDUCERS

CT1TR	0 to 1A	1 mA DC @ 1A	0-10K
CT1TRV	0 to 1A	10 VDC @ 1A	>2K
CT5TR	0 to 5A	1 mA DC @ 5A	0-10K
CT5TRV	0 to 5A	10 VDC @ 5A	>2K
CT10TR	0 to 10A	1 mA DC @ 10A	0-10K
CT10TRV	0 to 10A	10 VDC @ 10A	>2K
CT15TR	0 to 15A	1 mA DC @ 15A	0-10K
CT15TRV	0 to 15A	10 VDC @ 15A	>2K
CT20TR	0 to 20A	1 mA DC @ 20A	0-10K
CT20TRV	0 to 20A	10 VDC @ 20A	>2K

CURRENT TRANSDUCERS NOT ISOLATED

CT1R	0 to 5A	1 mA DC @ 5A	0-10K
CT1RV	0 to 5A	10 VDC @ 5A	>2K

* NOTE:
(1) CTR Series output is NOT isolated from input. Use instrumentation which is isolated from source. Caution is advised when making connections.
(2) All models have been calibrated at the factory to give the correct output at the specified input rating. The "CAL" adjustment is set at the factory and should not be adjusted unless recalibration is required. The "ZERO" adjustment is provided to correct for an output offset "at zero input conditions," without affecting the calibration of the unit.

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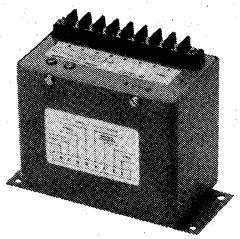
DC & RMS VOLTAGE TRANSDUCERS VT7 & VT8 SERIES



FEATURES AND APPLICATIONS:

VT7 SERIES:

- DC to 5 KHz Frequency Response
- Provides an output isolated signal proportional to DC input voltage
- 50 or 100 millivolt shunt model available
- 1500 V isolation input to output

ORDERING INFORMATION:

Add the "Code Designation" to the Model Number below for the Type, Rated Voltage, and Rated Output desired.

Example: VT7-01B: DC Input of 0 to 50 MVs and output 0 to 1 mA.

MODEL NO. VT * — O X

*CODE	TYPE
7	DC, Input
8	AC, AC/DC Input

O CODE	RATED VOLTAGE
(1) 01	50 mV
(1) 02	100 mV
1	12V
2	25V
3	50V
4	100V
5	150V
6	200V
7	300V
8	400V
9	500V
10	600V
11	700V
12	800V
13	900V
14	1000V

External multiplier resistance box is supplied.

X CODE	RATED OUTPUT SIGNAL
B	1 mA
D	10 Volts
E	4-20 mA

NOTES:
(1) 50 or 100 millivolt model is available in the VT7 Series only.
(2) Models with the rated input voltage above 600 volts require an external multiplier resistance box, which will be supplied with the unit.

FOR DIMENSIONS REQUEST CATALOG #288

FEATURES AND APPLICATIONS:

VT8 SERIES:

- DC to 5 KHz frequency response
- Output signal proportional to RMS value of AC, or AC/DC input
- 1500 Volt isolation between the input and output

SPECIFICATIONS:

INPUT:

Voltage: (Check code designation for rated input)

Overvoltage: 2 times rated input or 1500V whichever is smaller

Impedance: >100K ohm

Frequency Range: dc to 5 KHz

Response Time (99%): 50 μsec.

Isolation (Input/Output/Case/Instrument Power): 1500 VAC

Instrument Power Required: 115 VAC ±10%, 50-400 Hz

OUTPUT: (Short Circuit Protected)

Output Signal:
For VT7: 0 to ± mA, 0 to ±10 volts or a 4 to 20 mA signal which is directly proportional to the DC input voltage
For VT8: 0 to +1 mA, 0 to +10 volts or 4 to 20 mA DC signal which is directly proportional to the RMS input voltage

Response Time:
VT7 Models: 50 microseconds
VT8 Models: 200 milliseconds

Load on Output:
1 mA, 0 to 10K ohms
10 Volts, >2K ohms
4-20 mA, 0 to 500 ohms

Temperature Effects on Output (−10°C to +60°C): ±1%

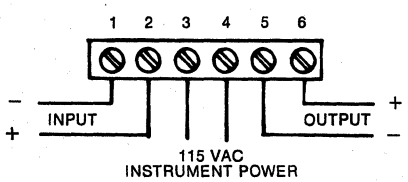
ACCURACY:

±0.5% RO
(including set point, linearity and repeatability)

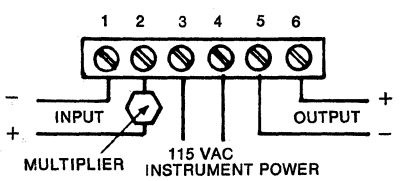
Calibration: Each unit is calibrated at the factory for Rated Input Voltage

CONNECTIONS

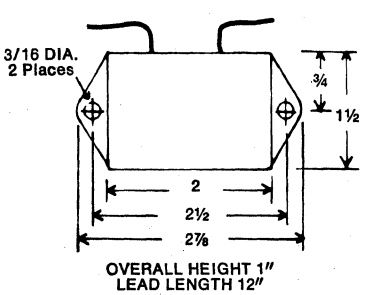
STANDARD MODELS



MODELS REQUIRING MULTIPLIER



MULTIPLIER BOX



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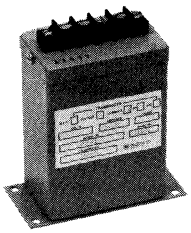
PHONE (614) 486-9561 • FAX 614-486-0743

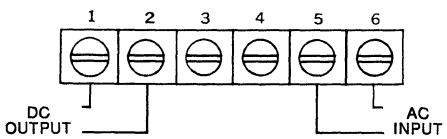
FREQUENCY TRANSDUCERS FT50, FT60 & FT400 SERIES



FEATURES AND APPLICATIONS:

- Analog output proportional to narrow frequency range
- Voltage or current output models available
- 50, 60, or 400 Hertz models available
- Rugged for industrial use
- Terminal block connections

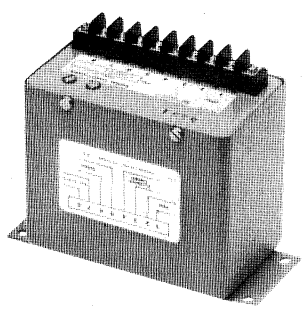
TRANSDUCER CONNECTIONS



SPECIFICATIONS:

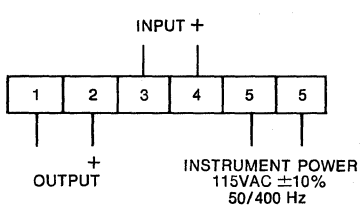
MODEL NUMBER	FT50	FT60	FT400
Input Voltage	95-135V	95-135V	95-135V
Over Voltage	150V	150V	150V
Frequency Range	45-55 Hz	55-65 Hz	375-425 Hz
Output	0-1 mA	0-1 mA	0-1 mA
Load on Output	0-10KΩ	0-10KΩ	0-10KΩ
Accuracy	±0.1 Hz	±0.1 Hz	±0.2 Hz
Temperature Range	−20°C +60°C	−20°C +60°C	−20°C +60°C
Temperature Effect	±0.005% °C	±0.005% °C	±0.005% °C
Response Time	400 mSec.	400 mSec.	400 mSec.
Burden	4 VA	4 VA	4 VA

PRECISION CURRENT CONVERTER SC-E SERIES



FEATURES AND APPLICATIONS:

- Provides 4 to 20 mA process control signal
- Excellent accuracy ±0.1% FS
- Models available for most common analog inputs
- Rugged for industrial application
- Terminal block connections



SPECIFICATIONS: (common to all):

INPUT:

Range: See Table
Overload (without damage): 10 times input
Isolation: (input is not isolated from output)

OUTPUT:

Range: 4 to 20 mA DC
Load on Output: 0 to 1500 ohms
Response Time 99%: 100 μSec.
Ripple: <1% FS
Accuracy and Linearity: ±0.1% FS
Calibration:
20 mA DC at rated input
4 mA DC at zero input
Temperature Effect: −20°C to +65°C, ±1%
Instrument Power: 115 VAC ±10%, 50-400 Hz

MODEL	INPUT SIGNAL	BURDEN ON INPUT
SC-E	0-1 mA DC	1KΩ
SC-E100	0-10VDC	10KΩ
SC-E.5	0-50 mV DC	>100KΩ
SC-E1.0	0-100 mV DC	>100KΩ
SC-E1.5	0-150 mV DC	>100KΩ

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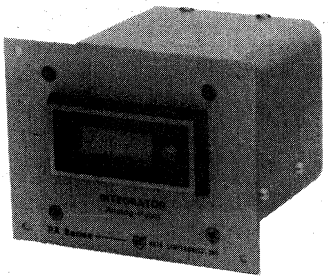
PROCESS ACCUMULATOR PA SERIES



FEATURES AND APPLICATIONS

- Accumulate watt hours, ampere hours, VAR hours volume, weight, or distance
- Readout directly related to the time integral of the analog input signal
- 6 digit 0.35″ LCD readout
- Battery backup
- Current or voltage inputs
- Can be set from 200 to 100,000 counts per hour
- Front panel, remote or combination reset
- Panel or rack mount

SPECIFICATIONS:

INPUT:

Rated: See Table Code*
Over-range: 1.25 X Rating
Burden:
Voltage Units > 100K Ohm
1 mA Units < 1K Ohm
20 mA Units < 100 Ohm

OUTPUT:

Counter: 6 digit 0.35″ LCD
Counter Batteries: (2) MN9100 Mallory
Reset — Front Panel Manual: Remote or Combination
Count Rate: 200 to 100K, Counts Per Hour

ACCURACY:

±0.25% RO
Linearity: ±0.1% RO
Temperature Effect: (−20°C to +60°C) ± 0.005%/°C
Instrument Power:
115 VAC ±10%, 50 to 400 Hz
220 VAC, 50 Hz, Add Option X22 to Part Number

ORDERING INFORMATION:

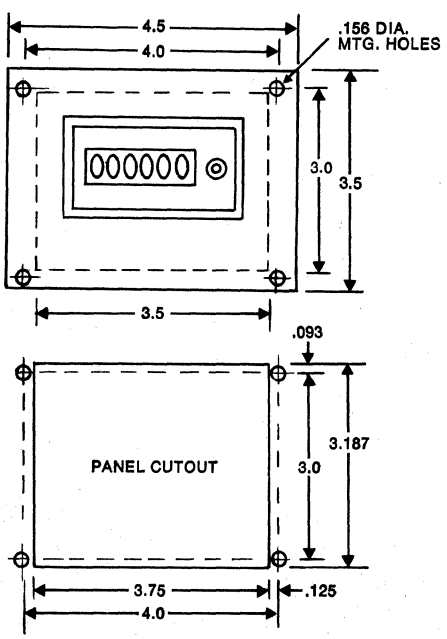
MODEL NO. PA * Y X

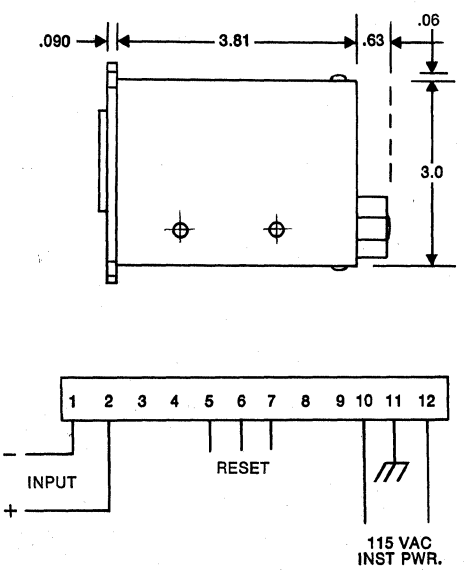
* CODE	RATED	INPUT
1	0-50	mV
2	0-100	mV
3	0-150	mV
4	0-250	mV
5	0-1	mA
6	0-10	Vdc
7	0-5	Vdc
8	0-20	mA
9	1-5	Vdc
10	4-20	mA

Y CODE RATED COUNTS PER HOUR
Specify the number of counts per hour required at the rated full scale input, output range is from 200-100K counts per hour. Note: Over 999, use 1K, 2.6K etc.

X CODE MOUNTING
P PANEL
R RACK 19″ x 3½″

DIMENSIONS AND CONNECTIONS





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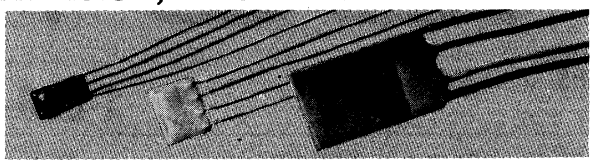
HALL EFFECT SENSORS HR & HP SERIES

HALLTRON, MAGNETIC FIELD SENSORS



FEATURES AND APPLICATIONS:

• For magnetic sensing • High linearity • Rugged and reliable • Measuring applications • Excellent stability • Low noise

MODEL NO.	HALL OUTPUT V_H, MILLIVOLTS ±25% B = 10Kg, Ic = (NOMINAL)	NOMINAL CONTROL CURRENT Ic, mA	OHMIC RESIDUAL V_{RO}, MILLIVOLTS (B=0 Ic - 10 mA)	OHMIC RESIDUAL V_{RO}, MILLIVOLTS (B=0 Ic - 100 mA)	INPUT RESISTANCE R/in, OHMS (NOMINAL)	OUTPUT RESISTANCE R/out, OHMS (NOMINAL)	DIMENSIONS L/W/T INCHES (NOMINAL)	LEAD INSULATION	TEMPERATURE COEFFICIENT OF VH IN %/°C (AVG.)
HR36	350	350	—	0.15	1.5	1.5	.625 .375 .028	PVC	−0.1
HR38	200	25	0.2	—	8	8	.625 .375 .028	PVC	−0.25
HR66	500	200	—	0.5	5	4	.200 .250 .028	Enamel	−0.15
HR67	200	25	0.2	—	9	5	.300 .150 .020	Teflon	−0.25
HR70	340	200	—	0.5	2	2	.200 .250 .028	PVC	−0.1
HR72	700	100	0.2	—	9	6	.200 .250 .028	Enamel	−0.25
HR77	550	100	—	1	10	10	.200 .250 .030	Enamel	−0.25
HR78	80	100	—	0.15	2	1.5	.100 .300 .020	Enamel	−0.10
HR88	400	300	—	4	2.5	2	.340 .375 .023	Enamel	−0.15
HR120	75	100	—	0.5	1.5	1.5	.200 .250 .030	Enamel	−0.05
HR125A	100	100	—	0.5	2.5	2.0	.200 .250 .028	Enamel	−0.05
HR170	10	100	—	0.03	0.7	0.6	.200 .250 .025	Enamel	−0.005
HS55	250	100	—	0.5	1.2	1	.500 .375 .025	PVC	—

* Denotes Axial Type Probes. All others are Transverse.

Operation Temperature Range: −65°C to +85°C

LOOP CONVERTER PI SERIES

FEATURES AND APPLICATIONS:

- No external power required
- Easy to install
- Small size
- High accuracy

SPECIFICATIONS:

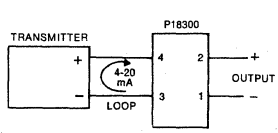
INPUT: 4-20 mA dc loop at a 400Ω load on input

OUTPUT: Model PI8300B — 0 to 1 mA dc into 0-4KΩ
Model PI8300D — 0 to 1 Vdc into > 10K load

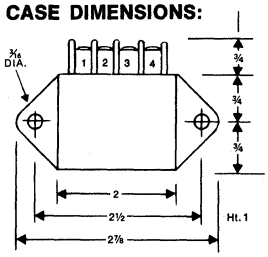
ACCURACY & LINEARITY: ±0.25% F.S.

Temperature Effects: −20°C to +65°C, ±0.005%/°C
Adjustments: (Internal) Factory Set
Grounding: Since the converter is a nonisolated type, either the input or the output can be grounded but not both. Although, if the 4-20 mA loop is grounded at any other point in the loop, it is advisable to float both input and output.

CONNECTIONS



CASE DIMENSIONS:



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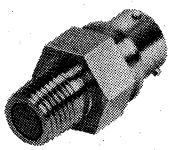
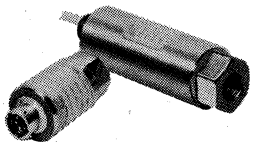
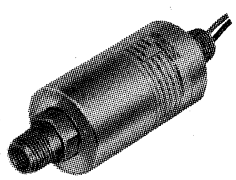
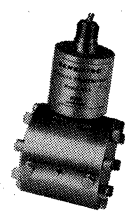
PRESSURE TRANSDUCERS
GAGE and ABSOLUTE

Sensotec's® industrially rugged and highly reliable pressure transducers are constructed with 17-4 stainless steel and designed with 4 arm strain gage bridges. Units are available with millivolt, volt or current output. Operating temperature range for most models is −65° to 320°F. Sensotec offers the industry's broadest range of standard options. Many models/ranges are stocked and available for quick delivery.

MODELS	TYPE	RANGE* (PSI)	ACCURACY* (±% F.S.)	SIZE* (Minimum)	PRICES*
STJE, TJE	Ultra Precision	0-1 to 0-15K	.05 to .1%	1½" X 2"	$480-$735
Z, A5	Precision	0-.5 to 0-30K	.25 to .5%	1½" X 2"	$295-$565
LM	Low Cost	0-100 to 0-10K	.5%	1⅛" X 2"	$160-$180
A105, S	Subminiature	0-10 to 0-20K	.5 to 1.0%	⅛" X ¼"	$335-$555
HTA	High Temperature	0-25 to 0-1500	.25%	1½" X 2½"	$675
DTPG	Microprocessor	0-2 to 0-10K	.1%	3" X 7"	$795-$850
HP, UHP	Ultra High Pressure	0-50K to 0-175K	.5 to 1.0%	1½" X 3¾"	$650-$1450
EB	Electronic Barometer	Barometric	.1%	1½" X 3⅞"	$675-$765

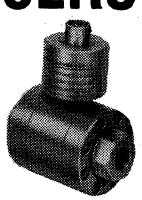
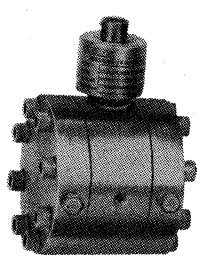
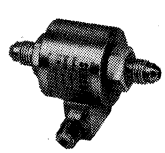
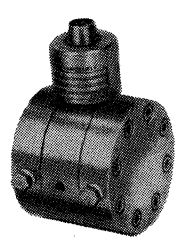
PRESSURE TRANSMITTERS

Sensotec's Factory Mutual Approved pressure transmitters are ideally suited for oil refineries, drilling rigs, chemical plants and other harsh environments where explosive vapors or high moisture conditions may exist. Two-wire 4-20ma current output permits cable runs up to 10 miles long with a high signal to noise ratio.

MODELS	TYPE	RANGE* (PSI)	ACCURACY (±% F.S.)	SIZE (DxL)* (Minimum)	PRICES* START AT
811 FMG	Gage Pressure	0-2 to 0-10K	.25%	2¼" X 4"	$550-$720
811 FMA	Absolute Pressure	0-2 to 0-10K	.25%	2¼" X 4"	$550-$720
911 FMD	W/W Differential	0-2 to 0-10K	.25%	2¼" X 2¾"	$775-$985

PRESSURE TRANSDUCERS
WET/WET DIFFERENTIAL

Sensotec's strain gage wet/wet differential pressure transducers have welded stainless steel diaphragms to accept fluid into both pressure ports. Units are available with millivolt, volt or current output. Mechanical overload stops protect the transducer from high overload pressures in either direction. Many models/ranges are stocked and available for quick delivery.

MODELS	TYPE	RANGE* (PSID)	ACCURACY (±% F.S.)	SIZE* (Minimum)	PRICES*
TJE	Ultra Precision	0-50 to 0-750	.1%	3" X 2½"	$950
Z, A5	Precision	0-0.5 to 0-10K	.25 to .5%	2¼" X 2¼"	$580-$850
DTPD	Microprocessor	0-2 to 0-25	.1%	8" X 9"	$1050-$1090
LPD	Low Power (2 ma)	0-1 to 0-10K	.25%	2¼" X 2¼"	$775-$985
VHL, UHL	High Line Pressure	0-200 to 0-5K	1.0%	3" X 5"	$1550-$3395
WD-TJE	Wet/Dry Differential	0-0.5 to 0-10K	.1%	1½" X 3"	$535-$640
P30P	Subminiature	0-5 to 0-2K	.3%	1⅛" X 1⅛"	$620-$695

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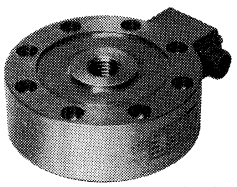
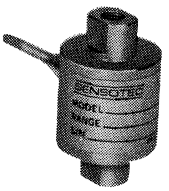
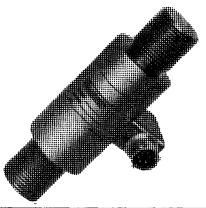
LOAD CELLS



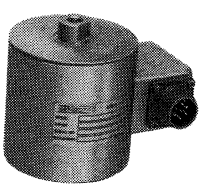


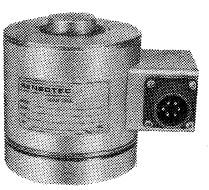


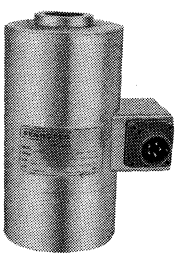
Sensotec's line of industrial load cells utilize high quality strain gages, precision gaging techniques and welded stainless steel construction to provide precise, reliable force measurements even in severe operating environments. Tension, compression, and universal models are offered. Ranges from 0-1000 grams thru 0-50,000 lbs. are stocked and available for quick delivery. Standard ranges from 0-50 grams to 0-3 million pounds are offered.

MODELS	TYPE	RANGE* (LBS.)	ACCURACY* (±% F.S.)	SIZE* (Minimum)	PRICES*
41, 43	Precision	0-5 to 0-400K	.2%	2½" X ¾"	$485-$2650
51, 53	Low Cost	0-5 to 0-50K	.25%	1¼" X ⅜"	$360-$585
31, 34	Miniature	0-0.1 to 0-10K	.2%	¾" X ½"	$565-$680
11, 13	Subminiature	0-0.1 to 0-1000	.25%	⅜" X ⅛"	$395-$540
HTC, HTT	High Temperature	0-50 to 0-100K	.25%	3" X 1"	$790-$2350
RF, RM	Rod End	0-250 to 200K	.2%	1¼" X 1¾"	$495-$1500
73, 75	Fatigue Rated	0-50 to 200K	.1%	3" X1"	$685-$2750
TH, D	Donut Shape	0-0.2 to 0-200K	.5 to 1.0%	½" X ⅛"	$450-$950
GR1, GR2	Load/Force Beam	0-100 to 0-10K	.06%	1¼" X 5⅛"	$450-$850
MIL	Million Pounder	0-500K to 3 Mil	.5%	5½" X 7"	$2850-$6700
MBL, MBH	Minigram Beams	0-.02 to 0-10	.1%	½" X 2½"	395-$450
81, 85, 87	S-Shaped	0-.1 to 0-1K	.1%	1" X 1¼" X ½"	$275-$450
SP	Single Point	0-5 to 0-100	.1%	1¼" X 3" X 6"	$350

PRECISION WEIGHING CELLS



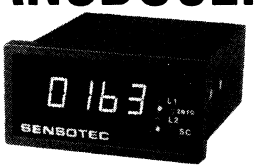




Sensotec's precision weighing cells are recommended for such applications as truck scales, tank weighing, silo weighing, or steel mill process control where precise, reliable measurements must be made in a rugged environment. Units are available for compression, tension, or universal service with millivolt, volt, or current output.

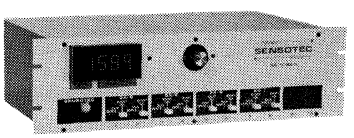
MODELS	TYPE	RANGE* (LBS.)	ACCURACY (±% F.S.)	SIZE (DxL)* (Minimum)	PRICES*
SG	Compression	0-10K to 0-200K	.05%	3½" X 2 1/5"	$750-$1690
UG	Universal	0-100 to 0-200K	.05%	2" X 2¾"	$850-$3890
WG	Compression	0-10K to 0-200K	.1%	3¼" X 3½"	$790-$1590

TRANSDUCER INSTRUMENTATION



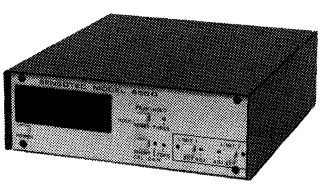
GM

Low cost, single channel strain gage transducer instrument featuring a 5 or 10 volt transducer excitation supply, an amplified 0-5VDC output, a 4½ digit display, and a shunt calibration on the front panel. Stocked for quick delivery. (Prices start at $375)



SA SERIES

Multi-channel, multi-function digital display instrumentation designed to provide power, amplification and signal conditioning for strain gage transducers. Users select a custom mix of amplifier and function cards to meet their specific requirements. Function cards are available with high/low limits, peak and hold, track and hold, and sum and difference capability. (Price per channel starts at $160)



450D

Low noise, low cost, single channel strain gage transducer amplifier and digital display indicator. Features include internal shunt calibration, zero and span adjustments and 0-5VDC output. Hi/Lo limits, peak detector, track and hold and 4-20ma output are optional. (Prices start at $595)

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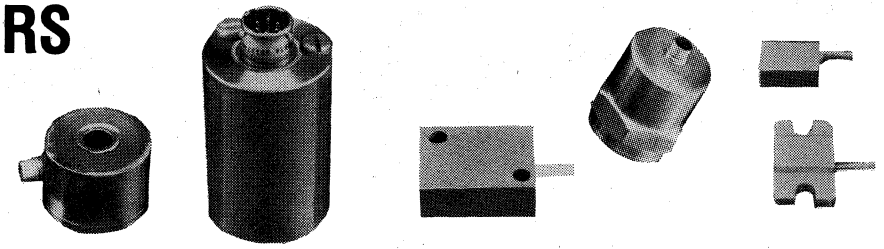
ACCELEROMETERS

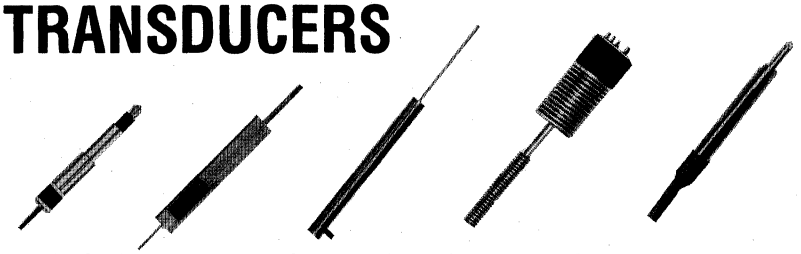


Sensotec's accelerometers utilize low impedance strain gages with a useable frequency range from 0 to 2000 Hertz. Rugged, austenitic stainless steel construction assures dependable performance. Overloads of 500% are endured without damage.

Piezoelectric accelerometers sensitivity is 100 pc/g nominal and a natural frequency of 30 KHZ.

MODELS	TYPE	RANGE* (G-Force)	LINEARITY (±% F.S.)	SIZE* (Minimum)	PRICES* START AT
JTFAF	Super Stable	±5 to ±100g	1%	1 1/2″ X 2″	$595
JTF	General Purpose	±5 to ±500g	1%	1″ X 3/8″ X 3/4″	$350
JTFS	Submersible	±5 to ±500g	1%	1″ X 1″	$500
JTFM	Miniature	±50 to ±500g	1%	3/8″ X 1/8″ X 1/4″	$350
JTFA	Amplified	±5 to ±500g	1%	1 1/2″ X 2″	$550
JTFB	Bi-axial	±5 to ±500g	1%	1″ X 1″ X 1/2″	$795
JTFT	Tri-axial	±5 to ±500g	1%	1″ X 1″ X 1″	$995
PEL	Piezoelectric	Up to ±2000g	1%	7/8″ X 1 4/5″	$395
PEI	Industrial	Up to ±2000g	1%	5/8″ X 4/5″	$425

DISPLACEMENT TRANSDUCERS



Sensotec's line of LVDT transducers are designed to meet the requirements of most single and multi-point industrial gaging applications as well as micro displacement measurements in research and scientific laboratories. Models are available with "free" unguided, "captive" spring return, and "captive" guided armatures.

MODELS	TYPE	RANGE* (Inches)	LINEARITY* (±% F.S.)	SIZE* (Minimum)	PRICES* START AT
PLV, S5	Ultra Precision	±.01 to ±0.2	.2%	1/4″ X 2″	$180
VL7	Long Stroke	±0.5 to ±18.5	.1 to .5%	3/4″ X 5″	$160
SM5	Miniature	±.025 to ±0.2	.2%	3/8″ X 3/4″	$115
S7	Submersible	±.04 to ±0.2	.2%	3/8″ X 1 5/8″	$290
DL	DC-DC	±0.5 to ±18.5	.25 to .5%	3/4″ X 6 7/8″	$265
S2	DC-DC Miniature	±0.1 to ±0.2	.25%	3/4″ X 2 1/8″	$205
W7	DC-DC Submersible	±0.5 to ±2.0	.25%	3/4″ X 5 1/2″	$390

***Column Heading Notes:**

Range: Indicates range of full scale capacities offered. For example, the Ultra Precision pressure transducer range of 0-.5 to 0-15K psi includes units with 0-.5 psi, 0-1 psi, 0-2 psi, 0-5 psi, 0-10 psi, etc.

Accuracy: Within the product type classification, accuracy varies according to model and/or range.

Size: Dimensions are rounded to nearest 1/8″ and are listed as diameter X length/height. Size varies with range. Some accelerometers are rectangular in shape.

Prices: Lower prices are available for large quantities.

OTHER SENSOTEC PRODUCTS

- Liquid Levels
- Leak Detectors (Pressure)
- Torque Transducers
- Velocity Transducers
- Non-Contact Sensors

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Product Type
Accuracy
Range
Operating Environment

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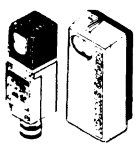
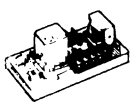
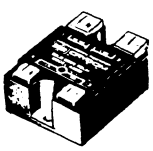
TOGGLE SWITCHES

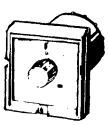

PHOTOELECTRICS

RELAYS


LIQUID LEVEL CONTROLS


SOLID STATE RELAYS

TERMINAL BLOCKS


TEMPERATURE CONTROLS

TIMERS

CABINETS
BUD

CIRCUIT BREAKERS
Airpax
Aromat
Carlingswitch
Heinemann
Potter & Brumfield

CONNECTORS & SOCKETS
Amphenol
Aromat
Curtis
Custom Connector
Idec
Lumberg
Master Electronics
Potter & Brumfield
Souriau
Vernitron-Beau
Welcon/Wells

COUNTERS
Engler
Hecon
IVO
Kessler-Ellis
Master Electronics
Omron
Redington
Red Lion
Sodeco/Maxmar
Stemco
Veeder-Root

DIODES
General Instr.

FANS
Aromat
U.S. Toyo

FILTERS
Curtis

RELAYS
Aleph International
Allied Controls
American-Zettler
Aromat
AT&T
Bosch
C.P. Clare
Coto
Crydom Controls
EAC
Elec-Trol
Fujitsu
Gordos
Grayhill
Guardian
Hi-G
Idec
ITT
Line Electric
Magnecraft
Master Electronics
MEC
Midtex
Omron
Potter & Brumfield
RBM
Schrack
Siemens
Sigma
Standex
Stantel
Struthers-Dunn
Telemecanique
Theta-J
Triridge

FUSES
Bussmann
Littelfuse
Underwriters Safety

HARDWARE & WIRING DEVICES
Aavid
Buchanan
Electrovert
Harvey Hubbell
H.H. Smith
Modor

KNOBS
Cosmo/Kurz-Kasch
Raytheon/Panel Products

SWITCHES
Acro
Alco
American Switch
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Arrow Hart
Carlingswitch
C&K
EECO
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Landis & Gyr
Linemaster
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McGill
Microswitch
Omron
Oslo
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Idec
IDI
IEE
JKL
Leecraft
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INDUCTORS
Jeffers
Microtran
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PHOTOELECTRIC
Aromat
Dolan-Jenner
Electro
Omron
Photoswitch/AB
Skan-A-Matic

PROXIMITY
Agastat
Electro
Omron

TIMERS
ATC
Agastat
Amperite
Antex
Crouzet
Eagle Signal
Guardian
Industrial Timer
Magnecraft
Master Electronics
Midtex
National Controls
Omron
Potter & Brumfield
SSAC
Struthers-Dunn
Syracuse Electronics

RESISTOR NETWORK
Beckman Ind.

TRIMMERS & POTS
Beckman Ind.

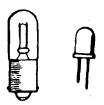
SOLENOID
Dormeyer
Guardian
Line Electric

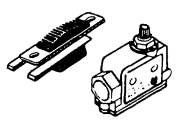
TERMINAL BLOCKS
Beau
Buchanan
Curtis
Electrovert
Kulka
Magnum
Marco
RDI
Underwriters Safety
Vernitron-Beau

TRANSFORMERS
Dormeyer
Microtran
Stancor
Thordarson
Triad

CIRCUIT BREAKERS FUSES & FUSEHOLDERS

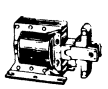
KNOBS


LAMPS & LEDS


SWITCHES

RELAYS

INDICATOR LIGHTS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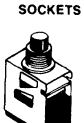
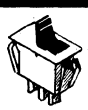
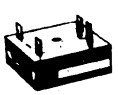
SOCKETS


PUSHBUTTON SWITCHES

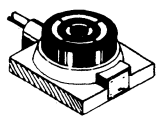

PADDLE SWITCHES

TRANSFORMERS


TIMERS

COUNTERS

FANS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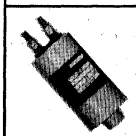
Setra Systems, Inc.

Product Line Summary

Gage - Absolute - Vacuum Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
204	General Purpose Intrinsically Safe R & D Laboratories Vacuum Systems	Absolute Pressure Gage Pressure Vacuum Pressure	25 to 5000 psia 25 to 10000 psig 0 to 14.7 psiv	0.11%	0.4 max Zero 0.3 max Span	Gas or liquid compatible with Stainless Steel	**204** 0-5 VDC **C-204** 4-20 mA
206/207 OEM	Equipment Automation Compressor Control Chillers Paper Converting Hydraulics & Pneumatics	Gage Pressure	25 to 5000 psig	0.13%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**206/207** 0.1-5.1 VDC **C-206/C-207** 4-20 mA
211	Test & Measurement Engine Test Cells Prototype Analysis Metrology Laboratories Hydraulic Test Equipment	Gage Pressure	25 to 5000 psig	0.13%	0.5 max Zero 0.5 max Span	Gas or liquid compatible with Stainless Steel	**211** 0.1-5.1 VDC **C-211** 4-20 mA
 280E	General Purpose Hydraulics & Pneumatics Process Control P/I Range Level Measurement	Absolute Pressure Gage Pressure Pneumatic Pressure Compound Pressure	15 to 5000 psia 15 to 10000 psig 3-15 psig -14.7 to 35, 50, 100 psig	0.11%	1.0 max Zero 1.5 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5 VDC **C-280E** 4-20 mA
270	Weather Data Systems Laser Interferometers Altimeter Setting Indicators Transfer Pressure Standard	Barometric Pressure Absolute Pressure Gage Pressure	600-1100 mbars 800-1100 mbars 5 to 100 psia 5 to 100 psig	0.05%	0.1 max Zero (0.2 Barometric) 0.1 max Span	Wet or Dry Air	0-5 VDC

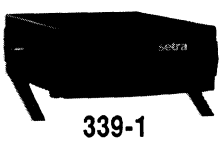
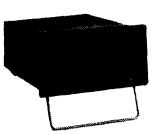
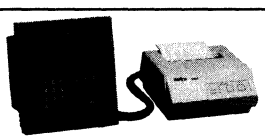
Differential Pressure Transducers

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
204D	General Purpose Intrinsically Safe High Differential Pressure	Differential Pressure	10 to 10000 psid	0.11%	1.0 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	0-5 VDC or ± 2.5 VDC
228-1	Process Control Filter Condition Monitoring Refrigeration Equipment Chillers	Differential Pressure (can be wet both sides)	Low diff. pres. 1 to 100 psid ± 0.5 to 50 psid	Low Ranges 0.15% High Ranges 0.25%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel (both pressure and reference sides)	**228-1** 0-5 VDC or ± 2.5 VDC **C-228-1** 4-20 mA
239	HVAC Control Leak Detection Environmental Testing R & D Scientific	Differential Pressure	0.5"WC to 10 psid ± 0.25"WC to ± 5 psid	0.14%	1.0 max Zero 1.0 max Span	Gas compatible with Stainless Steel, Aluminum	**239** 0-5 VDC or ± 2.5 VDC **C-239** 4-20mA
264	HVAC and VAV Control Energy Management Systems Clean Room Control Medical Instrumentation Filter Condition Monitoring	Very low Differential Pressure	0.1 to 25 in. WC	1.0%	3.3 Zero 3.3 Span	Air or Inert gases	**264** 0-5 VDC **C-264** 4-20mA

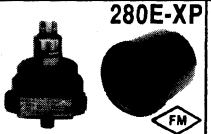
setra

45 Nagog Park, Acton, MA 01720
1-800-257-3872, In MA (617) 263-1400
Telex: 4430243, Telefax: (617) 264-0292

Digital Displays and Systems

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Analog Output
300	Panel Mountable Digital indicators for use with Setra transducers and Transmitters	Gage Pressure Absolute Pressure Differential Pressure Vacuum Barometric Pressure	.5" WC to 10000 psig 1 to 5000 psia .5"WC to 10000 psid ± .25"WC to ± 500 psid 0 to 14.7 psiv 800 to 1100 mbars	Transducer Accuracy	0 to 5V or 0 to ±2.5V 4-20 mA
 339-1	Bench Top Digital Pressure Indicator R & D Scientific Temporary Field Pressure	Gage Pressure Differential Pressure	0.5" to 30" WC ±0.25" to ±15"WC 5 to 10 psid ± 2.5 to ± 5 psid	± 0.14%	0 to 5V or 0 to ±2.5V
360	Panel Mountable or BenchTop Digital Pressure Gage	Gage Pressure Absolute Pressure Vacuum Pressure	20 to 2000 psig 20 to 2000 psia 0 to 14.7 psiv	±0.1%	0 to 5V
 361	Barometric Pressure Monitoring Weather Data Systems Environmental Data Engine Test Cells Calibration Standard	Gage Pressure Absolute Pressure Barometric Pressure	5 to 100 psig 5 to 100 psia 800 to 1100 mbars	±0.05%	0 to 5V Barometric 6.4 to 8.8V
 370 240P	Barometric Pressure Monitoring Altimeter Calibration Pressure Switch Setting Laser Interferometers Min/Max Tracking Hi/Lo Alarming Transfer Pressure Standard	Barometric Absolute Pressure	600 to 1100 mbars 800 to 1100 mbars 5 to 100 psia	± 0.02%	RS-232

Specialty Application Products

Model	Applications	Type of Measurement	Pressure Ranges	Accuracy (RSS Method)	Thermal Effect ± % FS/100°F	Media Compatability	Output
 280E-XP FM Approved	Explosionproof/Weatherproof Process Instrument Signals Natural Gas Lines Chemical Processing Off-Shore Drilling	Gage Pressure Absolute Pressure- Compound Pressure P/I	15 to 10000 psig 25 to 5000 psia -14.7 to 35, 50 100 psig 3 to 15 psig	0.11%	**280E/C280E** 1.5 max Zero 1.0 max Span	Gas or liquid compatible with Stainless Steel	**280E** 0-5VDC **C-280E** 4-20mA
C-290	Sanitary Pressure Lines Food & Beverage Processing Tank Level Measurement Pharmaceutical Processing Sanitary Filtration Systems	Gage Pressure	1 to 30 psig	0.14%	2.0 max Zero 2.0 max Span	Gas or liquid compatible with Stainless Steel	4-20 mA

Accelerometer	Applications	G Ranges (Full Scale Ranges ± G)	Comment
141	Transportation Equipment Position Sensing Robotics Shock & Vibration Testing	2, 4, 8, 15, 30, 60, 150, 600	Hi Level Output

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COMMONLY USED ELECTRICAL/ELECTRONIC ABBREVIATIONS AND ACRONYMS

A
AC alternating current
ABS acrylonitrile butadiene-styrene
A/D analog to digital
ADC analog to digital converter
ADP automatic data processing
AF audio frequency
AFC automatic frequency control
ALGOL algorithmic language
AM amplitude modulation
AND a logical operator
AQL acceptable quality level
ASCII American national standard code for information interchange
ASIC application specific IC
ATE automatic test equipment
AWG American wire gauge

B
BALUN balanced to unbalanced
BASIC beginners' all-purpose symbolic instruction
BCD binary-coded decimal
BNC baby "N" connector
BUS basic utility system

C
CAD computer aided design
CAM computer aided manufacture
CAMAC computer automated measurement and control
CATV cable television or community antenna television
CCC (leaded) ceramic chip carriers
CCD computer-controlled display
CERMET ceramic metal element
CLCC ceramic leadless chip carriers
CMOS complementary metal-oxide semiconductor
Comm. communications
CPS characters per second
CPU central processing unit

D
D/A digital to analog
DAC digital to analog converter
DC direct current
DIAC bidirectional trigger diode
DIL dual in-line
DIN Deutsche Industrie Normenausschuss
DIP dual in-line package
DPM digital panel meter
DRAM dynamic RAM
DTL diode transistor logic

E
EDP electronic data processing
EBCDIC extended binary coded decimal interchange code
EEPROM electrically erasable PROM
EIA Electronic Industries Association
EMC electromagnetic compatibility
EMI electromagnetic interference
EMP electromagnetic pulse
EPROM electrically programmable ROM
ESR equivalent series resistance

F
FEP fluorinated ethylene propylene Copolymar, 200° Teflon
FET field-effect transistor
FM frequency modulation
FORTRAN formula translator

G
GaAsFET gallium arsenide FET
GPIB general purpose interface bus
GPS global positioning system

H
HF high frequency (3 to 30 MHz)
HIPOT test, measurement and diagnostic equipment
HLL high level language
HV high voltage
Hz Hertz

I
IC integrated circuit
IDC insulation displacement contact
IF intermediate frequency
IO input/output (devices)
IR insulation resistance (or) infrared

J
JEDEC Joint Electronic Device Engineering Council
JFET junction FET
JMOS junction MOS

K
kHz kilohertz (10^3)
KSR keyboard send /receive

L
LC inductance capacitance
LCC leaded chip carrier
LCD liquid crystal display
LED light-emitting diode
LF low frequency (30 to 300 kHz)
LIF low insertion force
LNA low noise amplifier
LNB low noise band
LSI large scale integration
LVDT linear velocity displacement transformer

M
MASER microwave amplification by stimulated emission of radiation
MATV master antenna television
µF microfarad
MHz megahertz
MIB microcomputer interface board
MIC microwave IC
MIPS million instructions per second
MOS metal oxide semiconductor
MOSFET metal oxide semiconductor FET
MOSIGT metal oxide semiconductor insulated-gate transistor
MOV metal oxide varistor
MPU microprocessor unit
MSI medium scale integration

N
NBS National Bureau of Standards
NEMP nuclear electromagnetic pulse
NIM national instrumentation module
NOR not OR
NTC negative temperature coefficient

O
OCR optical character reader
OEM original equipment manufacturer
OR a logical operator

P
PC printed circuit
PCB printed circuit board
PCM pulse code modulation
pF picofarad
PGA pin grid array
PIN positive-intrinsic-negative (transistor)
PLA programmable logic array
PLCC plastic leaded chip carrier
PLL phased lock loop
PPI plan position indicator
PROM programmable ROM
PTC positive temperature coefficient
PUT programmable unijunction transistor

Q
QAM quadrature amplitude modulation
Q (meter) quality-factor meter

R
RAM random access memory
RC resistance-capacitance
RFI radio frequency interference
RMS root mean square
ROM read only memory
RF radio frequency
RFC radio-frequency choke
RFI radio-frequency interference
RTD resistance-temperature detector
RTL resistor transistor logic
RTV room temperature vulcanizing
RW read/write

S
SAS silicon asymmetrical switch
SBC single board (micro) computer
SBS silicon bilateral switch
SCR silicon-controlled rectifier
SCS silicon controlled switch
SDA source & detector assemblies
SIDAC bidirectional voltage-triggered switch
SIMM single in-line memory module
SIP single in-line package
SMD surface mount device
SMT surface mount technology
SO small outline
SOIC small outline IC
SOT small outline transistor
SSI small scale integration
SSR solid state relay
STL Schottky transistor logic
SUS silicon unilateral switch

T
TC temperature coefficient
TCE thermal coefficient of expansion
TXCO temperature compensated crystal oscillator
TFE tetrafluoride ethylene propylene Copolymer, 250° Teflon
TRIAC bidirectional AC switch
TTL transistor-transistor logic
TTY teletypewriter

U
UHF ultra high frequency (300 MHz to 3 GHz)
UJT silicon unijunction transistor
UL Underwriters Laboratory
UPS uninterruptible power supply

V
VAC volts (of) alternating current
VAN value added network
VAR volt-ampere reactive
VCR video cassette recorder
VDC volts (of) direct current
VHF very high frequency (30 kHz to 300 MHz)
VHSIC very high speed integrated circuit
VLF very low frequency (3 to 30 kHz)
VLSI very large scale integration
VME virtual machine environment
VRM voice recognition module
VTVM vacuum tube volt meter
VU volume unit
VSWR voltage standing wave ratio

W
WPS word processing software

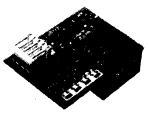
Y
YIG yttrium iron garnet

Z
ZIF zero insertion force

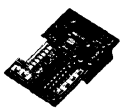
SHARP
Optoelectronics

Optical Rotary Encoders/ Magneto-Resistance Devices

GP1A13R
(GP1A16R, GP1A30R
GP1A33R, GP1A35R)

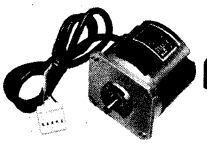

GP1R04

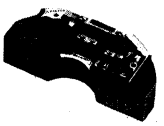
GP1R34


GP1R14

GP1R11
(GP1R21)

GP1R23


GP1R52


GP1R111

Optical Rotary Encoders

(Ta = 25°C)

Model No.	Absolute maximum ratings					Electrical characteristics				
	Vcc (V)	Topr (°C)	Tstg (°C)	R_L (kΩ)	I_{SINK} (mA)	Output signal	Resolution	Frequency (kHz) MAX.	Frequency R_L (kΩ)	Dissipation current I_{TOT} (mA) MAX.
GP1A13R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 1.14(mm)	10	I_F = 20(mA)	20
GP1A16R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.7(mm)	10	I_F = 20(mA)	20
GP1A30R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 1.14(mm)	5	I_F = 30(mA)	20
GP1A33R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.7(mm)	5	I_F = 30(mA)	20
GP1A35R	7	0 ~ +70	−40 ~ +80	—	—	Phase A (Digital output) Phase B (Digital output)	Disk slit pitch 0.22(mm)	tr(TYP.) 1.0μs	I_F = 30(mA)	20
GP1R04 Series	8	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/100/192/200 /360	20	10	70
GP1R14 Series	±15	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/192/200/360	20	10	75
GP1R34 Series	±15	0 ~ +70	−40 ~ +80	—	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/192/200/360	20	10	75
GP1R11	7.0	0 ~ +70	−40 ~ +80	—	20	Phase A (Digital output) Phase B (Digital output)	48/60/75/100	tr(TYP.) 0.2μs	10	70
GP1R21	7.0	0 ~ +70	−40 ~ +80	—	20	Phase A (Digital output) Phase B (Digital output)	120/200	tr(TYP.) 0.2μs	10	70
GP1R111 Series	8.0	0 ~ +70	−40 ~ +80	—	16	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/200/360	tr(TYP.) 0.3μs	0.3	80
GP1R23	6.0	0 ~ +70	−40 ~ +80	—	16	Phase A (Digital output) Phase B (Digital output)	500	tr(TYP.) 1.0μs	4.7	50
GP1R52 Series	8.0	0 ~ +70	−40 ~ +80	5.0	—	Phase A (Approx. sine wave) Phase B (Approx. cos wave) Phase Z (Index output)	96/200/360	20	10	70

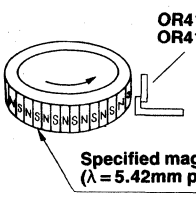
*Disk hub is optional. (GP1R52 has built-in disk hub.)

OR103M1

OR4103M

OR4104M

OR4108M



MR-CUE Head

(Ta = 25°C)

Model No.	Absolute maximum ratings			*2Cue signal playback output Vp-p (mV)						DC resistance Ro(Ω) TYP.
	Sensing current Is (mA)	Operating temperature Topr (°C)	Storage temperature Tstg (°C)	*32H record			*46H record			
				MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
OR103M1	10	+5 ~ +40	−30 ~ +60	3	10	60	1.3	3.0	—	400

* MR: Magneto-Resistance *2 Condition: is = 5.0mA Cue signal: f = 30Hz for 0.5 sec.
*3 Evaluate with a standard tape for 2H record. *4 Evaluate with a standard tape for 6H record.

MR Sensors

(Ta = 25°C)

Model No.	Absolute maximum ratings			Total resistance Ro (kΩ) TYP.	Resistance change ratio @ (%)		Middle-point voltage V_1, V_2 (V)		
	Vcc (V)	Topr (°C)	Tstg (°C)		TYP.	Is*5 (mA)	TYP.	H (Oe)	Vcc (V)
OR4103M	6	−20 ~ +80	−30 ~ +100	0.85	3.3	1	2.5	0	5
OR4104M	6	−20 ~ +80	−30 ~ +100	2.7	3.7	1	2.5	0	5
OR4108M	6	−20 ~ +80	−30 ~ +100	1	3.3	1	2.5	0	5

SHARP ELECTRONICS CORP., Micro Electronics Div., Sharp Plaza, Mahwah, NJ 07430-2135•201/529-8757 • Telex: 426903 (SHARPAM MAWA) • Fax: 201/529-8759

FINE CERAMICS **Tokin**

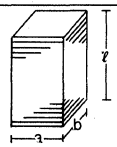
Tokin America Inc.
155 Nicholson Lane, San Jose, California 95134, U.S.A.
Tel: 408-432-8020 Fax: 408-434-0375
Chicago Branch
Presidents Plaza I, Suite 208N, 8600 W. Bryn Mawr, Chicago, IL 60631
Tel: 312-380-0030 Fax: 312-693-8334

PIEZOELECTRIC ACTUATORS

Model	Capacitance (nF) ±20%	tanδ (%) ±10%	Insulation Resistance (Ω) ±50%	Dielectric Displacement (μm/100V) ±10%	Force Generation (kg/100V) ±20%
NLA—1.4×3×9	125	3.0	1×10^9	6.5	14.0
NLA—2×3×9	175	3.0	1×10^9	6.5	21.0
NLA—2×3×18	400	3.0	5×18^8	13.5	21.0
NLA—5×5×9	650	3.0	5×10^8	6.5	87.0
NLA—5×5×18	1600	3.0	2×10^8	13.5	87.0
NLA—10×10×18	6500	3.0	5×10^7	13.5	350.0

- Response time: 0.1msec. or less
- Maximum operation voltage: 150V DC. Rated voltage is 100V, maximum peak voltage is 300V.
- Temperature: −20°C ~ +85°C

(mm)

Model	a=0.1	b=0.1	ℓ=0.05	Structure
NLA—1.4×3×9	1.4	3.1	9.00	
NLA—2×3×9	2.0	3.1	9.00	
NLA—2×3×18	2.0	3.1	18.00	
NLA—5×5×9	5.0	5.1	9.00	
NLA—5×5×18	5.0	5.1	18.00	
NLA—10×10×18	10.0	10.1	18.00	

Models are classified as follows:

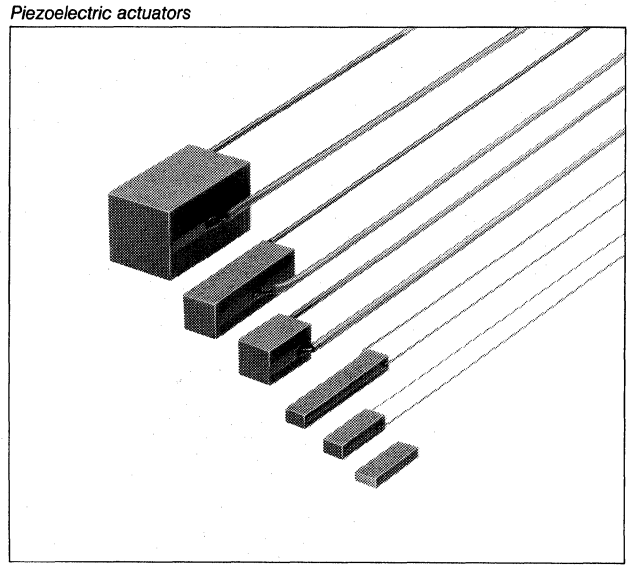
NLA—a×b×ℓ

NLA: Type

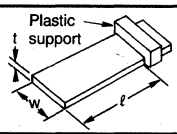
a×b: Dimensions of a section of transducer

ℓ: Length of the side that expands and contracts

Piezoelectric actuators

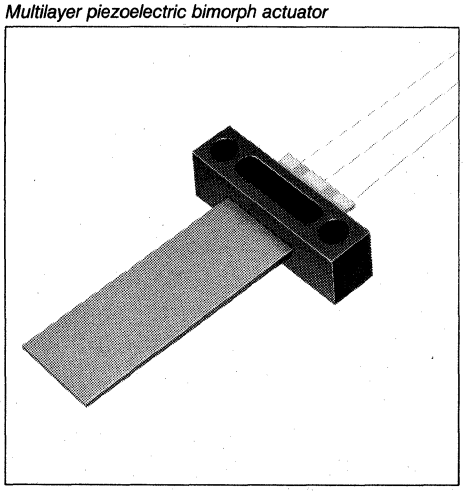


Multilayer Piezoelectric Bimorph Actuators

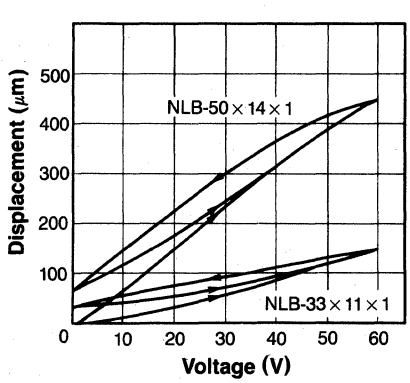
Model	Structure	Dimensions (mm) ℓ±1.0	W±0.5	t±0.25	Displacement ±20% (μm)	Force Generation ±20% (g)
NLB-33×11×1		25	10.5	0.6	150	30
NLB-40×12×1		32	12	0.6	300	30
NLB-50×14×1		41	13.5	1.0	450	48

*A plastic support custom designed to your specifications is optionally available.

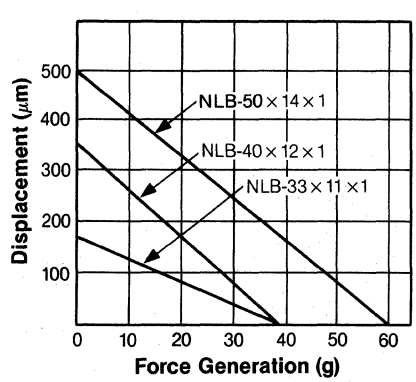
Multilayer piezoelectric bimorph actuator



Voltage vs. Displacement



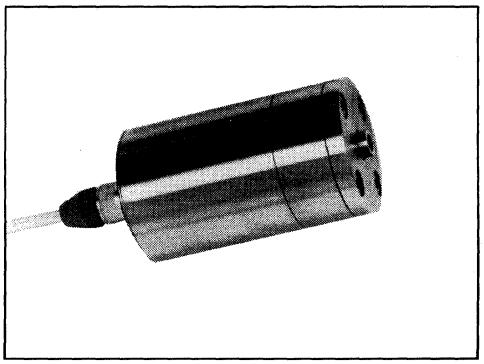
Force Generation vs. Displacement (measured at 60V DC)



TRANSDUCERS & SYSTEMS

Specialists in transducers and systems for low range force/weight measurements

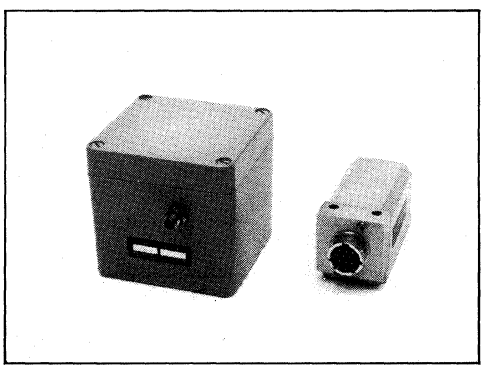
A PRIME TECHNOLOGY COMPANY



LOW RANGE FORCE/WEIGHT TRANSDUCERS

- **Highly repeatable — .02% F.R.**
- **Frictionless sensing**
- **Virtually indestructible**

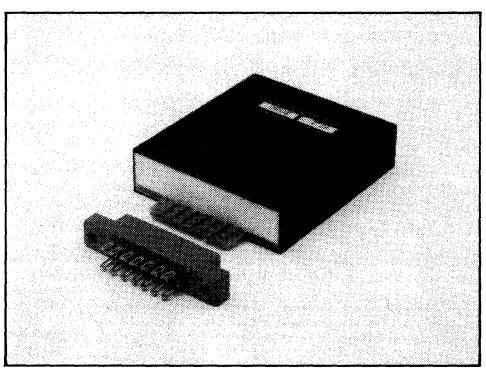
A virtually indestructible frictionless spring-loaded design has been proven in a wide range of applications — from demanding high volume arm flexture gram force calibration for disk drive manufacturers where durability and dependability are required . . . to sophisticated medical laboratory developments where pinpoint accuracy and precise repeatability are a must.



INCLINOMETERS

- **From ±5° to ±90° with 360° axial capability**
- **Resolution of 0.1 arc-second**
- **Fast response, low hysteresis, high stability, high accuracy**

The HO Series of inclinometers utilizes a frictionless assembly for measuring deviation from horizontal, with immediate response, virtually infinite resolution and no cross-axis sensitivity. It is an LVDT-based spring mass system with core material centered on a non-magnetic stainless steel shaft with two mass weights equidistant on either end. The HO-C Series is a more moderately priced alternative to the HO inclinometer that meets the performance standards of most applications.

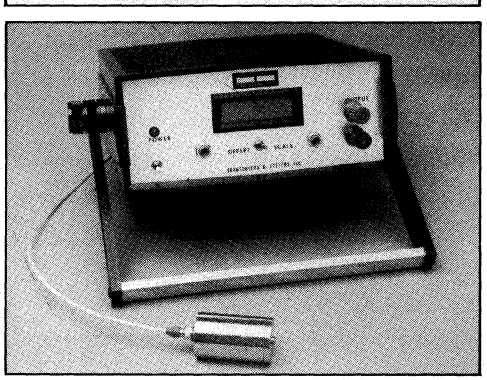


SIGNAL CONDITIONING MODULES

- **Flexible**
- **High resolution output**
- **Designed for use in existing OEM applications.**

These EL Series modules eliminate the need for developments of custom circuitry where DC to DC operation is desired. They provide a carrier-oscillator-demodulator filter and amplifier to provide a sharp, high resolution output. The unique EL2 has provision for remote offset and scale potentiometers as opposed to the more conventional EL3 with on-board adjustments.

Note: AC line, cord-operated, ±15VDC output power modules are available for use with EL2 and EL3 units.



SIGNAL CONDITIONING CONTROL BOXES

- **Zero & Span Adjustments**
- **4½ Digit Display**
- **AC Power Line Operation**

The CB14 control box is a highly flexible bench-top AC line-operated system. A 4½ digit LCD indicator and standard calibrations give a direct visual representation of measurement in grams of force or inclination related to the sine of the angle. Front panel accessible offset and scale potentiometers allow adjustment of any deviation experienced through mounting.

TRANSDUCERS & SYSTEMS
P.O. Box 185, North Branford, Connecticut 06471
TWX: 710-452-3092 / FAX: (203) 481-8937
CALL **203 481-5721**

U.S. DIGITAL

Softpot™ Optical Shaft Encoders

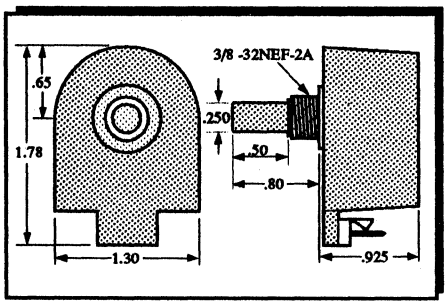
The Softpot optical shaft encoder is a **non-contacting direct rotory to digital converter**, eliminating the wear, contact bounce and digit bobble associated with pots and A/D converters.

These Softpots are fully **housed**, employing **unbreakable** disks, **metal** shafts and bushings, **LED** light sources and deliver **two channel** quadrature outputs from a single +5 volt supply.

Available with a **torque-loaded** shaft to provide the feel of a limitless potentiometer for front-panel manual interface or a **ball bearing** option for motion control applications.

We support each Softpot with a **two year warranty**, app notes and application engineering staff. **Call for updates** on our thru-shaft, **1024** cycle and other newly released products. We can build to your specs.

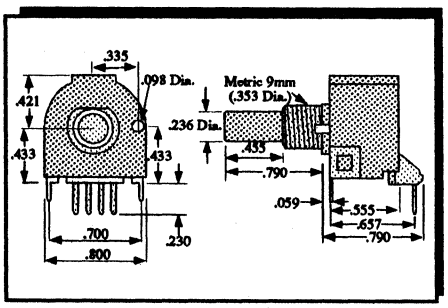
SP-16 Series



- 16 cycles/rev yielding 64 codes per revolution
- Outputs interface to TTL via an external 74LS244
- Ball bearing option available for tachometer applications
- Rugged ABS rotor & housing

$20 in 100's • Next Day Shipment •

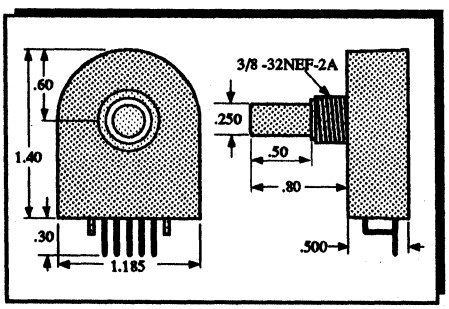
SPM-50 Series



- 50 or 100 cycles per revolution
- Outputs interface to TTL via an external 74LS244
- Miniature 0.800 diameter metal housing
- PC board mountable
- Metric dimensions

$22 in 100's • Next Day Shipment •

SP-500 Series



- 100, 200, 256, 360, 400, 500, or 512 cycles per revolution
- 400 to 2048 codes per revolution
- TTL compatible, drives 2 standards loads
- Ball bearing option operates to 10,000 RPM
- -40 to +100°C operating temperature
- 0.500 inch minimal depth housing

$27 in 100's • Next Day Shipment •

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U.S. Digital Corp. • 12371 Kensington Rd. • Los Alamitos, CA 90720

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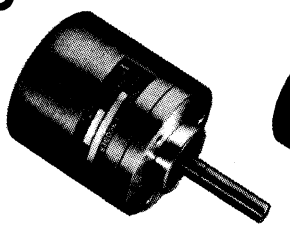
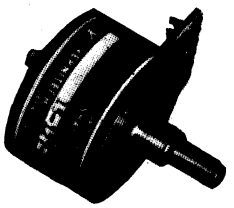
SHAFT ENCODERS
CONTACTING AND OPTICAL
INCREMENTAL/ ABSOLUTE



DIAL-CODER™



OPTICAL INCREMENTAL

* Dial-Coder Call Factory For Details

Size	Resolution	Diameter	Length	Features (Optical)	Options
5	To 256 Pulses	0.500	0.85	Only Available in Photo Sensor Output All Solid State Light Source High Reliability TTL, DTL compatible output.	• Sealed* • Index Marker • Quadrature Output • 1X-2X-4X Multiplier* • Extended Temperature Range • Non-Standard Supply Voltage • Photo Sensor Output • HTL Compatible Output* • Open Collector Output* • Rugged Construction* • Line Drivers* • Connectors • Direction Sensing
11	To 1024 Pulses	1.062	1.500		
23	To 1200 Pulses	2.250	1.875		
25	To 3000 Pulses	2.500	2.500		

* Not Available in Size 5

OPTICAL ABSOLUTE

Size	Output Code	Counts/Turn	Least Count Angle	Features	Options
23	Any	Up to 512	0.7°	† Quadrature Output on LSB Available TTL, DTL compatible Counting Speed 30 kHz max. Slew Speed 5000 RPM max. L.E.D. light source Output, parallel non-ambiguous	• Multiturn Available - Size 23 BCD Only - Size 30 - Any Code • Rugged Construction • Extended Temperature Range • 19 Bit Total Count • Other output levels available • Connectors
30	Any	Up to 1024	.18°		

† On Selected Models

CONTACTING ABSOLUTE

Size	Code	Counts/Turn	Revolutions for Full Count	Full Count	Features	Options
11	Gray/Binary	To 256	1 to 64	To 2^{14}	Operating Speed: To 200 RPM DTL/TTL Compatible 5,000,000 Rev. — Life Slew Speed: 1000 RPM Output: Parallel Non-Ambiguous Most units contain internal logic circuits for DTL, TTL compatibility	• Operating Temp.: −55°C to 125°C • Various Output Voltage Ratings • 18 and 19 Bit Total Count • Connectors • Increasing Count — CCW Rotation
	BCD	To 100	1 to 100	To 9999		
18	Gray/Binary	To 512	1 to 2048	To 2^{19}		
23	Binary	To 256	1 to 2048	To 2^{19}		
	BCD	To 400	1 to 100	1 x 10^6 BCD		
31	Gray/Binary	1024	Single Turn	To 2^{10}		

OPTICAL INCREMENTAL MODULAR

Size	Resolution	Light Source	Construction	Features		Options
Unhoused 15 or 23	To 1024 Pulses	LED	Modular	Low Cost	TTL, DTL Compatible 2 Channel Output Index Channel Photo Sensor Output	• Squared Output - Size 15 & 23 • Operating Voltages: 5 to 15 VDC • Photo Sensor Output - Size 15 & 23
5	To 256 Pulses	LED	Modular	Low Cost		

Housed versions also available.

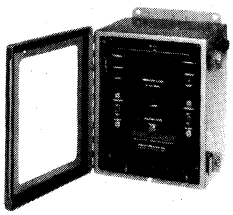
Refer to sections 2440, 3500, 4750 for additional product listings.

Vibra-Metrics INC.

FAX 203-288-4937
1-800-352-2001

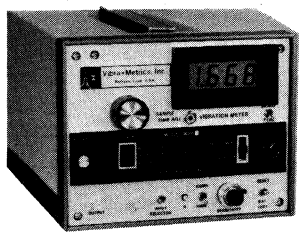
VIBRA-METRICS • 1014 SHERMAN AVENUE, HAMDEN, CT 06514 • (203) 288-6158 • TWX 710-465-0169

MACHINERY VIBRATION MONITORS



Monitoring Level: 0-1 ips RMS
Frequency Range: 5-3,000 Hz (3db)
Colored LED's: Alert—Amber, Danger—Flashing Red, Channel Status—Green to Red—Auto Guard Transducer malfunction
Trip Accuracy: 5% of setting
Two Trip Levels: Alert, Danger; adjustable front panel set pots
Internally Adjustable Trip Delays: 1-10 seconds—Factory set 8 secs.
Trip Level Calibration/Check via Level Meter
Reset Button (remote contacts available)
Digital RMS Velocity Level Indicating Meter
Channel Selector Switch for Level meter, Calibration & Velocity AC Output
115VAC Input Power (220V option)
Fail-Safe Power Loss Protection (disables Shutdown Relay)
Optional Filters: Low, High or Band Pass
Inputs for (1-6) Accelerometer Signals; rear panel BNC jacks
Outputs: A. AC Signal: 5VAC/ips (peak) BNC jacks (rear), (1) BNC jack (front) B. DC signal: 4VDC/ips RMS (1-6) BNC jacks (rear) C. Two DP/DT relays per channel—3 amps D. Remote Reset (option)

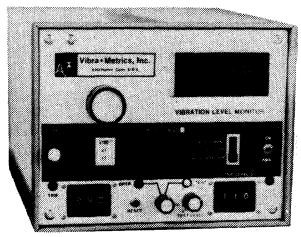
M8D DIGITAL VIBRATION METER [Battery Operated]



Metric scale optional

Functions: Velocity, Acceleration and displacement.
Ranges [Decade]: Velocity-Full scale .02 to 200 in/sec (PK)
Acceleration .002 to 20 g
Displacement to 2000 mils (PP)
Output: 2 Volts (Full scale) AC/DC Recorder option
Frequency Range [3db]:
Accel. 2HZ - 15KHZ
Vel. 5HZ - 3KHZ
Disp. 5HZ - 1KHZ
Accelerometer Power: 2 ma, 15 Volts (DC) from input connector
Filters [Front Panel Selectable]: Plug in optional High pass, low pass or band pass
Accelerometer: 7 - 14 mv/g
70-140 mv/g

M9D VIBRATION METER/MONITOR



Specifications same as M-8D with the following additions

Accelerometer: 100 mv/g

Trip Alarms: One or two

Set Points: Digital 0-200% of Full scale selected.
Outputs: Relay contacts NO/NC BCD (Option)
2 Volts (Full scale) DC Recorder option

VM-350 PREDICTIVE MAINTENANCE VIBRATION METER

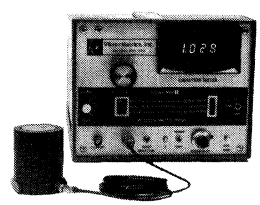
An accurate solid-state instrument for use in predictive maintenance and quality assurance

Velocity Ranges: 0.1 to 30 (I.P.S.)
Frequency Range: 3HZ-5 KHz
Input: Low impedance accelerometer included in vibration probe (VP 300) or individual sensor
Power: Battery
Size: 7" long x 2½" deep x 4" wide

SEISMIC VIBRATION METER SYSTEM

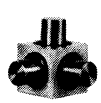
Consists of **M8DSP** Meter and 1030 Seismic Accelerometer

Most Sensitive Full Scale Range:
20 Micro g
200 Micro in/sec
20 Micro in (PP)

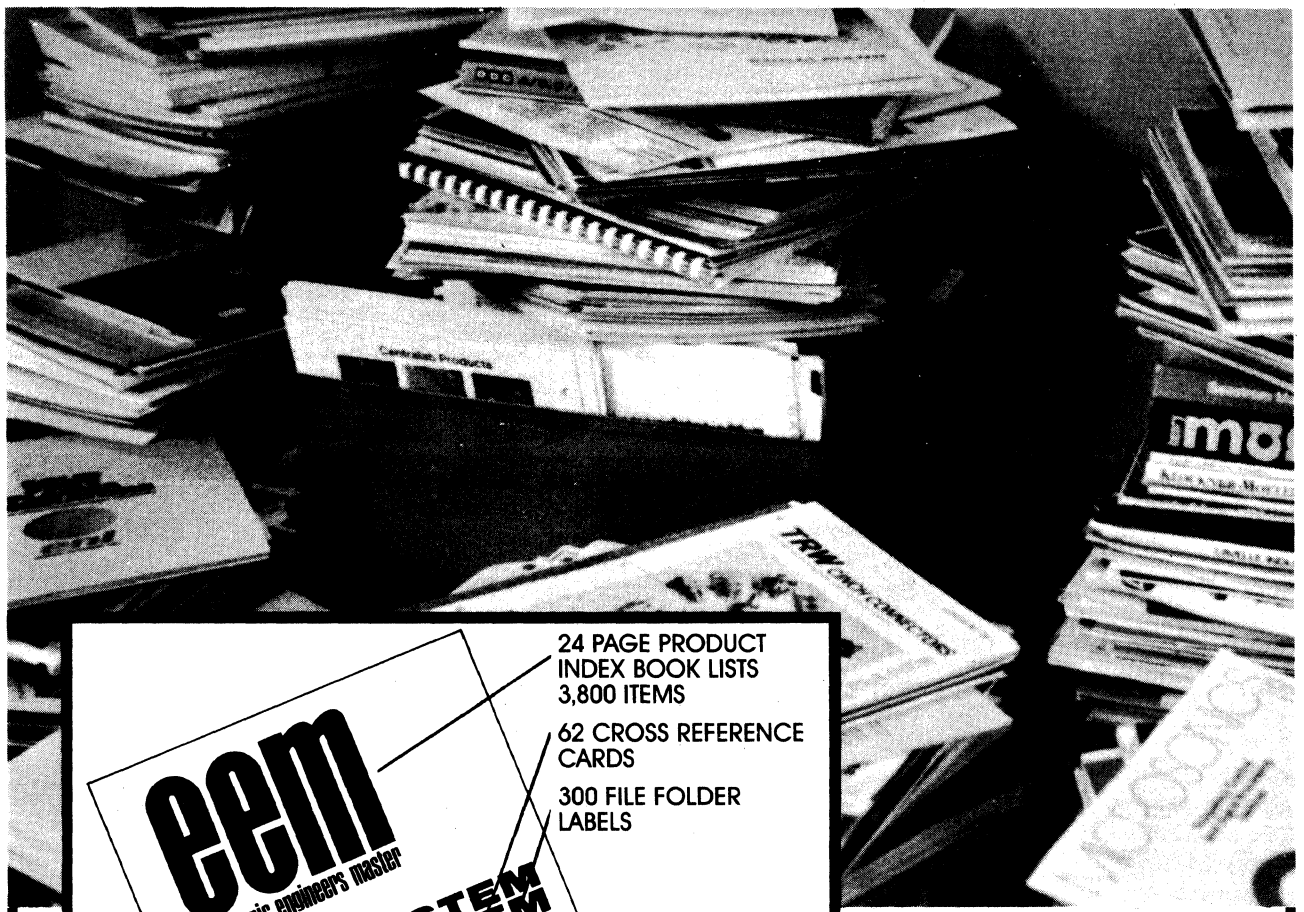


VIBRAMITE ACCELEROMETER WITH "BUILT-IN" ELECTRONICS

LOW IMPEDANCE SPECIAL "OEM" DESIGNS

	MICROMITE	MINIATURE	TRIAXIAL	GENERAL PURPOSE	HIGH OUTPUT	INDUSTRIAL	5 VOLTS
							
	0.7 GRAM	1.8 GRAM	10 GRAM			RUGGED	SEISMIC
MODEL	**9001**	**1000/1001**	**3000**	**1018/1019**	**1020/1021**	**6022**	**1030**
Sensitivity mv/g	7	10	10	10	100	100	5 Volt
Frequency Range [±5%]	5-10K	3-10K	3-10K	3-10K	2-10K	3-5K	.01-200
Noise g(rms)	.004	.0015	.0015	.0015	.00015	.00015	5X 10-6
Iso Shield	NO	YES/NO	YES	YES/NO	YES/NO	YES	YES
Pre-filter Option	NO	NO	NO	NO	YES	YES	YES
Temperature [F]	250	250	250	250	250	250	250
Weight [gms]	0.7	2/1.8	10	15	50	60	485
Dimensions [in]	.25 H x .25D	.4H x .25D	.75H X .5D	.75H x .5D	1.2H x .75D	.2H x .8D	2.5H X 2.5D

MORE THAN 30 MODELS AVAILABLE FROM STOCK. MODELS MEETING API 678 SPECIFICATIONS NOW AVAILABLE!



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Are your catalog files organized? Can you find any given catalog in a matter of seconds? If your answer is "Yes," you probably already have the EEM File System. But, if you said "No," you really ought to look into this simple system. It will save hours of time and tons of aggravation.

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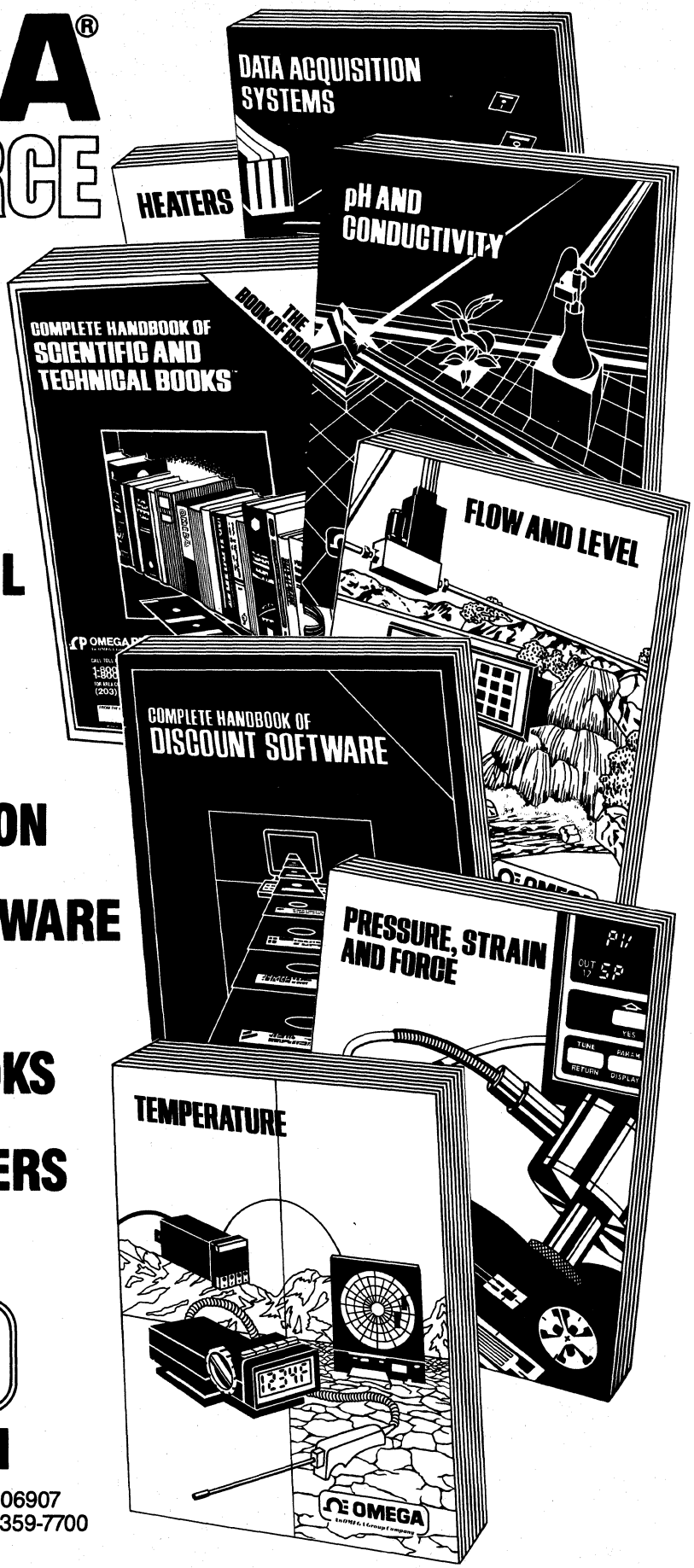

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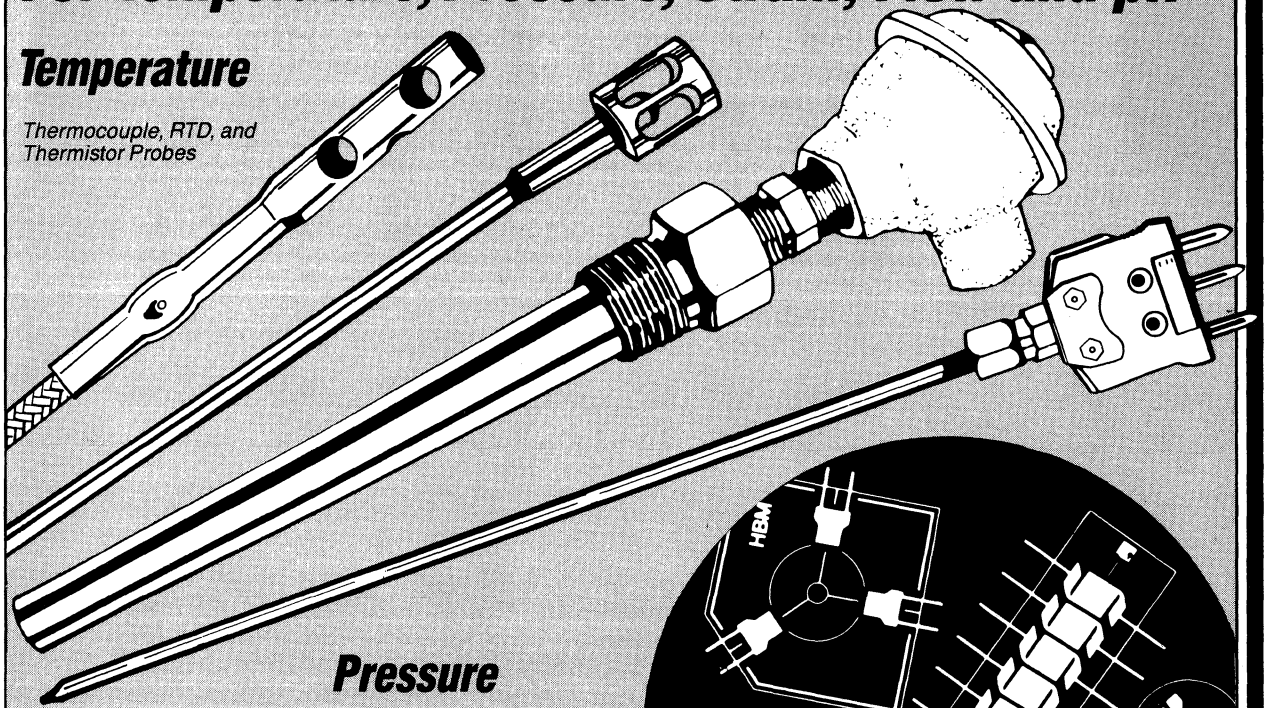
TRANSDUCERS AND ENCODERS

For Temperature, Pressure, Strain, Flow and pH

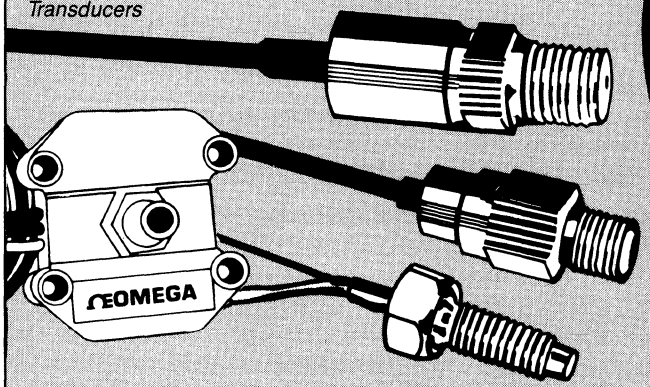
Temperature

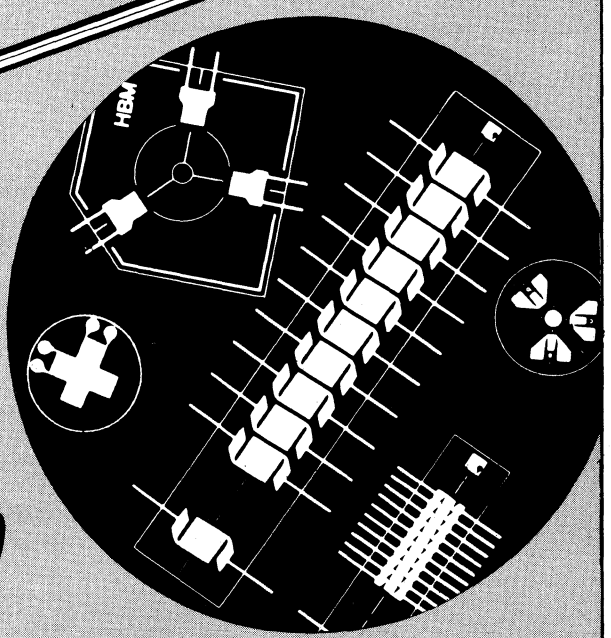
Thermocouple, RTD, and Thermistor Probes



Pressure

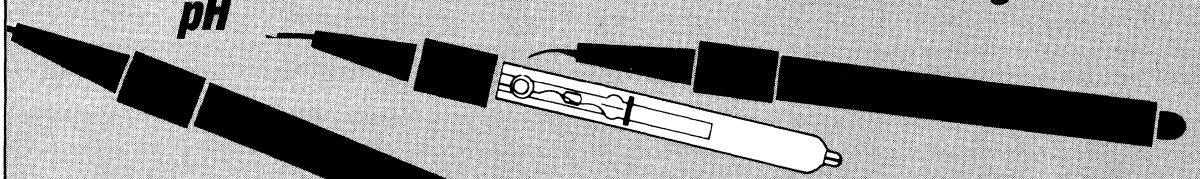
Transducers

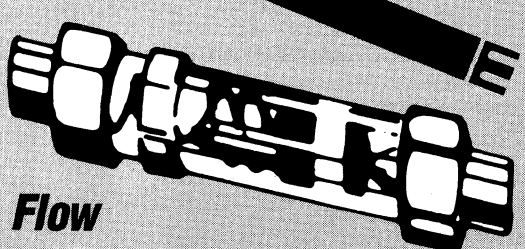




Strain Gages

pH





Flow

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SI UNITS

RELATIVE QUANTITY SYMBOLS

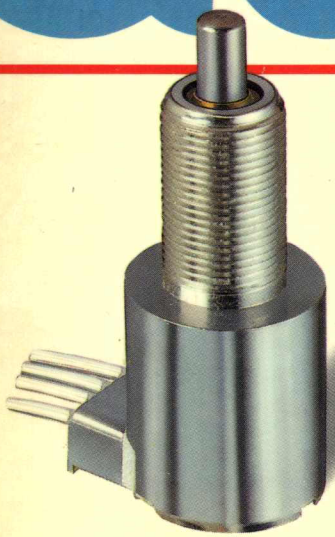
$\neq$	not equal to
$\approx$	approximately equal to
$\propto$	proportional to
$<$	smaller than
$\leq$	smaller than or equal to
$\ll$	much smaller than
$>$	larger than
$\geq$	larger than or equal to
$\gg$	much larger than
$\equiv$	identical to or equivalent
$\uparrow$	increases
$\downarrow$	decreases

PREFIXES FOR SI UNITS

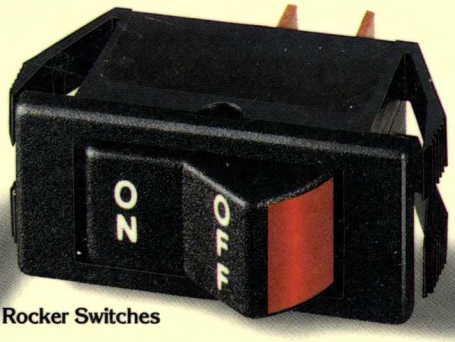
Multiple	Prefix	Symbol
10^{12}	tera	T
10^{9}	giga	G
10^{6}	mega	M
10^{3}	kilo	k
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

Quantity	Symbol	SI Unit	Symbol	Derivation
acceleration	a	m s^{-2}	—	velocity/time
acceleration due to gravity	g	m s^{-2}	—	velocity/time
amount of substance	n	mole	mol	mole fraction (n) used
amplification factor	μ	*a ratio*	—	—
angle	$\theta_1, \varphi_1, \alpha_1$	—	—	—
angle of incidence	i	degree or radian	°	—
angle of refraction	r	degree or radian	°	—
angle, Bragg	θ	number	—	—
angle, critical	c	degree or radian	°	—
anode slope resistance	R_A	ohm	Ω	$\Delta V_a / \Delta I_a$
area	A	metres squared	m^2	$l \times b$
atomic number	Z	a number	—	number of protons
Avogadro constant	L, N_A	number	—	—
breadth	b	metre	m	fundamental unit
capacitance	C	farad	F	charge/p.d.
charge, electric	Q	coulomb	C	current × time
charge on electron	e	coulomb	C	$1{\cdot}6 \times 10^{-19}$ C
conductance	G	ohm^{-1}	Ω^{-1}	reciprocal of resistance
current, electric	I	ampere	A	fundamental unit
decay constant	λ	*a ratio*	—	—
density	ρ	kg m^{-3}	—	m/V
distance along path	s	metre	m	fundamental unit
efficiency	η	*a ratio*	—	work output/work input
electrochemical equiv.	z	g C^{-1}	—	mass/charge
electromotive force	E	volt	V	energy/charge
electron	e	—	—	—
energy	E	joule	J	N m
energy, kinetic	E_k	joule	J	N m. $E_k = 1/2mv^2$
energy, potential	E_p	joule	J	N m. $E_p = mgh$
Faraday constant	F	coulomb mol^{-1}	C mol^{-1}	96,500 C mol^{-1}
field strength, electric	E	V m^{-1}	—	potential gradient: p.d./dist.
field-strength magnetic	H	ampere-turns	—	current × no. of turns
flux, magnetic	Φ	weber	Wb	e.m.f/rate of change of flux
flux density	B	tesla	T	flux/area
focal length	f	metre	m	—
force	F	newton	N	kg m s^{-2}
free energy	ΔG	joule	J	—
frequency	f	hertz	Hz	oscillations/time
gas constant	r	joule	J	energy
half-life,radioactivity	$t_{1/2}$	second	s	fundamental unit
heat capacity	C	J K^{-1}	—	quantity of heat/temp. rise
heat of reaction	ΔH	joule	J	heat energy
heat capacity, specific	c	J K^{-1} kg^{-1}	—	heat capacity/mass
heat, quantity of	q	joule	J	energy

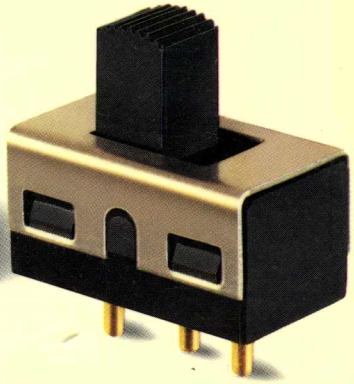
QUALITY



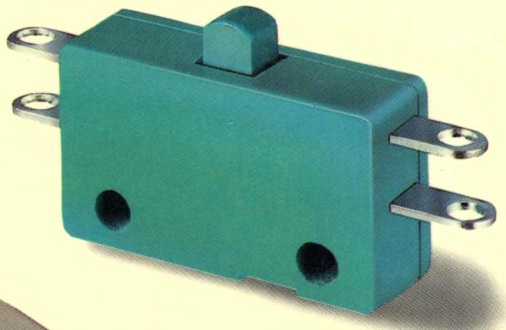
Sealed Switches



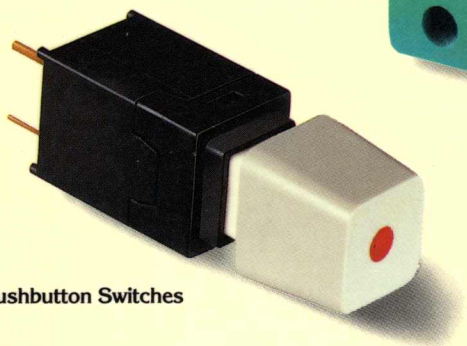
Rocker Switches



Slide Switches



Basic
Snap Action
Switches



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Rotary Switches

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